NASA CONTRACTOR REPORT

NASA CR - 61037

NASA CR - 61037

SPACE ENVIRONMENT CRITERIA SEMIANNUAL REPORT SPACE ENVIRONMENT BIBLIOGRAPHY

Prepared under Contract No. NAS 8-11285 by

AEROJET-GENERAL CORPORATION
Azusa, California

FACILITY FORM 602

N65 17610
(ACCESSION NUMBER)

(THRU)

298
(PAGES)

1
(CODE)

CR 61037
(NASA CR OR TMX OR AD NUMBER)

30
(CATEGORY)

GPO PRICE $ _____

OTS PRICE(S) $ _____

Hard copy (HC) 6.00

Microfiche (MF) 1.50

For

NASA - GEORGE C. MARSHALL SPACE FLIGHT CENTER
Huntsville, Alabama

February 3, 1965

NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the National Aeronautics and Space Administration (NASA), nor any person acting on behalf of NASA:

A) Makes any warranty of representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B) Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method or process disclosed in this report.

As used above, "persons acting on behalf of NASA" includes any employee or contractor of NASA, or employee of such contractor, to the extent that such employee or contractor of NASA, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with NASA, or his employment with such contractor.

CASE FILE COPY

SPACE ENVIRONMENT CRITERIA
SEMIANNUAL REPORT
SPACE ENVIRONMENT BIBLIOGRAPHY

Prepared under contract No. NAS 8-11285 by

AEROJET-GENERAL CORPORATION
Azusa, California

For

Aero-Astrodynamics
Laboratory

This report is reproduced photographically
from copy supplied by the contractor

NASA-GEORGE C. MARSHALL SPACE FLIGHT CENTER

FOREWORD

This report was prepared by Aerojet-General Corporation under Contract NAS 8-11285 for the George C. Marshall Space Flight Center of the National Aeronautics and Space Administration. The work was conducted under the supervision of Mr. Robert E. Smith of the Aero-Astrodynamics Laboratory, Aerospace Environment Office, of the George C. Marshall Space Flight Center. The work described herein was performed between 1 July 1964 and 31 December 1964.

Approved by:

U. A. Coty, Manager
Manufacturing Division

AEROJET-GENERAL CORPORATION

W. W. Howard, Program Manager
Special Products Department

R.L. Buller, Manager
Special Products Department

CONTENTS

	Page
INTRODUCTION	iii
I. OBJECTIVE	1
II. SUMMARY	1
III. INTERPLANETARY SPACE	2
A. General	3
B. Cosmic Rays	7
C. Meteors	20
D. Meteoroids	35
E. Interplanetary Radiation	69
F. Magnetic Fields and Geomagnetic Trapped Radiation	86
G. Ionosphere	140
H. Earth Atmosphere	190
I. Interplanetary Magnetic Fields	232
IV. LUNAR ENVIRONMENT	234
A. General	235
B. Gravity	235
C. Magnetic Fields	236
D. Meteoroids and Ejecta	236
E. Radiation	237
F. Surface Geography and Geology	237
G. Atmosphere	248
V. PLANETARY ENVIRONMENTS	250
A. General	251
B. Radiation	256
C. Magnetic Fields	261
D. Gravitational Fields	262
E. Atmospheres	263
F. Surface Characteristics	283

INTRODUCTION

The bibliography in this report contains documents which will be considered in providing an accurate definition of the space, Lunar, and planetary environments as they affect flight mechanics and the aerodynamic aspects of space travel. Our present knowledge of the space environment is quantitatively incomplete. Concepts and ideas develop and change rapidly and continual updating of this bibliography is necessary to keep abreast of our ever expanding understanding of the space environment. Each of the documents contained herein will be considered and analyzed; this bibliography will be revised and updated, and only the most pertinent documents will be listed in the final report.

I. OBJECTIVE

The objective of this program is to define the natural space environment and determine the reliability limits for those natural space environment parameters either currently required or for which a requirement is anticipated for future application to problems associated with flight mechanics and aerodynamics aspects of space vehicle design.

II. SUMMARY

17610

The literature survey has been completed and analysis of the data has been initiated. The completed bibliography is included in this document. The listed documents in this bibliography have been separated into major environment groups and alphabetized under each environmental parameter. The information contained in this document emphasizes radiation, space debris, and magnetic fields of interplanetary space, with cosmic rays and solar phenomena being treated secondarily. The lunar environment section is concerned with the geological aspects of the lunar surface, the atmosphere, and meteoroid environment. The planetary environment section deals largely with the definition of the various atmospheric structures.

The sources of information for this bibliography are books, periodicals, meeting papers and conference proceedings, translations of foreign articles, and scientific and technical aerospace reports (STAR). A careful evaluation of published data prior to 1964 has made it possible to include only the reports and papers of greatest importance. Sufficient time has not yet elapsed to permit the same level of evaluation of the 1964 material.

author

III. INTERPLANETARY SPACE

Significant changes in the definition of the interplanetary space environment have occurred during the past two years. New data from Explorer XVIII and Interplanetary Monitoring Platform, IMP 1, provide some of the more striking alterations of the classical concept. For example, the earth's magnetosphere has been determined to be not spherical as the name implies, but comet-like in shape, split by a neutral pinch sheet.

By the acquisition of totally new data, greater confidence has been developed in a number of areas. For example, Mariner II data, taken over an extensive time period, significantly reduced the error associated with plasma flux and micro-meteoroid flux. On the other hand, certain conflicts have been resolved with newer data. Explorer XII has resolved the former disputes regarding the magnitude of the Van Allen belt elctron flux; the value is now given as 10^8 electrons/cm^2-sec. In addition, some of the theories presented regarding the origin of various environmental parameters have been proven false. An example of this is the neutron-albedo effect as the predominant source of radiation belt particles. Recent experiments carried by the Injun I satellite have definitely established that this effect is not the primary source of these particles.

III. INTERPLANETARY SPACE

A. GENERAL

Banna, P., "Features of the Physical Universe," The Man and Technology in the Nuclear and Space Age; Proceedings of the International Congress, Milan, Italy, Apr. 18-21, 1962. (In Italian).

Basilova, R. N., Vernov, S. N., Nesterov, V. E., Pisarenko, N. F., Savenko, I. A., and Shavrin, P. I., "Study of the Space Radiation at Altitudes from 200 to 350 km by the Cosmos-4 and Cosmos-7 Satellites," Kosmicheskie Issledovaniia, Vol. 2, Mar.-Apr. 1964 (In Russian).

Blagonravov, A. A., "Investigations of Interplanetary Space and Upper Layers of the Atmosphere," Akademiia Nauk SSSR, Vestnik, Vol. 33, Sept. 1963 (In Russian).

Bonnor, W., "The Mystery of the Expanding Universe," New York, Macmillan Co.; London, Collier-Macmillan, Ltd., 1964.

An evaluation of the two rival theories that currently dominate the science of cosmology, the relativistic, and the steady-state theories of the universe, is offered to the general reader.

Chow, Y. H., "Research in Interplanetary Flight," International Symposium on Space Technology and Science, Tokyo, Japan, August 27-31, 1962, 4th Proceedings, Edited by Tamiya Nomura, Tokyo, Japan and Rutland, Vt., Japan Publishing Trading Co., 1963.

Search for a representative theory of interplanetary flight to be extended to all planets. It is assumed that a spacecraft flies to Mars and returns to Earth, also that the Earth and Mars move in a circular orbit around the Sun with their respective mean radius on the same plane.

Dahanayake, C., Kaplon, M. F. and Lavakare, P. J., "The Isotopic Composition and the Energy Spectrum of Low Energy Helium Nuclei in Primary Cosmic Radiation," 10 Apr. 1964, Sponsored in part by NASA and AF. (URPA-31)

The isotopic composition and the energy spectrum of low energy helium nuclei were investigated using a nuclear emulsion stack. The proportion of He^3 nuclei at the top of the atmosphere was determined to be $18 \pm 5\%$ within the kinetic energy interval of 160 to 370 Mev/nucleon and $24 \pm 8\%$ within the rigidity interval 1.1 to 1.4 Bv/c.

Derpgol'ts, V. F., On Water Exhange Between Earth and Outer Space (Universe), 11 Oct. 1963 [Transl. into English of an article from Geogr. Sb., Geogr. Obshchestvo Soyuza SSR (USSR),] 1962. (AD 425566)

This report presents various hypotheses concerning: (1) the origin of water on earth; (2) the existence of water, in all three phases, in interplanetary space; (3) the arrival of water on earth from interplanetary space; (4) the arrival of water from the terrestrial atmosphere in interplanetary space; and (5) the use of ice in space.

III,
A. GENERAL (CONT.)

Duboshin, G. N. and Okhotsimskii, D. E., "Some Problems in Astrodynamics and Celestial Mechanics," Mezhdunarodnyi Astronavticheskoi Kongress, 14th, Paris, France, Sept. 25-Oct. 1, 1963; Kosmicheskie Issledovaniia, Vol. 1, Sept.-Oct. 1963 (In Russian).

Gintsburg, M. A., "Shock Wave Radio Emission Near the Earth and in the Interplanetary Gas," 15 May 1964 [Transl. into English from Kosmich. Issled. (Moscow)], Vol. 2, No. 1, 1964 (Contract NAS5-2078).

A new effect is considered here - the radio emission in the 10 to 30 kc/s frequency range, which must emerge from the leading shock wave near the Earth and planets.

Goldreich, P., "Secular Changes in the Solar System," Feb. 1963, supported by NSF (CRSR-128).

Hartz, T. R., "Spectrum of the Galactic Radio Emission Between 1.5 and 10 MC/S as Observed from a Satellite," Nature, Vol. 203, July 11, 1964.

Outline of the results of the galactic noise measurements as a function of frequency. The automatic-gain control voltage of the sweep-frequency receiver of the Alouette satellite (1962 Beta Alpha 1) is telemetered to the ground, making possible simultaneous measurements of the background radio noise.

Hoyle, F. and Tayler, R. J., "The Mystery of the Cosmic Helium Abundance," Nature, Vol. 203, Sept. 12, 1964.

Presentation of a suggestion that the high helium content in our Galaxy and its neighbors is due to "cooking" at temperatures in excess of 10^{10} °K, of the material of our galaxy, and probably the whole local group of galaxies.

Imyanitov, I. M. and Shvarts, Ya. M., "Electrostatic Field Strength Measurements with Sputnik III," Transl. into English from Iskusstv. Sputniki Zemli (Moscow), No. 17, 1963.

Kallmann-Bijl, H. K. and Sibley, W. L., "Diurnal Variation of Temperature and Particle Density Between ≈100 KM and ≈500 KM," COSPAR, International Space Science Symposium, 4th Warsaw, Poland, June 3-11, 1963; Space Research IV; International Space Science Symposium, 4th Warsaw, Poland, June 4-10, 1963, Proceedings, Organized by the Committee on Space Research (COSPAR) and the Polish Academy of Sciences, Edited by P. Muller, 1964.

III,
A. GENERAL (CONT.)

King-Hele, D. G., Cook, G. E. and Rees, J. M., "Determination of the Even Harmonics in the Earth's Gravitational Potential," Geophysical Journal, Vol. 8, Sept. 1963.

Development of a method for determining the first seven even harmonics in the Earth's gravitational potential, using data on the orbits of artificial Earth satellites. The technique is applied to derive as much information as possible from existing orbital data for seven satellites having orbital inclinations between 28° and 97°.

Moore, G. W., "Magnetic Disturbances Preceding the 1964 Alaska Earthquake," Nature, Vol. 203, Aug. 1, 1964.

Interpretation of the magnetometer record of positive magnetic disturbances which preceded the 1964 Alaska earthquake.

Nicks, O. W., "Interplanetary and Interstellar Exploration," Spaceflight, Vol. 6, May 1964.

Review of present knowledge of solid objects in space, with special reference to exploration of the solar system, with some comments on objects composing the rest of the universe. The characteristics of the Sun, the planets, and some of their major satellites are described.

Nicks, O. W., "The Exploration of Interplanetary and Interstellar Space," presented to the Staff and Teachers of the San Francisco City Schools, 8 Jan 1964, Available from NASA, Office of Scientific and Technical Information, Wash., D.C.

According to Mr. Oran W. Nicks, the exploration of objects in space is of the greatest importance. The nature of the objects in space is discussed as well as the possibilities they afford for exploration. The technological aspects of interplanetary flight, some of the findings of the Mariner II spacecraft on its journey from Earth to the vicinity of Venus, and the possibility of exploring objects outside our solar system are among the topics discussed.

Roberts, D. L., "The Scientific Objectives of Deep Space Investigations: Interplanetary Space Beyond 1 AU," Feb. 4 1964 (NASA Contract NASr-65(06)).

Aspects dealt with are the solar wind, the interplanetary magnetic field, cosmic rays, and the distribution of interplanetary matter. The primary concern has been to describe what is and what is not known about the interplanetary medium, and to point out what further information is urgently needed and can be obtained from space probes.

Shcheglov, P. V., "Some Results of Observations with Electron Telescopes," Transl. into English of Chapter 13 of "Elektronnaya Teleskopiya," Moscow, State Publ. House for Physico-Math. Literature, 1963, 9 Mar. 1964.

III,
A. GENERAL (CONT.)

Shen, C. S. and Chopra, K. P., "Thermionic Screening of Bodies in the Atmosphere and Interplanetary Space," Repr. from J. of Atmospheric Sci., Vol. 20, No. 5, Sep. 1963 (Previously published as NASA TM X-50226; see N63-2017820-13)

This paper considers problems that accompany thermionic emission of electrons from a hot body surrounded by a plasma.

Shevchenko, V. V., "Apparent Migration of the Earth in the Lunar Sky," Kosmich. Issled., Vol. 1, No. 2, Sep.-Oct. 1963 (Translation). (NASA-TT-F-8812)

The general nature of the apparent migrations of the earth in the lunar ecliptic and horizontal systems of coordinates is ascertained. Formulas are derived for compilation of ephemerides.

Sisakyan, N. M., Parin, V. V., Chernigovskiy, V. N. and Yazdovskiy, V. I., "Certain Problems of Studying and Mastering Cosmic Space," Prob. of Space Biol., Nov. 1963.

The evolution of space biology and its main problems are briefly discussed under three headings: (1) factors due to the intrinsic conditions of flight dynamics of the space vehicle (e.g., accelerations, vibrations, weightlessness); (2) factors due to the nature of the ambient space (e.g., electromagnetic and corpuscular radiations, composition and thermal state of space); (3) factors created by the exposure of human beings to the artificial environment of the space ship (isolation, confinement to restricted space, different diet, and different rhythm of life).

Snyder, C. W. and Neugebauer, M., "Interplanetary Solar-Wind Measurements by Mariner II," COSPAR, International Space Science Symposium, 4th, Warsaw, Poland, June 3-11, 1963; Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Organized by the Committee on Space Research (COSPAR) and the Polish Academy of Sciences, Edited by P. Muller, Interscience Publishers, New York, 1964.

Svestka, Z. and Vanysek, V., "Interstellar Matter," To the Near and Distant Universe, 16 Jul. 1963.

The following subjects are included in the discussion of interstellar matter: (1) the hypothesis of luminiferous ether; (2) distribution of interstellar dust in space; (3) diffuse and planetary nebulae; (4) differences between gaseous and dusty nebulae; (5) reason for radiation from the gas in a nebula; (6) formation of planetary nebulae; and (7) radioastronomical research on interstellar hydrogen.

Vernov, S., "Problems of Inner and Outer Space," Aviatsiia i Kosmonavtika, June 1963 (In Russian).

III. INTERPLANETARY SPACE

B. COSMIC RAYS

Anderson, C.D., Neher, H.V., Leighton, R.B., and Cowan E.W., High Energy Cosmic Rays and Solar Activity, Final Report, Contract Nonr-220(17), 1964.

Apparao, M.V.K., "On the Modulation of Cosmic-Ray Nuclei with Z> 2 During Their Propagation," Nuovo Cimento, Serie Decima, Vol. 32, Grant No. AF-AFOSR-62-32, June 1, 1964.

Apparao, M.V.K. and Ramadurai, S., "On the Relative Characteristics of Proton and Helium Spectrums in Primary Cosmic Radiation," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964.

Apparao, M.V.K., "Hysteresis in the Variation of the Intensity of Multiply Charged Primary Cosmic-Ray Nuclei Over a Solar Cycle," Nuovo Cimento, Vol. 34, Oct. 1, 1964.

Arnold , R.L., Winckler, J.R., and Hoffman, R.A., "Comparison of the Total Cosmic Radiation in Deep Space and at the Earth During the March-April 1960 Events," Journal of Geophysical Research, Vol. 69, May 1, 1964.

Asatiani, T.L., Krishchian, V.M., and Sharkhatunian, "Polarization of Cosmic Ray μ^+ Mesons," Soviet Physics - JETP, Vol. 18, May 11, 1964.

Asatiani, T.L., Krishchian,V.M., and Sharkhatunian, R.O., "Polarization of Cosmic Muons of Various Energies," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 46, June 1964 (In Russian).

Babarykin, V.K., Baiarevich, V.V., Stozhkov, I.I., and Charakhch'ian, T.N. "Latitudinal Measurements of the Intensity of Cosmic Rays in the Stratosphere," Geomagnetism i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Badhwar, G.D., Isotopic Composition of Low Energy Hydrogen Nuclei in the Primary Cosmic Radiation, Grant AF-AFOSR-439-63, 8 July 1964.

Baradzey, L.T., Logachev, Y.I., and Shishkov, P.P., "Investigation of the Variations of Cosmic Rays at Altitudes of 9-12 Kilometers," Cosmic Rays, July 1964.

Basilova, R.N., Vernov, S.N., Nesterov, V.E., Pisarenko, N.E., Savenko, I.A. et al, "Cosmic Radiation Analysis of Heights of 200-350km on Cosmos 4 and 7," Cosmic Res., Vol. 2, No. 2, 8 June 1964.

Bazilevskaia, G.A., Krasotkin,A.F., Charakhch'ian, A.N., "The Energy Spectrum and Total Number of X-Ray Photons in Extensive Cosmic Ray Air Showers," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 46, May 1964 (In Russian).

III,
B. COSMIC RAYS (CONT.)

Baikov, V.M., "Behavior of the Cosmic-Ray Energy Spectrum at High Energies," Soviet Astronomy, Vol. 7, Jan.-Feb. 1964 (Translation)

Bingham, R.G., and Kellermann, E.W., "On the Anisotropy of the Cosmic Radiation II," Nuovo Cimento, Vol. 33, July 1, 1964.

Balasubrahmanyan, V.K. and McDonald, F.B., "Solar Modulation Effects on the Primary Cosmic Radiation Near Solar Minimum," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Blokh, Y.L., Dorman, L.I., and Dubrovin, M.M., "Meteorological Cosmic-Ray Effects Below Ground," Cosmic Rays, July 1964.

Blokh, Y.L., Dorman, L.I., and Kaminer, N.S., "The Superposition of Forbush Effects in July 1959," Cosmic Rays, June 1964.

Blokh, Y.L., Kaminer, N.S., and Dorman, L.I., "On Cosmic-Ray Effects - The Forerunners of Magnetic Storms," Cosmic Rays, June 1964.

Boella, G., Antoni, G. D., Dilworth, C., Panetti, M., and Scarsi, L., Measurement of the Cosmic Ray Neutron Flux at 45° Geomagnetic Latitude, Grant AF-EOAR-63-106, 11 May 1964.

Boley, F.I., "Atmospheric Cerenkov Radiation From Cosmic-Ray Air Showers," Reviews of Modern Physics, Vol. 36, July 1964.

Bostrom, R., "Geomagnetic Effects on Anisotropic Cosmic Radiation," Journal of Geophysical Research, Vol. 69, April 1, 1964.

Brooke, G., Wolfendale, A.W., "Anti-Matter in the Cosmic Radiation," Nature, Vol. 202, May 2, 1964.

Brooke, G., Meyer, M.A., and Wolfendale, A.W., "The Engery Spectrum of Cosmic Ray Pions Near Sea Level in the Range 0.7-150 Gev.," Physical Society, Proceedings, Vol. 83, Pt. 5, May 1964.

Brooke, G., Hayman, P.J., Kamiya, Y., and Wolfendale, A.W., "The Interrelation of the Primary and Sea-Level Spectra of Cosmic Rays," Physical Society, Proceedings, Vol. 83, Pt. 5, May 1964.

Brooke, G., Wolfendale,A.W., "The Momentum Spectrum of Cosmic Ray Protons Near Sea Level in the Momentum Range 0.6-150 Gev/C.," Physical Society Proceedings, Vol. 83, Pt. 5, May 1964.

III,
B. COSMIC RAYS (CONT.)

Brown, R.R., "On the Influence of Composition and Spectra of Solar Cosmic Rays on the Intensity Ratio I (λ5577)/I(λ3914) in Polar-Glow Aurora," Planetary and Space Science, Vol. 12, July 1964.

Bruzak, A., "Optical Characteristics of Cosmic-Ray and Proton Flares," Journal of Geophysical Research, Vol. 69, Contract No. AF 19(604)-7993, June 1, 1964.

Burbidge, G.R., Hoyle, F., "On Cosmic Rays as Extragalactic Phenomenon," Physical Society, Proceedings, Vol. 84, July 1964.

Brunstein, K.A., "Measurement of Low-Engery Cosmic-Ray Protons," Physcial Review, 2nd Series, Vol. 133, March 23, 1964.

Charakhch'ian, A.N., "Fluctuations in the Intensity of Cosmic Rays in the Stratosphere Caused by Processes on the Sun," Uspekhi Fizicheskikh Nauk, Vol. 83, May 1964 (In Russian).

Charakhch'ian, A.N., and Charakhch'ian, T.N., "Decrease in Cosmic-Ray Intensity in the Stratosphere During Magnetic Storms," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Charakhch'ian, A.N., "The Secular Variation of Cosmic-Ray Intensity in the Stratosphere," Geomagnetism and Aeronomy, Vol. 3, No. 4, 1963 (Translation).

Charakhch'yan, A.N., "Investigations of Cosmic Ray Intensity Fluctuations in the Stratosphere Caused by Solar Processes," Uspekhi Fiz, Nauk, Vol. 83, No. 1, 1964.

Charakch'yan, A.N., "Study of Cosmic Ray Intensity Fluctuations in the Stratosphere, Caused by Processes Occurring on the Sun," Usp. Fiz, Nauk. (Moscow), Vol. 83, No. 1, NASA-TT-F-9027, July 1964.

Charakhch'yan, A.N., Tulinov, V.F., and Charakhch'yan, T.N., "On the 27-Day Variations of Cosmic Rays in the Stratosphere During the Period Between July 1957 and February 1958," Cosmic Rays, June 1964.

Chirkov, N.P., "Variations in Cosmic-Ray Intensity During the Passage of Cyclones," Geomagnetism and Aeronomy, Vol. 2, No. 3, 1962 (Translation).

Chketiya, A.M., and Shatashvili, L.K., "27-Day Recurrence Tendency in Hard-Component Intensity During a Solar-Activity Minimum According to Observations in Tbilisi," Cosmic Rays, June 1964.

Dorman, L.I., Kolomeets, E.V., Kozak, L.V., Pivneva, V.T., and Sergeeva, G.A., "Fluctuations of Cosmic-Ray Intensity During a Forbush Decrease," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963 (Translation).

B. COSMIC RAYS (CONT.)

Dorman, L.I., and Inozemtsev, O.I., "Nature of the Local Source of Diurnal Cosmic-Ray Anisotropy During the Main Phase of a Magnetic Storm," Geomagnetism and Aeronomy, Vol. 2, No. 3, 1962 (Translation).

Dorman, L.I., Ivanov, V.I., Kolomeets, E.V., and Kashkarov, I.E., "The Nature of the Effect of Small Bursts in the Cosmic-Ray Hard Component, "Geomagnetism and Aeronomy, Vol. 3, No. 4, 1963 (Translation).

Dorman, L.I., Ivanov, V.I., and Kolomeets, E.V., "Increase in the Intensity of the Hard Component of Cosmic Rays During 'Small' Chromospheric Flares on the Sun," Geomagnetizm i Aeronomiia, Vol. 4, No. 2, NASA-TT-F-9005, Mar.-Apr. 1964 (In Russian).

Dorman, L.I., "Coupling Constants and Interpretations of Underground Observations of Cosmic-Ray Variations, Geomagnetizm i Aeronomiia, Vol. 4, Mar.-Apr. 1964 (In Russian).

Dorman, L.I., Ivanov, V.I., and Kolomeets, E.V., "The Effects of Chromospheric Flares in the Neutron Component of Cosmic Rays in Magnetically Quiet Days and During Powerful Flares Accompanied by Absorption of Type III," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Dorman, L.I. and Inozemtseva, O.I., "The Nature of Disturbances in the Diurnal Variation of Cosmic Rays Approaching Earth from Different Directions During Magnetic Storms," Cosmic Rays, June 1964.

Dorman, L.I., "Recent Concepts of the Variations of Cosmic Rays," Cosmic Rays, July 1964.

Dorman, L.I., "The Problem of the Effect on Cosmic Rays of a Solar Corpuscular Stream in the Form of a Magnetized Envelope," Cosmic Rays, June 1964.

Dorman, L.I., Blokh, Y.L., and Kaminer, N.S., "Nature of the Increase in Cosmic-Ray Intensity at a Forbush-Effect Minimum," Cosmic Rays, June 1964.

Dorman, L.I., "Coupling Coefficients for the Primary and Secondary Variations of Cosmic Rays in the High Energy Region," Cosmic Rays, July 1964.

Dorman, L.I., "The Problem of Nature of the Source of the Diurnal Variation of Cosmic Rays from the Direction of the Sun," Cosmic Rays, June 1964.

Dorman, L.I., and Inozemtseva, O.I., "Experiments with Crossed Telescopes and the Nature of the Solar Diurnal Variation of Cosmic Rays During a Solar Maximum and a Solar Minimum," Cosmic Rays, June 1964.

III,
B. COSMIC RAYS(CONT.)

Dorman, L.I., "Sudden Increases in Cosmic-Ray Intensity Connected with Corpuscular Streams and with Electromagnetic Conditions in Interplanetary Space and in the Vicinity of the Earth," Cosmic Rays, June 1964.

Dorman, L.I., and Shatashvili, L.K., "Investigation of the 27-Day Variations of Cosmic Rays According to Data from the Worldwide Network of IGY Stations for the Period July to December 1957," Cosmic Rays, June 1964.

Dorman, L.I., "On Cosmic-Ray Variations Due to an Asymmetric Solar Wind," Cosmic Rays, June 1964.

Dorman, L.I., "On the Cosmic-Ray Variations Caused by an Expanding Turbulent Magnetized Cloud," Cosmic Rays, June 1964.

Dorman, L.I., "The Earth as a Cosmic-Ray Absorber and its Role in the Creation of Forbush-Type Effects and 27-Day and 11-Year Variations," Cosmic Rays, June 1964.

Dubinskii, I., Khalupka, P., Gadek, V., and Mrkos, A., "Determination of the Cosmic Ray Equator at 14° West Longitude," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963 (Translation).

Escobar, Ismael, "Time Variations in Cosmic Rays and Radiosonde Measurements," Cuaderno, No. 25, Grant AF-AFOSR-62-395, June 1963 (Final Technical Report).

Fichtel, C.E., "Very High-Energy Cosmic Rays," Phys. Review Letters, Vol. 11, No. 4, (NASA-RP-260) 15 Aug. 1964.

Fichtel, C.E., Guss, D.E. Stevenson, G.R., and Waddington, C.J., "Cosmic-Ray Hydrogen and Helium Nuclei During a Solar Quiet Time in July 1961," Phys. Rev. Vol. 133, No. 3B, NASA-RP-203, 10 Feb. 1964.

Fichtel, C.E., Guss, D.E. Kniffen, D.A., and Neelakantan, K.A., "Modulation of Low-Energy Galactic Cosmic-Ray Hydrogen and Helium," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Fomenko, B.D., "Correlation of the Secular Dependence of Cosmic Rays in the Stratosphere with the Solar Activity," Geomagnetizm i Aeronomiia, Vol. 4, March - April 1964 (In Russian).

Fomin, L.A., and Khristiansen, G.B., "Energy Spectrum and Composition of Cosmic Rays of Galactic and Metagalactic Origin," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 46, June 1964 (In Russian).

Freier, P.S., and Waddington, C.J., The Modulation of Heavy Nuclei in the Primary Cosmic Radiation, Contract Nonr-710(19), Feb. 1964.

III,
B. COSMIC RAYS (CONT.)

Fretter, W.B., Brown, R.R., and Anderson, K.A., Research in High Energy Particle Physics and Research on Cosmic Rays and Solar Particle Emissions, Final Report, Contract Nonr-222(40), Dec. 15, 1954 - June 30, 1963.

Friedlander, M.W., Neelakantan, K.A., Tokunaga, S., Stevenson, G.R., and Waddington, C.J., "The Fragmentation of Heavy Cosmic Ray Nuclei in Light Elements," Philosophical Magazine, 8th Series, Vol. 8, October 1963.

Getmantsev, G.G. and Tokarev, I.V., "Nonthermal Radio Emission of the Galaxy and the Electron Component of Cosmic Rays in a Nonstationary Approximation," Geomagnetizm i Aeronomiia, Vol. 4, March - April 1964. (In Russian)

Gill, P.S. and Khera, M.K., "Directional Distribution of the Hard Component of Cosmic Rays," Nuovo Cimento, Serie Decima, Vol. 32, April 1, 1964.

Ginzburg, V.L. and Syrovatskii, S.I., "Gamma and X-Rays Related to Galactic and Metagalactic Cosmic Rays," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 46, May 1964 (In Russian)

Ginzburg, V.L., Kurnosova, L.V., Razorenov, L.A., and Fradkin, M.I., "Investigations of the Nuclear Component of Cosmic Rays Made on Soviet Satellites and Rockets," Usp. Fiz. Nauk, (Moscow) Vol. 82, No. 4, April 1964.

Ginzburg, V.L. and Syrovatskii, S.I., "Secondary Electron Component of Cosmic Rays and the Spectrum of Total Galactic Radio Emission," Astronomicheskii Zhurnal, Vol. 41, (In Russian) May-June 1964.

Ginzburg, V.L., Kurnosova, L.V., Razorenov, and Fradkin, M.I., "Soviet Satellite and Rocket Investigations of the Nuclear of Cosmic Rays," Uspekhi Fizicheskikh Nauk, Vol. 82, Mar. 1964 (Translation).

Ginzburg, V.L., Kurnosova, L.V., Razorenov, L.A., and Fradkin, M.I., "Investigations of the Nuclear Component of Cosmic Rays, Conducted by Means of Soviet Satellites and Rockets," Uspekhi Fizicheskikh Nauk, Vol. 82, April 1964 (In Russian)

Ginzburg, V.L., Kurnosova, L.V., Razorenov, L.A., and Fradkin, M.I., "Some Results Obtained from the Study of Cosmic Rays and Radiation Belts with Soviet Satellites and Space Rockets," Space Science Reviews, Vol. 2, Dec. 1963 (Translation).

Glokova, Y.S., "The Question of the Sidereal Diurnal Effect in Cosmic Rays During 1954," Cosmic Rays, June 1964.

Glokova, Y.S., Dorman, L.I., and Kaminer, N.S., "On Methods of Introducing Meteorological Corrections into Cosmic-Ray Intensity Data," Cosmic Rays, July 1964.

Glokova, E.S., "Geographic Distribution of the Solar DailyVariation in the Neutron Component of Cosmic Rays," Geomagnetizm i Aeronomiia, Vol. 4, March - April 1964 (In Russian).

III,
B. COSMIC RAYS (CONT.)

Gosling, J.T., "A Study of the Relationship Between Absorption-Time Profiles of Polar-Cap-Absorption Events and Forbush Decreases of Cosmic-Ray Intensity," Journal of Geophysical Research, Vol. 69, April 1, 1964.

Grigorov, N.L., Zhuraviev, D.A., Kondrat'yeva, M.A., Rapoport, I.D., and Savenko, I.A., "Investigation of Cosmic Radiation Beyond the Atmosphere," Kosmich. Issled., Vol. 1, No. 3, 1963 (NASA-TT-F-8831).

Grigorov, N.L., "Composition of Nuclear-Active Component of Cosmic Rays in the Atmosphere," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 45, Dec. 1963 (Translation).

Grigorov, N.L., Zhuravlev, D.A. Kondrat'eva, M.A., Rapoport, I.D., and Savenko, A., "Investigations of Cosmic Radiation Beyond the Atmosphere," Cosmic Res., 14 Feb. 1964.

Gronkvist, B.O., Spectral Variations During Cosmic Ray Storms, Technical Note. No. 4, Contract AF 61(052)-614, 20 March 1964.

Hao-hwai, K., Shih-wei, W., Yu-kuei, Y., "Nuclear Interactions of Cosmic-Ray High-Energy Particles with Liquid Scintillator," Scientia Sinica, Vol. 13, May 1964. (Translation).

Hatton, C.J., and Carswell, D.A., Asymptotic Directions of Approach of Vertically Incident Cosmic Rays for 85 Neutron Monitor Stations, Available from Scientific Document Distribution Office, Atomic Energy of Canada Ltd. Chalk River, Ontario, Aug. 1963.

Hayakawa, S., "The Origin of Cosmic Rays," Lectures on Astrophysics and Weak Interactions; Brandeis Summer Institute in Theoretical Physics, Ed. by Ford, K.W., Vol. 2, 1963.

Hayman, P.J., Palmer, N.S., and Wolfendale, A.W., "The Rate of Energy Loss of High-Energy Cosmic Ray Muons," Royal Society (London), Proceedings, Series A, Vol. 275, Oct. 8, 1963.

Hill, C.R., Woodhead, D.S., "Tissue Dose Due to Neutrons of Cosmic-Ray Origin," The Natural Radiation Environment, Ed. by Adams, J.A.S., Lowder, W.M., 1964.

Inozemtseva, O.I., "Dirunal Anisotropy of Cosmic Rays and Variation of the Geomagnetic Field," Geomagnetizm Aeronomiia, Vol. 4, March - April 1964 (In Russian).

III,
B. COSMIC RAYS (CONT.)

Jacklyn, R.M., "A Solar Anisotropy in Cosmic Radiation, Viewed from a Terrestrial Frame of Reference," Nature, Vol. 200, Dec. 28, 1963.

Kaminer, N.S. Blokh, Y.L., and Dorman, L.I., "The Cosmic-Ray Burst of 4 May 1960," Cosmic Rays, June 1964.

Kaminer, N.S., Dorman, L.I., Blokh, Y.L., "The Magnetic Storm in Mid-May 1959 and the Variations of Cosmic Rays," Cosmic Rays, June 1964.

Kane, R.P., "Energy Spectrum of Daily Variation of Cosmic-Ray Intensity," Nuovo Cimento, Serie Decima, Vol. 32, April 16, 1964.

Kaplon, M.F., and Skadron, G., A Heuristic Model for the Variation with Rigidity of the Cosmic Ray Charge Spectrum, (Grants AF-AFOSR-439-63; NSF GP-1372) 12 June 1964.

Kastner, J., Oltman, B.G., and Marinelli, L.D., "Measurement of the Cosmic-Ray Neutron Background," Radiological Phys. Div. Summary Report, July 1962- June 1963.

Kiss, E., "Recent Literature on Cosmic Radiation, 1962-1963," Meteorol, and Geoastrophys, Vol. 14, No. 11, Nov. 1963.

Koch, L., Engelmann, J., Labeyrie, J., and de Zertucha, D., Charge and Energy Spectra of Z<3 Primary and Secondary Cosmic Rays at 46° Geomagnetic Latitude, Presented at COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964.

Kodama, M., and Wada, Masami., "On Cosmic Ray J-Index as a Trail to Represent Degree of Disturbance in Time Variations," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 2, 1963.

Konstantinov, B.P., and Kocharov, G.E., "The Interaction Between Ultrahigh-Energy Cosmic Rays and Neutrinos in the Universe," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 46, April 1964 (Translation).

Kolomeyets, Y.V., and Sergeyeva, G.A., "Study of the Effect of Small Solar Flares on the Intensity of the Neutron Component of Cosmic Rays," Cosmic Rays, June 1964.

III,
B. COSMIC RAYS (CONT.)

Korff, S.A., "Production of Neutrons by Cosmic Radiation," The Natural Radiation Environment, Ed. by Adams, J.A.S., and Lowder, W.M.. 1964.

Kraushaar, W.L., Cosmic Ray Equilibrium, NASA Grant MsG-386, 1964.

Kraushaar, W.L., Clark, G.W. Agagino, M., Garmire, G., Helmken, H. et al, Cosmic Gamma Ray Results from Explorer XI, NASA Grant NsG-386.

Krivsky, L., "On the Flare of 1956 August 31 Connected with the Ejection of Cosmic Ray After Y-Shapped Phase," Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, No. 2, 1964.

Kuklin, G.V., Luzov, A.A., "The Existence of a Semidiurnal Intensity Variation of Cosmic Rays During a Disturbed Period," Geomagnetizm i Aeronomiia, Vol. 4, No. 1, 1964, (In Russian).

Kurnosova, L.V., Razorenov, L.A., and Fradkin, M.I., "The Investigation of the Nuclear Component of Cosmic Rays on the Third Cosmic Rocket," Artificial Earth Satellites, (Moscow), No. 8, 1961 (Translation).

Kuz'min, A.I., Danilov, A.A., Krymskiy, G.F., Skripin, G.V., "Energy Chracteristics of Cosmic-Ray Variations During Magnetic Disturbances," Cosmic Rays, June 1964.

Kuz'min, A.I., Yefimov, N.N., Krasil'nikov, D.D., Skripin, G.V., Sokolov, V.D. et al, "Investigation of the Temporal Variations of the Different Components of Cosmic Rays in Relation to Observations Made at a Single Point," Cosmic Rays, July 1964.

Kuz'min, A.I., Skripin, G.V., Krivoshapkin, P.A., and Krymskii, G.F., "Energy Spectrum of Diurnal Cosmic-Ray Variations and Diurnal Temperature Variations at a Height of 20-40 km," Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963 (Translation).

Laster, H., The Spectrum and Composition of High Energy Cosmic Rays, Technical Report No. 368, NASA Grant NsG-58-60, March 1964.

Laster, H., "Galactic and Extragalactic Propagation of Cosmic Rays," Physical Review, 2nd Series, Vol. 135, Sept. 7, 1964.

Laster, H., On the Galactic and Extragalactic Propagation of Cosmic Rays, Physics Department Technical Report No. 373, NASA Grant NsG-58-60, 1963.

Lingenfelter, R.E., "The Cosmic-Ray Neutron Leakage Flux," Journal of Geophysical Research, Vol. 68, Oct. 15, 1963.

III,
B. COSMIC RAYS (CONT.)

Maeda, K., "On the Zenithal Distribution of Extemely-High-Energy Cosmic-Ray Muons in the Atmosphere," Journal of Geophysical Research, Vol. 69, May 1, 1964.

Markichev, E.I., "Determination of the Contribution of Cosmic Radiation to the Background of Gas Counters," Instruments and Experimental Techniques, Oct. 1963, (Translation).

May, H., and Marinelli, L.D., "Cosmic-Ray Contribution to the Background of Low-Level Scintillation Spectrometers," The Natural Radiation Environment, Ed. by Adams, J.A.S., Lowder, W.M., 1964.

Meyer, P., Cosmic Radiation, Presented at the GY/IGC Symp., Los Angeles, NASA Grant NsG-144-61, August 1963.

Milford, S.N., Cosmic Ray Hazards in the Solar System, Presented at the AIAA Aerospace Sci. Meeting, N.Y., 20-22 Jan. 1964 (AIAA Paper 64-66).

Miles, R.F., "Density of Cosmic-Ray Neutrons in the Atmosphere," Journal of Geophysical Research, Vol. 69, April 1, 1964, Contract No. Nonr-220(17).

Miyake, S., Narasimham, V.S., Ramana Murthy, P.V., "Cosmic-Ray Intensity Measurements Deep Underground at Depths of (800 ÷ 8400) M.W.E., " Nuovo Cimento, Serie Decima, Vol. 32, June 16, 1964.

Miyake, S., Narasimham, V.S., and Ramana Murthy, P.V., "Energy Spectrum of Cosmic-Ray Muons at Sea Level," Nuovo Cimento, Serie Decima, Vol. 32, June 16, 1964.

Neher, H.V., and Anderson, H.R., "Change of Cosmic-Ray Intensity with Distance from the Sun," Journal of Geophysical Research, Vol. 69, May 1, 1964.

Neher, H.V., and Anderson, H.R., "Cosmic-Ray Intensity at Thule, Greenland, During 1962 and 1963 and a Comparison with Data from Mariner 2," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Nerurkar, N., and Webber, W.R., "Observations of Primary Cosmic-Ray Variations Using Ion Chamber and Geiger Counters. I - A Comparison of the Long-Term and Forbush Variations," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Nesterova, N.M., and Nikol'skii, S.I., "Composition of the Primary Cosmic Radiation Based on Fluctuations of the Cherenkov Light in Wide Atmospheric Showers," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 46, May 1964 (In Russian).

Okuda, Haruyuki, "Geomagnetic Effects of Cosmic Ray Electron Intensity," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 1, 1963.

Osborne, J.L., "Cosmic-Ray Muon Polarization Studies of the K/π Ratio," Nuovo Cimento, Serie Decima, Vol. 32, May 16, 1964.

III,
B. COSMIC RAYS (CONT.)

Parker, E.N., "Theory of Streaming of Cosmic Rays and the Diurnal Variation," Planetary and Space Science, Vol. 12, August 1964 (Grant No. NsG 96-60).

Petukhov, V.A., "Possibility of the Formulation of Chemical Elements Under the Influence of Cosmic Rays," Probl. of Cosmogony, Vol. V 27, April 1964.

Pomerantz, M.A., Duggal, S.P., and Witten, L., Spectrum of Heavy Nuclei in the Primary Cosmic Radiation, Space Research IV; Internation Space Science Symposium; 4th Warsaw, Poland, June 4-10, 1963, Proceedings, Ed. by Muller, P.

Pomerantz, M.A.,Data Reduction and Analysis for Heavy Primary Cosmic Ray Experiment in Explorer VII Satellite, Final Report, 1 Nov. 1961-31 Dec. 1963, Contract NASr-79)

Ray, E.C., "Cosmic-Ray Cutoffs at High Latitude," Journal of Geophysical Research, Vol. 69, May 1, 1964 (Grant No. NsG-382).

Rasin, V.A., Physical Conditions in the Vicinity of the Solar System According to Polarization Measurement Data of Cosmic Radio Emission, Contract NAS5-3760, 30 Sept. 1964 (Translation).

Rosen, A., Vogl, J.L.,"Cosmic Rays in Space," Space Physics, Ed. by LeGalley, D.P., and Rosen, A., 1964.

Rossi, M., "Protection Against Cosmic Rays During Space Flights," The Man and Technology in the Nuclear and Space Age, Proceedings of the International Congress, Milan, Italy, April 18-21, 1962, (In Italian).

Sakakibara, S., and Sekido, Y., "Anisotropy of μ- Rich Air Showers," Physical Review, 2nd Series, Vol. 133, Jan. 27, 1964.

Sandstrom, A.E., Dyring, E., Ekstrom, L., Gronkvist, B.O., Lindgren, S. et al, Cosmic Ray Intensity Variations During 1963, Contract AF 61(052)-614), 15 Mar. 1964.

Sandstron, A.E., Geophysical Aspects of Cosmic Rays, Final Report,(Contract AF61(052)-614) 27 April 1964.

Sauer, H.H., Ray, E.C., "On Cosmic Ray Cutoffs," Annals of Physics, Vol. 25, Nov. 1963.

Savenko, I.A., Pisarenko, N.F., Shavrin, P.I., and Nesterov, V.E., Control Over the Cosmic Radiation Level During Flight of Space Vehicle Vostok 3, Vostok 4, Vostok 5, and Vostok 6, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964.

Sciama, D.W., Cosmic X-Rays as a Tool for Exploring the Large-Scale Properties of the Universe, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964.

III,
B. COSMIC RAYS (CONT.)

Shapiro, M.M., "Notes on Cosmic Radiation," Evoluzione Delle Stelle; Scuola Internazionale Di Fisica 'Enrico Fermi,' XXVIII Corso, Rendiconti, Ed. by Gratton, L., Academic Press, Inc., New York and London, 1963.

Shapiro, M.M., The Primary Cosmic Radiation, Presented at a lecture at the Enrico Fermi Intern. School of Phys., Varenna, Italy, Aug. 1962, (25 April 1963).

Shafer, Y.G., Sokolov, V.D., "Some Results of Stratospheric Investigations of the Intensity of Cosmic Rays at Yakutsk," Cosmic Rays, July 1964.

Shishov, V.I., "The Influence of a Radial Magnetic Field on the Diffusion of Cosmic Rays," Geomagnetism and Aeronomy, Vol. 3, Translation, No. 4, 1963.

Simpson, J.A., "Recent Investigations of the Low Energy Cosmic and Solar Particle Radiations," Pontificiae Academiae Scientiarum Scripta Varia, No. 25, 1963, Contracts No. AF 49(638)-1008; No. AF19(604)-4554; Grant No. AF AFOSR 62-23.

Simpson, J.A., Research on the Solar-Geophysical Aspects of Cosmic Radiation and Magneto-Hydrodynamics, Final Technical Report, 18 Dec. 1954- 30 Nov. 1962, (Contracts AF 19(604)-4554; AF 19(604)-1288), 3 Sept. 1963.

Simpson, J.A., Recent Investigations of the Low Energy Cosmic and Solar Particle Radiations, Pontifical Academy of Science's Scripta Varia No. 25, 1963, (Contracts AF 49(638)-1008; AF 19(604)-4554; AF AFOSR Grant 62-23).

Syrovatskii, S.I., Fomin, I.A., Knristiansen, G.B., "The Energy Spectrum of Primary Cosmic Rays and their Composition in the Ultra-High-Energy Range," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 45, Nov. 1963, (Translation).

Stromer, P.R., Mc Cormick, H.B., Cosmic Radiation: An Annotated Bibliography, 1960-1963, (Contract AF 04(647)-787), May 1963.

Tamplin, A.R., and Fisher, H.K., Galactic Cosmic Radiation and Manned Space Flight, (Contract AF 49(638)-700; Proj. RAND) Dec. 1962.

Takahashi, Hachiro, "On the Change in the Rigidity Spectrum of Primary Cosmic Rays During Short-Term Variation," Report on Ionosphere and Space Research in Japan, Vol. 17, No. 1, 1963.

Tyasto, M.I., "Empirical Determination of the Temperature Effect for the Hard Component of Cosmic Rays over Heiss Island," Cosmic Rays, July 1964.

Van Allen, J.A., and Lin, W.C., "The Edge of the Polar Plateau for Galactic Cosmic Rays and their Charged Albedo," Journal of Geophysical Research, Vol. 69, Feb.1, 1964, Contract No. Nonr 93803; Grant No. NsG-233-62.

III,
B. COSMIC RAYS (CONT.)

Van Allen, J.A., Lin, W.C., and Leinbach, H., On the Relationship Between Absolute Solar Cosmic Rays Intensity and Riometer Absorption, (Contract Nonr-93803) July 1964.

Vakulov, P.V., Vernov, S.N., Gorchakov, E.B., Logachev, I.I., Charakhchian, A.N., Charakhchian, T.N., and Chudakov, A.E., Investigation of Cosmic Rays, Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Ed. by Muller, P., 1964.

Vernov, S.N., Savenko, I.A., Shavrin, P.I., Nesterov, V.E., Pisarenko, N.F., and Basilova, R.N., A Study of Cosmic Rays at Altitudes of 200 to 400 km, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964.

Webber, W.R., McDonald, F.B., "Cerenkov Scintillation Counter Measurements of the Intensity and Modulation of Low Rigidity Cosmic Rays and Features of the Geomagnetic Cutoff Rigidity," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Webber, W.R.,"The Motion of Low-Rigidity Cosmic Rays in the Earth's Magnetic Field and the Effects of External Fields," J. Geophys. Res., Vol. 68, No. 10, 15 May 1963, (NASA Grant NsG-281-62).

Yefimov, N.N., "On the Problem of the Temporal Distribution of Extensive Air Showers of Cosmic Rays," Cosmic Rays, July 1964.

Young, O.B., and Lieh, J.W., "Heavy Primary Cosmic-Ray During 1957," Nuovo Cimento, Serie Decima, Vol. 31, March 1, 1964.

Zatsepin, V.I., "Angular Distribution of the Intensity of the Cerenkov Light from Extensive Atmospheric Cosmic-Ray Showers," Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki, Vol. 47, August 1964, (In Russian).

III. INTERPLANETARY SPACE
C. METEORS

Alexander, W. M., Mc Cracken, C. W., and La Gow, H. E., Interplanetary Dust Particles of Micron Size Probably Associated With The Leonid Meteor Stream (NASA-TN-D-1154) Dec. 1961.

> An interplanetary dust particle event, coincident with the Leonid meteor shower and lasting approximately 70 hr, was recorded by a sensor on the Vanguard III satellite. During this interval, the satellite's microphone system registered impacts of approximately 2,800 dust particles with moments exceeding 10^{-2} dyne-second.

Astapovich, I. S. and Fedynaskiy, V. V., "Progress In Meteor Astronomy in 1958-1961" Meteoritika (Translation) 3 Feb. 1964 (JPRS-23047; OTS-64-21470)

> Progress discussed in meteor astronomy includes: (1) the study of meteoric matter in space by means of instruments installed in satellites and rockets; (2) the use of rocket technology to impart escape velocities to bodies and to create artificial meteors in order to experimentally verify theory; (3) the determination of the rate of loss of material from the surface of meteors by the fusion of meteoric material in an air stream at supersonic velocity; (4) the obtainment of data on the ionization of atmospheric gases by the shock wave arising from the flights of meteoric bodies at cosmic velocities; (5) the use of radar to study meteors and the use of meteor phenomena (ionization for example) for long-range radio communications; (6) the study of the true density of meteoric matter in the region of the earth's orbit; (7) the determination of the orbits of a considerable number of meteors; (8) the discovery of meteor streams connected with a number of observed comets; (9) the first photographing of the flight of a bolide that finally fell as a meteorite; and (1) the study of the influence of interplanetary magnetic fields on the formation of the solar system's dust clouds. Also, meteor research during the IGY is discussed.

Astapovich, I. S., "Radiants of Meteor Streams Based on Observations In China In The First Millenium of Our Era", In its Probl. of Cosmogony, Vol. VII 25 May 1964 p 167-179.

Bezgin, L. S. and Ivashchenko, M. I., "Approximate Design of Protective Meteor Shields" News of the Acad of Sci. of the USSR, 16 June. 1964 p 27-33.

> Increasing wall thickness is the simplest way to protect space equipment from the dangers of meteors. An approximate method is given in equations for calculating the upper limit for the thickness of a screen and housing of a meteor shield.

III,
C. METEORS (CONT.)

Carrara, N., Checcacci, P. J., Consortini, A., de Langer, M. E., and Ronchi, L., Research on Meteor Trail Echoes (Contract AF-61(052)-592) Sep. 1963.

The status of the research in the meteor field performed at the Centro Microonde of C.N.R., Florence, Italy, is described. Some results which are reported about the meteor flow have been derived from experimental data.

Ceplecha, Z., Jezkova, M., Novak, M., Rajchi, J. Sehnal, L., and Davies, J. G., "Ondrejov Double-Station Meteors During The IGY and IGC" Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, No. 4 p. 144-155 1964.

Presentation of data on 88 meteors derived from double-station photographs exposed during the years 1957, 1958, and 1959. Fixed camers with rotating shutters were used at Ondřejov and Prčice; moving cameras were used at Ondřejov. For each meteor, 34 different data concerning the geocentric trajactory and heliocentri orbit, velocity, deceleration, and luminosity are given in a table. Additional data on velocity and deceleration for 12 meteors are presented in another table.

Ceplecha, Z., "Study of a Bright Meteor Flare by Means of Emission Curve of Growth" Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, No. 3, p 102-112, 1964.

Spectroscropic analysis of a meteor flare of -12 visual magnitude, on the basis of an 11 to 38 Å/mm spectrogram with known absolute intensities of the lines. Theoretical emission curves of growth for three different models (sphere with uniform density, sphere with constant velocity of expansion, cylindrical shock-wave) are presented and were used for the computation of the excitation temperature and abundance of FeI using 70 lines. The abundances of 8 other elements were computed using altogether 27 lines with some simplifying suppositions. The composition of the body was found to be stony.

Chepura, V. F., Kashcheyev, B. L., and Bondar, B. G., "Research on the Directional Scattering of UHF Radio Signals by Meteor Trails" Elektrosvyaz (Translation) Vol. 16 no. 11, p 3-10, Feb, 11, 1963.

Results are given of an experimental study of UHF scattering by meteor trails. Data have been obtained on the variation in the correlation factor of two signals of nearly the same frequency received simultaneously at the same location.

III,
C. METEORS (CONT.)

Chytil, Bohumil, "A Note on the Amplitude Distribution of Signals Scattered on Meteor Trails" Studia Geophysica et Geodaetica, Vol. 8, no. 3, p. 268-273 1964.

Application of the theory of random-signal interference to the determination of the amplitude distribution of radio waves reflected by meteor trails. The analysis is limited to trails for which the attenuation of the reflected signal with time follows the exponential law. The results indicate that the distribution of even small amplitudes can widely vary from case to case.

Consortini, Anna, Meteor Data Bulletin No. 15, May 1963, Apr. 1964.

This bulletin presents some elaboration of the meteor radar data obtained at the Centro Microonde in May 1963. From the date, the hourly rate was analyzed as a function of the time, antenna direction, and radar distance. The distribution of the echo duration and the duty cycle were computed. More detailed observations of particular behaviors are reported.

Consortini, Anna, Meteor Data Dulletin No. 16, November-December 1963 Astronomy and Astrophysics, Apr. 1964.

This bulletin presents some elaborations of the meteor radar data obtained at the Centro Microonde in the period November-December 1963. From the data, the hourly rate was analyzed as a function of the time, antenna direction, and radar distance. The distribution of the echo duration and the duty cycle were computed. More detailed observations of particular behaviors are reported. Also, titles of reports on meteor research are listed.

Consortini, Anna, Meteor Data Bulletin No. 17, February 1964, Apr. 1964.

This bulletin presents some elaborations of the meteor radar data obtained at the Centro Microonde in February 1964. From these data, the hourly rate was analyzed as a function of time, antenna direction, and radar distance. The distribution of the echo duration and the duty cycle were computed. More detailed observations of particular behaviors are reported. Also, titles of reports concerning meteor research are listed.

Consortini, Anna, Meteor Data Bulletin No. 18, March 1964.

This bulletin presents some elaborations of the meteor radar data obtained at the Centro Microonde in March 1964. From the data, the hourly rate was analyzed as a function of the time, antenna direction, and radar distance. The distribution of the echo duration and the duty cycle were computed.

III,
C. METEORS (CONT.)

Davis, J., "Photoelectric Meteor Observations and the Colour Indices and Visual Magnitudes of Meteors", Royal Astronomical Society Monthly Notices, Vol. 126, no. 5, 1963

Theoretical and experimental investigation of the sensitivity of a practical photoelectric system for detecting meteors. A system for the objective measurement of color indices of meteors down to visual magnitude + 4 is described. Results obtained with this equipment show a variation of color index with meteor brightness in good agreement with the subjective results of Jacchia and Davis.

Davidson, T. W., and Martyn, D. F., A Supposed Dependence of Meteor Rates on Lunar Phase; JGR 69, 19 p 3981 - 3987 (Oct. 1, 1964).

Meteor rates appear to be random with respect to lunar phase (either monthly or daily).

Delov, I. A., Lagutin, M. F., and Lysenko, I. A., "Investigation of Certain Turbulent Flow Parameters by the Method of Radar Location of Meteor Trails (Isseldovaniya Nekotorykh Parametrov Turbulentnykh Dvizheniy Metedom Radiolokatsii Meteornykh Sledov)", Izv. Vyssh. Ucheb. Zaved., Radiofiz (Gor'kiy), (Translation), Vol. 7, no. 2. p 225 - 231 (NAS5-2078) 1964.

This paper discusses the results of experimental investigations of turbulent motions in the meteor zone by the method of radar location of meteor trails. The magnitude of the basic statistical parameters characterizing the turbulent motion is estimated. The daily variations of some of the parameters are investigated. Although the parameters of turbulent motion, found in this work, are by their order of magnitude near those found in previous works, the radar location method applied here on the basis of local properties of turbulence provides a more correct estimate of the values of ϵ. The presence of daily variations of a series of statistical turbulence parameters provides the basis of assuming that the "intensity" of turbulence in the meteor zone is controlled by the sun.

Ellyett, C. D., and Fraser, B. J., "On The Correlation of Meteors with Micropulsations," Journal of Geophysical Research, Vol. 68, p. 5937 - 5945, Nov. 1, 1963.

Description of nighttime geomagnetic micropulsations observed in the 1.5-cps frequency band down to a limiting sensitivity of 0.05 mγ. The results are compared with all-sky and localized radar meteor rates obtained at the same site to investigate the magnetic effects produced by meteors. Individual meteor occurrence has been examined by recording

III,
C. METEORS (CONT.)

on the same chart as the mocropulsation activity. Most individual meteors do not have any associated micro-pulsation activity, but the number of coincidences is greater than random, and it is possible that some of the larger meteors do produce magnetic effects.

Ellyett, C. D., and Keay, C. S. L.,"Effect of the Moon on Terrestrial Meteor Rates:" Journal Geophysical Research 69, 7, p 1397 - 1401 (April 1, 1964).

There is little or no effect of the moon on terrestrial meteor rates, certainly less than 10%.

Ellyett, C., Keay, C. S. L., and Mc Lauchian, E. C., Radar Investigation of Meteors at High Rates of Detection, Jan 1964.

The construction and operation of an improved type of radar system for delineating meteor radiants is discussed. High rates of detection, quite often exceeding 1,000 meteors per hour, have been obtained. It is found that the very faint meteors which are detected in such large numbers completely obliterate many of the recognized showers.

Evans, J. V., and Brockelman, R. A., Radio-Echo Studies of Meteors at 68-CM Wave-Length, Part II: Shower Meteors (AF 19(628)-500) 15 Jan. 1964.

Radio-echo observations of five nighttime meteor showers are described. The observations were made at a wavelength of 68 cm and constitute part of a program of meteor observations carried out in the period 1960 to 1962 at the Millstone Hill Radar Observatory. The values for the velocities of the showers are presented and compared with values from other sources.

Fay, J. A., Moffatt, W. C., and Probstein, R. F., "Analytical Study of Meteor Entry" American Institute of Aeronautics and Astronautics, Conference on Physics of Entry into Planetary Atmospheres, AIAA Journal, Vol. 2, p 845 - 854, May 1964.

Fireman, E. L., and DeFelice, J., "Multiple Fall of Pribram Meteorites Photograhed. VII - The Tritium and Argon-39 in the Pribram Meteorite." Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, no. 3, 1964, p. 113.

Presentation of the results of measurements of radioactivities in the Pribram meteorite.

Fiocco, G., "Optical Radar Results and Meteoric Fragmentation" Journal of Geophysical Research, Vol. 69, p. 1795 - 1803, May 1, 1964.

Recent optical radar experiments utilizing a ruby laser as the source of radiation have indicated the existence of a scattering layer in the upper atmosphere at an altitude between 110 and 140 km. The echoes have been tentatively interpreted in accordance with a model of meteoric fragmentation and have been related to other experimental results. By progressive fragmentation in its flight through the atmosphere, a meteoroid should show an enhancement of cross section which is responsible for those echoes. The atmosphere would be working as a "filter," and the average size distribution of micrometeorites would vary with the height.

Francey, J. L. A., "Ambipolar Diffusion in Meteor Trails," Australian Journal of Physics, Vol. 16, Dec. 1963.

Examination of ambipolar diffusion, with reference to equality of electron and ion concentrations. The diffusion equations are established, based on a diffusion current under the action of a concentration gradient and a drift current due to a local electrostatic field. From the results, it is indicated than at densities above $10^7/m^3$, electrons and ions diffuse together at the ambipolar diffusion rate, and below this figure the changes tend to separate, owing to weakening of the effect of the electrostatic forces.

Furman, A. M. "Notes on the Theory of Ionization of Meteor Trails. III - Ionization Due to Air Molecules and Atoms Reflected from a Meteoroid," Astronomicheskii Zhurnal, Vol. 40, July-Aug. 1963. Soviet Astronomy, Vol 7, Jan. - Feb. 1964 (Translation).

Gul'medov, Kh. D., Lyubarskiy, K. A., and Latyshev, I. N., "Dependence of Meteor Height on Solar Activity," 18 May 1964. Izv. Akad. Nauk Turkm. SSR, Ser. Fiz.-Tekhn., Khim. i Geol. Nauk (USSR), no. 6, 1960 (Translation)

Solar activity has a strong effect on such atmospheric parameters as density and temperature. Ultraviolet and corpuscular radiation give rise to heating and expansion of the atmosphere and fluctuation of isobaric surfaces. Meteor heights are a function of the density and temperature of the atmosphere and may serve as a sensitive indicator of their variation. An attempt was made to determine the dependence of meteor height on solar activity by photographic observations of meteors; the effects of seasonal fluctuations were eliminated. The geocentric velocity of meteors has a strong effect on their height. The data obtained showed that meteor heights decreased with an increase in solar activity.

Gul'medova, A. A., Simonenko, A. N., and Iushkevich, E. S., "Results of Photographic Observations of Meteors (Rezul'taty Fotograficheskikh Nabliudenii Meteorov)." Akademiia Nauk Turkmenskoi SSR, Izvestiia, Seriia Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk, no. 3, 1964. In Russian.

Application of photographic methods to the determination of individual meteor orbits in the solar system and their motion in the upper atmosphere. A verified and improved version of orbit parameters previously reported for a number of meteors is presented in a table.

Hawkins, G. S., Lindblad, B. A., and Southworth, R. B., "The Velocity of Faint Meteors." Smithsonian Contributions to Astrophysics, Vol. 8, no. 4. (NASr-158)

Results of preliminary measurements of meteor velocity to a limiting magnitude of +10 obtained with a multistation radar system. A systematic change in the average velocity of meteors that depends on the magnitude (and hence on the size) has been found. Between magnitudes +6 and +9, the velocity decreases by 5 km/sec. There are indications that the effect becomes more marked for meteors fainter than +9. This effect is attributed to the difference in orbits within the various meteor populations.

Jacchia, L. G. "Meteors, Meteorites, and Comets: Interrelations." The Moon, Meteorites, and Comets, Vol. IV - The Solar System, 1963.

Review of the progress in our understanding of the physical nature and the origin of meteors, meteorites, and comets, which led to the present concept according to which comets are icy conglomerates that eject soft meteoric matter, while meteors have a different, probably asteroidal origin. Examined in some detail are: the formation of meteor streams, dispersal of meteor streams by gravitational forces and such nongravitational effects as the Pointing-Robertson effect, the Yarkovskii-Radzievskii effect, the solar corpuscular radiation effect, and the Jupiter barrier. Discussed are recurrent showers associated with comets, and the principal known showers for which a relation with a known comet has been established are tabulated. The physical characteristics of meteor showers are outlined.

Kalinkov, M., "Distribution of Meteors According to Stellar Magnitude (Raspredeleniye Meteorov Po Zvezdhym Velichinam)." Astronom. Zh. (Translation) Vol. 41, no. 2, (NAS5-2078) 1964.

Estimates of k within the limits of stellar magnitude -5^m to -12^m are given. These are based on data on 319,000 meteors available in various papers. In the -4^m to $+3^m$ interval the luminosity function cannot be approximated by an exponential function.

Katasev, L. A., "The Effect of the Earth's Atmosphere on the Motion of Meteoric Particles." Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4 - 10, 1963, Proceedings.

Presentation of the results of an analysis showing that part of the meteoric particles moving through the atmosphere may pass from hyperbolic orbits to elliptical geocentric orbits and that they may thus be transformed into meteoric satellites of the Earth. From the results it can be seen that for particles of a given mass and velocity, the capture zone is not wide. Slow and small meteorites are captured mainly.

Katasev, L. A., "The Influence of the Earth's Atmosphere on the Motion of Meteor Particles." Geomagnetizm i Aeronomiia, Vol. 3, no. 2 1963 Geomagnetism and Aeronomy, Vol. 3, no. 2 1963 (Translation).

Discussion of the influence of the atmosphere on the motion of meteor particles. It is shown that the velocity of the meteor particle and atmospheric density are the most important factors in this process. The results of computations show that the region of "trapping" of meteor particles and their transformation into Earth meteor satellites is small for particles of a given velocity and mass. However, for particles with masses from 10^{-9} to 1 gram, whose velocity is about 15 km/sec, this region as a whole is 40 km and lies at heights of 73 to 113 km. It is shown that as a result of the influence of the atmosphere the orbital elements of the meteor particles change considerably and there is a movement of meteor matter in the direction lying closer to the Sun.

Keay, C. S. L., "The Annual Variation in the Radiant Distribution of Sporadic Meteors," Repr. from J. Atmospheric and Terrest. Phys., Vol. 25, 1963.

Meteor data obtained from the Southern Hemisphere confirm that the strengths of the helion, apex, antihelion sources of sporadic meteor activity are in the ratio 2:1:2 when averaged over a whole year. During the year the helion and antihelion source strengths vary from 0.8 to 4.0 times that of the apex.

III,
C. METEORS (CONT.)

Keay, C. S. L., "The Distribution of Meteors Around the Earth's Orbit," Monthly Notices of the Royal Astron. Soc., v. 126, no. 2. 1963

As a result of 69.5 mc radar survey of meteoric activity recently undertaken in New Zealand, the variation of incident flux with solar longitude has been determined. It has been confired that the spatial density of small-size (sixth magnitude) meteoric matter is greater along the earth's orbit during the latter half of the year. However the comparison of results from both hemispheres shows that at midlatitude observing stations the asymmetry has a smaller influence than the gyrations of the ecliptic on the seasonal variation in observed meteor rate. These effects taken together provide a satisfactory explanation for most of the differences between the results from the two hemispheres.

Keay, C. S. L., "Some Salient Features of the Occurrence of Meteors," Astronomical Journal, Vol. 69, Feb. 1964.

The results of a year-long survey of meteor activity made in Christchurch, New Zealand, using monopulse radar techniques are compared with data obtained in other countries by visual and photographic methods. The radar survey was made at a frequency of 69.5 Mc and includes data on 700,000 meteors. The comparative results show a measure of agreement and reveal a correlation in meteorite falls. There appear to exist two or more distinct, large-scale associations of meteoroids encountered by the Earth during the year.

Kohoutek, L., "On the Hyperbolic Velocities of Sporadic Meteors from the Diurnal and Seasonal Variation," Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, no. 1, 1964.

Brief consideration of possible error sources in the value of the distinctly hyperbolic heliocentric velocity of sporadic meteors as determined from visual and telescopic observations. It is shown that these values are systematically distorted by the physiological effects of the angular meteor velocity. If this effect is eliminated, it is seen that the heliocentric velocity values range within the interval of elliptic velocities consistent with the results of radioelectric and photographic measurements.

Kresak, L'., "The Lattitude Variation of the Meteor Shower Influx," Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, no. 2, 1964.

Determination of the variation in geographic latitude for both the influx of shower meteors into the atmosphere, and for the portion of this influx that lends itself to optical observation. General formulas derived from geometrical considerations are applied to 24 major showers and to the sporadic background. It is shown that the results can be used to eliminate latitude dependence from the data of photographic meteor surveys. The results can also serve as a basis for discussion of the sources of various secondary phenomena which have been hypothetically associated with an increase in the dust content of the atmosphere due to meteor showers.

Kruchinenko, V. G., Moysya, R. I., Bayrachenko, I. V., "Radar Observations of Meteor Streams," Meteor Observation by Radar, 30 Apr. 1963 (Translation)

The role of the USSR in the IGY and IGC program in solving by radar observation the problem of recording meteor activity and explaining the relative role of meteors in the E layer of the ionosphere is discussed. The method of processing observational results, as well as the results of the observations, is examined. A discussion of the various recognized values of the relative distribution of the large and small bodies in the meteor stream is included.

Kruchinenko, V. G., Soviet Reports on Meteor Observation by Radar, 30 Apr. 1963.

Contents:

1. Kruchinenko, V. G., Moysya, R. I., Bayrachenko, I. V., Radar Observations of Meteor Streams

2. Bayrachenko, I. V. and Podogorodetskiy, Ye. D., Apparatus for Experimental Investigation of the Scattering of Radio Waves by Meteor Trails

Lebedinets, V. N., "Density of Meteoric Matter in the Vicinity of the Earth's Orbit, From Radar Observations of Meteors," (Astronomicheskii Zhurnal, Vol. 40, July - Aug. 1963), Soviet Astronomy, Vol. 7, Jan. - Feb. 1964 (Translation).

Lebedinets, V. N., "On the Mechanism of Formation of a Region of Higher Atomic Density with Atoms of Meteoric Origin at 100-110 KM," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4 - 10, 1963, Proceedings, 1964.

Investigation of the evaporation process in small meteorites, taking into account the energy loss by heat radiation. Formulas for the distribution of ionization along the meteor trails are derived. Numerical examples are included and discussed.

Marochnik, L. S., "Cause of Ionization of Cometary Molecules," (Astronomicheskii Zhurnal, Vol. 40, July - Aug. 1963) Soviet Astronomy, Vol. 7, Jan. - Feb. 1964. (Translation)

Marochnik, L. S., "On the Magnetic Effect of Meteors," Geomagnetizm i Aeronomiia, Vol. 4, no. 1, 1964. In Russian.

Brief discussion of the magnetic effect of meteors which is manifested during the flight of a meteoritic body through the atmosphere of the Earth in a slight local disturbance of the geomagnetic field.

Medvedev, Iu. A., "Radio Emission From a Meteor Trail," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5, 1963) Geomagnetism and Aeronomy, Vol. 3, no. 5, 1963, (Translation).

Theoretical analysis of the emission of radio waves from a simplified meteor model. Although radar reflection data suggest that the geomagnetic field has a strong effect on the diffusion of the trail, it is found that the natural emission of the meteor should not depend strongly on the location of the trail relative to the lines of force of the geomagnetic field.

Millman, P. M. and McKinley, D. W. R., "Meteors," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, 1963.

Survey of the astronomical and geophysical aspects of the study of meteors. Examined are the advanced methods of observation and recording of meteors, based on direct photography, and photoelectric and radio techniques. Outlined are the methods used to determine the heights and velocities of meteors, along with a classical physical theory of meteors, based on observational evidence of meteor luminosities and spectra.

Nazarova, T. N., Bektabegov, A. K., and Komissarov, O. D., "Preliminary Results Concerning the Investigation of Meteor Material Along the Flight Trajectory of the "Mars-1" Space Probe", Kosmich. Issled. v. 1, no. 1, Jul - Aug. 1963. (Translation) (NASA-TT-F-8570)

Investigation of meteor material was carried out on the Mars 1 space probe by means of piezoelectric sensors. The area exposed to the impact of meteor particles comprised $1.5m^2$. The space probe intercepted a Taurid meteor stream; this meteor material was analyzed, and preliminary results are discussed.

Neff, S. H., "Excitation in Atomic Collisions Related to Meteor Radiation," Astrophysical Journal, Vol. 140, July 1964.

Determination of emission cross sections for certain atomic and molecular collisions at velocities near those of atoms evaporated from meteors passing through the atmosphere. The results are discussed with regard to the effects of the electronic configuration and ionizing potential of the bombarding ions, and of possible spin conservation effects on the emissions.

Nilsson, C. S., "A Southern Hemisphere Radio Survey of Meteor Streams," Australian Journal of Physics, Vol. 17, June 1964.

Research supported by the Radio Research Board of Australia and the University of Adelaid. Review of a radio survey of the orbits of 2200 meteors of radio magnitude +6 made at Adelaide, Australia (latitude 35°S) during 1961. The observational technique used, based on the reflection of the data processing and analysis methods employed. Data on the observed streams are tabulated and discussed and are briefly compared with those from other studies.

Nilsson, C. S., "The Sextanid Meteor Stream," Australian Journal of Physics, Vol. 17, Mar. 1964.

Presentation of some results of radio survey of the orbits of the Sextanid meteors. The orbit equipment was operated during the period of Sept. 21 - 29, 1961, and nine Sextanid meteors were detected during the period of Sept. 24 - 29. Orbital parameters for the meteor stream are presented and compared with those of the Geminid meteor stream.

Purbosiswojo, K., "Effects of Meteor-Impacts on Stationary Satellites," Proc. Bandung Inst. of Tech., v. 3, no. 2, 1964

The changes of the orbital elements of stationary satellites due to meteor impacts are discussed. From these changes in principle it should be possible to determine whether or not there exists a correlation between meteor mass and velocity. Numerical results, however, show that effects of meteor impacts can be neglected.

Rajchl, J., "Some Results from Meteor Spectra of Low Dispersion," Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, no. 4. 1964

Consideration of the two problems of the occurrence of ca-II emission in meteor spectra, and of the conditions and mechanism of origin of the forbidden green line of neutral oxygen by meteors. It is shown that, besides the geocentric velocity of the meteor, a correlation between ca-II occurrence and parameter B is evident. The concept that the important role of solar activity, especially its corpuscular component, makes green-line visibility for meteors possible, is supported. The hypothesis of the existence of emission characteristics for each aerodynamic regime for the range of meteor velocities is proved.

Romig, M. F., The Physics of Meteor Entry (P-2902; AD-438437) Apr. 1964.

A survey is made of recent papers on the physics of meteor entry. The various regimes of luminous flight are defined, and present techniques for obtaining the mass and density of meteoroids are critically discussed. The effect of the assumed mode of heat transfer on the mass loss is shown for two recent fireballs. A relatively simple method for estimating original mass and velocity is presented.

Rosinski, J. and Pierrard, J. M., "Condensation Products of Meteor Vapors and Their Connection with Noctilucent Clouds and Rainfall Anomalies," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Jan. 1964.

Discussion of the presence of noctilucent clouds and worldwide rainfall anomalies attributed to the formation of secondary particles from meteor vapors. These particles are formed by coagulation of meteor vapors and are subject to horizontal and vertical displacement by a Lorentz force and the gravitational force of the Earth. The increase of the

residence time of the secondary particles in the vicinity of 80 km, due to rapid decrease in particle settling velocity, and the consequent increase in particle concentration and the action of the Lorentz force on positively charged particles are assumed to cause formation of noctilucent clouds. The variable time lag between the appearance of meteor showers and corresponding rainfall anomalies is attributed, primarily, to the time of settling of sharply defined concentration profiles of coagulating particles through the 80 - 40 km layer.

Savrukhin, A. P., "The Photographic Observation of the Drift of Meteor Trails," (Geomagnetizm i Aeronomiia, Vol. 3, no. 3, 1963) Geomagnetism and Aeronomy, Vol, 3, no. 3, 1963. (Translation)

Description of a method of meteor-trail photography using cameras and films of readily available quality. Short focal length objectives are attached to a binocular telescope to permit visual observation of the trail while making a 10- to 30-second exposure, using film which has been subjected to a degree of pre-exposure. Results of the examination and interpretation of two photographed trails are given.

Shoemaker, E. M., "Impact Mechanics at Meteor Crater, Arizona," The Moon, Meteorities, and Comets, Vol. IV - The Solar System, 1963.

Deduction of a theory of the formation of craters in rock by meteorite impact, from the geology of Meteor Crater, Arizona, and its structural similarity to a nuclear explosion crater. A detailed analysis is given of the manner in which and in what form the meteoritic material reaches certain depths demanded by geologic relations. Discussed is the energy distribution during penetration.

Stawikowski, A., and Greenstein, J. L., The Isotope Ratio C^{12}/C^{13} in a Comet; Astrophysics Journal 140, 3, (Oct. 1, 1964).

The ratio C^{12}/C^{13} is 70 $\pm$ 15 in the comet Ikeya (1963a), which is close to the terrestrial value.

III,
C. METEORS (CONT.)

Tinsley, B. A., Tait, J. J., and Ellyett, C. D., "A Search For Thermal Radiation From Meteor Trails," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964.

Theoretical analysis of the probability of detection of infrared radiation from a meteor trail, in the range 0.9 to 2.5 μ, using equipment at ground level, indicating that no more than one sporadic meteor is likely to be detected in 350 hours of observing. The rate may improve briefly during the peak of a shower. Observations were made with several optical systems, which altered the size of meteor likely to be detected but not the probability of detection. No infrared pulses were observed that could be attributed to meteors.

Verniani, F., On the Luminous Efficiency of Meteors Research in Space Science, (NASA Grant NsG-87-60) 17 Feb. 1964.

The ratio of the photographic luminous efficiency τ_ρ to the square of the density ρ_m of meteors has been computed directly from observational data. It is possible to determine τ_ρ only in the few cases in which the meteors show positive evidence of asteroid origin. The dependence τ_ρ pn v is found, and it is shown that a power law $\tau_p = \tau_{o\rho}\ v^n$ best represents τ_ρ as a function of v.

III. PLANETARY SPACE

D. METEOROIDS

Alexander, W.M., Mc Cracken, C.W., Secretan, L., and Berg, O.E., Review of Direct Measurements of Interplanetary Dust from Satellites and Probes, Presented at the COSPAR Meeting May 1962 (Previously published as N63-17107 15-23), (NASA TM X-54570: X-613-62-25).

The results of direct measurements from various penetration and fracture experiments are presented. Two satellite experiments. Vanguard III (1959 Eta) and Explorer I (1958 α), give evidence for dust particle streams.

Alexander, W.M., McCracken, C.W., Secretan, L., and Berg, O.E., "Review of Direct Measurements of Interplanetary Dust from Satellites and Probes," Space Res., III, Presented at the 3rd Intern. Space Sci. Symp., Washington, 30 April-9 May 1962.

Direct measurements of selected parameters of interplanetary dust particles have been obtained from experiments on rockets, satellites, and deep space probes.

Ander, E., "Meteorite Ages," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, Ed. by Middlehurst, B.M., and Kuiper, G.P., Chicago and London, University of Chicago Press, 1963.

Discussion of methods whereby five events in the history of meteorites can be dated by means of radioactivity. The events considered are: (1) nucleosynthesis, (2) melting of the meteorite parent bodies, (3) their cooling, (4) their breakup, and (5) the fall of the meteorites.

Micrometeoroid Satellite (Explorer XIII) Stainless-Steel Penetration Rate Experiment, (NASA TN D-1986) Oct. 1963.

Baadsgaard, H., Folinsbee, R.E., and Cumming, G.L., "Peace River Meteorite," Journal Geophysical Research, Vol. 69, (Oct 1, 1964).

Peace River meteorite was a detonating bolide of 1963, March 31, 4:35 a.m. MST (Peace River, Alberta) of which seven pieces totaling 49 kg were recovered. The investigators to whom pieces have been sent are tabulated. Chemical analysis is given.

Baranov, V.I. and Knorre, K.G. "Age and Evolution of Meteoritic and Terrestrial Matter in Light of Recent Investigations," Meteoritika (Moscow), No. 21, 1961, (Translation), 31 July 1964.

All known facts do not contradict the concept that terrestrial and meteoritic substances were formed in an identical, and possibly, a single process of nucleogenesis.

III,
D. METEOROIDS (CONT.)

Bauer, C.A., "The Helium Contents of Metallic Meteorites," Journal of Geophysical Research, Vol. 68, Nov. 1, 1963.

Description of measurements of the He^3 and He^4 concentrations in 53 samples taken from 34 different metallic meteorites.

Bradford, D.C., and Dycus, R.D., A Review of the Meteoroid Environment in Cis-Lunar Space and on the Lunar Surface, American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, New York, N.Y., Jan. 20-22, 1964, Preprint 64-63.

It is noted that the solution for the puncture-size meteoroid flux in cis-lunar space and on the lunar surface must depend on theoretical considerations. It is shown that the lunar surface flux varies with the lunar phase, reaching a maximum of 55% of the near-Earth flux at the 1st quarter and decreasing to 23% at the 3rd quarter. Considerations of lunar secondary ejecta have not been included.

Briggs, M.H., Organic Constituents of Carbonaceous Chondrites, Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Ed. by Florkin, M. and Dollfus, A., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964.

Brief discussion of forms of meteorite carbon, leading to the conclusion that nearly all the carbon in carbonaceous chondrites is present as organic matter. Attempts to extract and identify this organic matter are reviewed. A brief review on studies of "organic elements" contained within the meteorites is presented.

Burkser, E.S. et al,"Meteoritics No. 19," Meteoritika (Moscow), (NASA-TT-F-100), June 1964 (Translation).

CONTENTS:

1. The Age of Meteorites, Burkser, Y.S.
2. Some Problems of the Chemistry of Meteorites, Yavnel',A.A.
3. The Problem of Tektites and Silica-Glasses, Vereb'yev, G.G.
4. An X-Ray Study of the Composition of Certain Meteorites, Stulov, N.N.
5. An X-Ray Study of the Fused Crust of the Kunashak Stone Meteorite, Kolomenskiy, V.D.
6. Determination of the Lead Content in Iron Meteorites, Starik, I.Y, Sobotovich, E.V., and Lovtsyus, G.P.
7. Preliminary Results of the Work of the Tungus Meteorite Expedition of 1958, Florenskiy, K.P., Vronskiy, V.I., Yemel'yanov, Y.M., Zotkin, I.T., and Kirova, O.A.
8. On the Discovery of the Susuman Iron Meteorite,Vronskiy, B.I.
9. The Lifetime of Cometary Ices in the Field of Photon and Corpuscular Radiation from the Sun, Cherednichenko, V.I.

III,
D. METEOROIDS (CONT.)

Black, Sydney D., "Space-Debris Hazards of Interplanetary Exploration," Journal of Spacecraft and Rockets, Vol. 1, May-June 1964.
(For abstract see Accession No. A63-24239-29)

Butler, C.P., and Jenkins, R.J., "Temperature of an Iron Meteoroid in Space," Science, Vol. 142, Dec. 20, 1963.
Experimental measurements, under laboratory simulated conditions, of the solar absorptance and hemispherical emittance of meteoritic iron from -100° to 300° C for a surface characterized by a 400-grit finish. The temperature of an iron meteoroid at the Earth's mean distance from the Sun is shown to be about 90° C, and it is assumed that 10% of the surface is optically black because of holes and cracks.

Cameron, A.G.W., "Formation of the Solar System," Advances in the Astronautical Science Vol. XI, Ed. by Jacobs, H.
Deduction of information bearing on the early history of the solar system from a study of the anomalies in the isotopic composition of certain elements extracted from meteorites. It is shown that in stone meteorites, Xenon is sometimes enriched in Xe^{129}; and in iron meteorites, silver is sometimes enriched in Ag^{107}.

Carter, N.L., and Kennedy, G.C., "Origin of Diamonds in the Canyon Diable and Nove Urei Meteorites," Journal of Geophysical Research, Vol. 69, No. 12, 15 June 1964, (Grant NsG-314-63; Contract Nonr-233(28)).
Detailed optical studies of the textural features of several hundred diamonds and associated phases in three specimens of the Canyon Diable meteorite and one specimen of the Nuvo Urei achondrite were made.

Chakraburtty, A.K., Stevens, C.M., Rushing, H.C., and Anders, E., "Isotopic Composition of Silver in Iron Meteorites," Journal of Geophysical Research, Vol. 69, No. 3, Feb. 1, 1964.
In quest of dating by extinct 6.8 million year Pd^{107}, Ag^{107} was analyzed in several iron meteorites. No enrichment was found, contrary to Murthy's result.

Chapman, D.R., Larson, H.K., and Scheiber, L.C., "Population Polygons of Tektite Specific Gravity for Various Localities in Australasia," Geochim. Cosmochim. Acta, Vol. 28, No. 6, 1964, (NASA-RP-299).
Measurements of specific gravity by the method of liquid flotation have been made on about 6,000 tektites from 18 different localities in Australasia, from 1 locality in Texas and 2 in Czechoslovakia.

III,
D. METEOROIDS (CONT.)

Chapman, D.R., "Reply (To Sun's Article on Tektites)," Journal of Geophysical Research, Vol. 69, No. 9, 1 May 1964, (NASA-RP-235).
In this report, the author replies to Sun's comments that question the following: (1) the theory of the lunar origin of tektites: (2) the suggestion that they might have come from the large lunar crater Tycho (Chapman, 1963): and (3) the reliability of the particular atmosphere-entry trajectories deduced from the areodynamic analysis in papers by Chapman, 1963, and Gault and Heitowit, 1963.

Chapman, S., "The Interplanetary Gas and the Earth's Outermost Atmosphere," AGARD, Advan. in Upper Atmosphere Res., 1963.
The zodiacal light, which it now appears, is caused mainly by dust, shows that there is interplanetary matter. There must also be some gas among the dust, mostly atomic hydrogen, that is an extension of the solar corona.

Clarke, W.B., and Thode, H.G., "The Isotopic Composition of Krypton in Meteorites," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964.
Measurement of the isotopic composition and amounts of krypton extracted from four stone meteorites and one sample of meteoritic troilite.

Cobb, J.C., "Determination of Lead in Meteorites by Alpha Activation Analysis," Journal of Geophysical Research, Vol. 69, May 1, 1964.
Application of the alpha activation analysis to the problem of lead isotopic abundances in meteorites. The results for the stone meteorite samples show a more radiogenic lead than can be accounted for by their lead-to-uranium and lead-to-thorium ratios. These measurements do not support the assumption that stone meteorites, when they crystallized, incorporated lead of the same isotopic composition. However, there is evidence of contamination of the meteorite lead with a few tenths of a ppm terrestrial lead, which could explain this discrepancy.

Cohen, A.J., "Fossil Glasses Produced by Impact of Meteorites and Asteroids with the Planet Earth," Advances in Glass Technology, Part 2, (NASA Grant NsG-57-60).
Fossil glasses produced by the impact of meteorites and asteroids, or possibly by comet impact, are reviewed. These glasses, know as tektites, differ in general from volcanic glasses in that they are lower in water content, have lower gallium and germanium contents, and are not necessarily in magnetically unstable continental areas.

III,
D. METEOROIDS (CONT.)

Colombo, G., and Fiocco, G., Optical Radar Results and Meteoric Fragmentation, (NASA CR-55057; SAO Special Rept. 139) 15 October 1963.

Recent optical radar observations of echoes from the upper atmosphere were reported. The results of numerous successive nights of observations indicate weak, sporadic echoes at altitudes between 110 and 140 km. These results are summarized and presented in graphic form. On the basis of the radar observations and of the model of fragmentation, an attempt can be made to estimate the influx on earth of meteoric material that is undergoing fragmentation and is of a size suitable for observation.

Cooley, W.C., Luckhardt, P.G., Janda, R.J., and Brockert, P.E., Investigation of a Micrometeoroid Vehicle Damage Assessment System, Contract NAS8-5033, (NASA-CR-56562; TR-004), June 1963.

A laboratory calibration model of a meteoroid-puncture detection system has been developed, which can be used to measure the visible and infrared radiation produced by "puncture flash" in hypervelocity impact facilities. Research is reported on the infrared and visible radiation signals obtained from punctures of steel, Pyrex, and sapphire spheres through 50-mil aluminum in vacuum, air, helium,gaseous oxygen, and liquid oxygen. The nature of puncture flash phenomena is discussed, and conclusions are drawn as a result of correlation of the test data.

D'Aiutolo, C.T., Review of Meteoroid Environment Based on Results from Explorer XIII and Explorer XVI Satellites, Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Ed. by Müller, P., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964.

(For abstract see Accesion No. A63-18797 17-32)

Dalton, C.C., Estimation of Tolerance Limits for Meteoroid Hazard to Space Vehicles 100-500 Kilometers Above the Surface of the Earth, (NASA TN D-1996), Feb. 1964.

Quartile estimates are established for mean flux, puncturable thickness of aluminum and steel walls as functions of meteoroid mass, puncture flux as functions of the thickness of wall, and thickness of walls necessary for reliability and operational design objectives.

Dauvillier, A., "On the Cosmic Origin of Tektites," Académie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 19, May 11,1964 (In French).

Demonstration that the tektites of Asia and Australia may have been strewn at the time of the grazing collision with a swarm of obsidian blocks, constituting the core of a short-period comet and sprung from the superficial obsidian crust of the Olbers protoplanets.

III,
D. METEOROIDS (CONT.)

Davison, E.H., and Winslow, P.C., Jr., Micrometeoroid Satellite (Explorer XVI) Stainless-Steel Penetration Rate Experiment,(NASA-TN-D-2445), Aug. 1964.

A successful experiment to assess the meteoroid hazard to thin stainless-steel skin material was flown as part of the Explorer XVI satellite. A total initial area of 3.625 sq ft consisting of 0.001-, 0.003-, and 0.006-in.-thick AISI 304 stainless-steel segments was exposed in space for a period of 221 days. The 0.001-in.-thick surface experienced six penetrations, the 0.003-in.-thick surface experienced one penetration, and the 0.006-in.-thick surface experienced zero penetrations. This report describes the results of the experiment and the conclusions drawn from the results.

Degens, E.T., "Genetic Relationships Between the Organic Matter in Meteorites and Sediments," Nature, Vol. 202, June 13, 1964.

Presentation of information in support of the abiotic nature of the finely disseminated organic matter in carbonaceous chondrites. It is stated that, inasmuch as the organic matter in meteorites is basically similar in composition to terrestrial organic debris, there is, a priori, no reason to assume that hydrocarbons in meteorites and terrestrial materials having the same thermal history should differ principally from each other.

Derham, C.J., Geake, J.E., and Walker, G., "Luminescence of Enstatite Achondrite Meteorites," Nature, Vol. 203, July 11, 1964 (Contract No. AF 61(052)-379).

Presentation of additional information to that previously published concerning red luminescence of meteorites under proton excitation, with revised estimated of radiation efficiency. Investigations were conducted on three meteorites and on different samples of the same meteorite.

Derham, C.J. and Geake, J.E., "Luminescence of Meteorites," Nature, Vol. 201, Jan. 4, 1964.

Presentation of the results of an experimental investigation of the luminescence spectra of a number of materials, of types which might possibly exist on the lunar surface. The investigation has been carried out with the view of permitting comparison with the luminescence spectrum of the Moon itself.

Dieter, H., "Sputtering of Meteorites by He^+, Ne^+, and Ar^+ Ions," Journal of Geophysical Research, Vol. 69, No. 9, May 1, 1963.

Erosion rates (of order 1 mg/coulomb) and sputtering coefficients are given.

III,
D. METEOROIDS (CONT.)

DuFresne, E.R., and Anders, E., "Chemical Evolution of the Carbonaceous Chondrites," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, Ed. by Middlehurst, B.M., and Kuiper, G.P., 1963.

Presentation of evidence for the preterrestrial origin of water-soluble salts in carbonaceous chondrites. A detailed analysis leads to the conclusions that (1) carbonaceous chondrites contain specialized minerals produced by the action of water on conventional meteoric minerals, (2) the time scale of these aqueous reactions has been a duration sufficient to permit production of highly ordered dolomite, and (3) that is is not necessary to postulate an object large enough to retain a permanent atmosphere in order to account for the presence of water nor to postulate extraordinary oxidation procedures to account for the presence of Fe^{+++} and SO_4^{--}, as these are capable of existing at or near equilibrium with liquid water, hydrocarbons, $FeCO_3$, FeS, and the specialized minerals.

Fesenkov, F.G., "The Nature and Possible Origin of the Meteorites, Zodiacal Light, and the Asteroids," Probl. of Cosmogony, Vol. 1 (1952), 25 May 1964.

The nature and possible origin of meteorites, zodiacal light, and asteroids are reviewed.

Fitch, F.W., and Anders, E., "Organized Element: Possible Indentification in Orgueil Meteorite," Science, Vol. 140, June 7, 1963.

Review of an investigation of the staining properties of various pollen grains, in order to test the Claus and Nagy hypothesis that "Type-5 organized element" found in carbonaceous chondrites is entirely dissimilar in its morphology to known terrestrial forms. It is found that ragweed pollen grains obtained with the Gridley method have an appearance strikingly similar to the Type-5 organized element, which leads to the conclusion that the latter can no longer be said to be entirely dissimilar in its morphology to known terrestrial forms.

Fredriksson, K., and Wickman, F.E., "Meteorites," Svensk Naturvetenskap, NASA Grant NsG-317-63, 1963, (In Swedish).

The scheme of meteoritic falls, including total destruction, dust trails, breakup, region of retardation, explosion, craters, and settling of meteoritic dust, is described. Map locations of selected meteoritic craters, both for the world and for Sweden, microphotographs of meteoritic materials, and photographs comparing tektites with ablated glass models, are given.

III,
D. METEOROIDS (CONT.)

Gault, D.E., Heitowit, E.D., and Moore, H.J., Some Observations of Hypervelocity Impacts with Porous Media, The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. by Salisbury, and Glaser, P.E., New York, Academic Press, Inc., 1964.

Presentation of experimental studies of hypervelocity impact in rock and sand. In the impact into the macroscale model of the fairy-castle structure, fragments are ejected under conditions for which the projectile was small with respect to the grain and pore size of the structure. Thus, by inference, the impact of microparticles of interplanetary debris can be effective in ejecting material from a similar porous material on the lunar surface into ballistic trajectories across the surface of the Moon. The results constitute strong but not incontrovertible, evidence in support of the hypothesis of a "steady-state" cloud of fragments flying across the lunar surface.

Graziano, E.E., and Mc Cormick, H.B., The Meteoroid Hazard to Space Vehicles: An Annotated Bibliography, Contract AF 04(647)-787), Aug. 1963.

This bibliography consists of 78 references to published materials on the meteoroid hazard to space vehicles in the near-earth environment.

Greenland, L., "Fractionation of Chlorine, Germanium, and Zinc in Chondritic Meteorites," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963.

Analysis of 39 ordinary chondrites, five enstatite chondrites, and four carbonaceous chondrites for Cl, Ge, and Zn. These elements are shown to be fractionated among the carbonaceous, enstatite, and ordinary chondrites in a pattern similar to that of Pb, Bi, Tl, I, Te, and Hg, as reported previously. Of the carbonaceous chondrites, only Orgueil is enriched in Zn and Ge, whereas all are enriched in Cl; in the enstatite chondrites only Indarch is enriched in Cl and Zn, and all are uniformly enriched in Ge. The most notable finding is the fractionation of Zn and Ge within the carbonaceous chondrite group.

Guth, V., and Ceplecha, Z.,"More Distant Inhabitants of Our Solar System," To the Near and Distant Universe, 16 July 1963.

Materials found in the space between the larger bodies of the solar system (planets, satellites, etc.) are discussed. Comets, asteroids, meteors, and meteorites are included in the discussion of interplanetary matter; also discussed is the very fine meteoric dust and the cloud it forms — zodiacal light.

III,
D. METEOROIDS (CONT.)

Hale, D.P., and Wright, J.J., "Meteoric Flux and Density Fields about an Infinitesimal Attractive Center Generated by a Stream Monoenergetic and Monodirectional at Infinity," Journal of Geophysical Research, Vol. 69, Note 17, Sept. 1, 1964.

Hale, D.P., and Wright, J.J., "Meteoric Flux and Density Fields about a Finite Attractive Center Generated by a Stream Monoenergetic and Monodirectional at Infinity," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964.

Presentation of detailed meteoric flux and particle density field patterns generated by a meteoric stream, monodirectional and monoenergetic at infinity, incident upon a finite attractive center. Flux and density contours are obtained for a series of incident speeds spanning the entire range of established meteoric stream velocities. An explicit theoretical explanation of abrupt discontinuities in flux and enhanced particulate concentrations near the Earth, both of which are observed in rocket and satellite experiments, is given.

Hamermesh, B., "Micrometeoroids," Space Physics, Ed. by LeGalley, D.P., and Rosen,A., New York, John Wiley and Sons, Inc., 1964.

Brief survey of the sources of information on micrometeoroids. Following a discussion of various indirect sources of data, a description of the current state of development of detectors is presented. Direct space measurements of micrometeoroid flux are reviewed. The subject of micrometeoroid damage is touched on, and the associated problems of hypervelocity impact are mentioned. This subject is said to play a very important role in the problem of detector calibration. The difficulties encountered in the experimental and theoretical studies of hypervelocity impact are also described.

Hastings, E.C.,Jr., The Explorer XVI Micrometeoroid Satellite, Supplement III, Preliminary Results for the Period May 27, 1963, through July 22, 1963, NASA TM X-949, March 1964.

Punctures were recorded in 44 of the 0.001-in.-thick beryllium-copper pressurized cells and in 11 of the 0.002-in.-thick beryllium-copper pressurized cells. Corresponding puncture rates are 0.031 and 0.016 puncture/ft^2/day, respectively. When expressed in equivalent thicknesses of aluminum, the puncture rates still lie somewhat above the lower previous estimates for that material. No punctures of 0.005-in.-thick beryllium-copper cells have been recorded. Impact detector data indicate higher impact rates than those found in previous impact detector experiments.

III,
D. METEOROIDS (CONT.)

Hawkins, G.S., "Interplanetary Debris Near the Earth," Annual Review of Astronomy and Astrophysics, Volume 2, Ed. by Goldberg, L., Deutsch, A.J., and Layzer, D., (1964).

Statistics pertaining to the fall of meteorites and the flux of objects entering the Earth's atmosphere. Equations are given for the number of stones and irons of asteroidal and cometary origin that strike the Earth in the period of a year. The physical characteristics of meteorites and micrometeorites are described from evidence of the electron microscope, electron diffraction, crushing strength, and chemical analyses. Rocket collection techniques are discussed in some detail with special emphasis on the Explorer 16 (1962 Beta Chi 1) shot.

Heide, F., Meteorites, (Translation of Kleine Meteoritenkunde, Berlin, 1957), Chicago, University of Chicago Press, 1963.

This book presents a study of important aspects in the study of meteorites. Topics included are: fall phenomena covering light, sound, impact, meteorite showers, meteorite craters, number of falls, distribution of falls in space and time, the hazards of falls, historical facts concerning meteorites, recommended data-recording practices in observing a meteorite fall, and methods of recognizing meteorites; meteoritic matter, including weight, size, shape, surface features, chemical constitution, meteorite minerals, structure, classification, age, origin, and formation.

Heymann, D., "Sputtering of Meteorites by He^+, Ne^+, and Ar^+ Ions," Journal of Geophysical Research, Vol. 69, May 1, 1964.

Presentation of some measurements on the erosion of meteorites by He^+ and Ne^+ ions made in the isotope separator of the Laboratory for Mass Separation in the Netherlands. The results are given in tabular form. The Ne^+ bombardments on Canyon Diablo and Richardton give equal erosion rates. The erosion rates of Ar^+ ions on Canyon Diablo and of Ne^+ ions on Richardton decrease slightly with energy from 20 to 10 kev. One of the tables gives the sputtering coefficients on copper and iron obtained by other investigators. Sputtering coefficients are not significantly dependent on ion energy between 2 and 25 kev. Also calculated are the ratios of erosion rates for 20-kev ions at normal incidence: Ar^+: Ne^+:He^+=2.0: 0.7: 0.006.

Hintenberger, H., Konig, H., Schultz, L., and Wanke, H., "Radiogenic, Spallogenic, and Primordial Rate Gases in Stone Meteorites," Zeitschrift für Naturforschung, Vol. 19a, Mar. 1964 (In German).

Presentation of data showning the total content and isotopic composition of helium and neon in 47 stone meteorites. Also included are the concentrations of He^3,He^4,Ne^{20},Ne^{21},Ne^{22}.

III,
D. METEOROIDS (CONT.)

Hodge, P.W., and Wright, F.W., "Studies of Particles for Extraterrestrial Origin II - A Comparison of Microscopic Spherules of Meteoritic and Volcanic Origin," Journal of Geophysical Research, Vol. 69, June 15, 1964.

Analysis of microscopic volcanic spherules that may be similar to the supposed meteoritic spherules found in polar ice sediments. Sampled dust deposits from five Pacific Coast volcanoes are investigated. In composition they are similar to only a few of the polar glacier particles analyzed previously by the authors. It is felt that, since the microscopic spheroids of volcanic origin are somewhat different in composition and in numerical ratios from the supposed meteoritic spherules found in polar ice deposits, the majority of the polar spherules cannot be explained on the basis of a volcanic origin.

Hodge, P.W., Wright, F.W., and Lagway, C.C., Jr., "Studies of Particles for Extraterrestrial Origin. III- Analyses of Dust Particles from Polar Ice Deposits," Journal of Geophysical Research, Vol. 69, July 15, 1964.

Description of electron-beam microanalysis of 166 dust particles collected principally from Greenland and Antarctic ice. Several particles were found to have Ni/Fe ratios indicative of a meteoritic origin. The remainder are also thought to be primarily of cosmic origin. The rate of deposit of opaque spherules is found to be nearly, but not exactly, the same at all geographical locations sampled.

Hodgson, G.W. and Baker, B.L., "Evidence for Porphyrins in the Orgueil Meteorite," Nature, Vol. 202, April 11, 1964.

Presentation of results of spectral, chromatographic and chemical tests on organic extracted from the Orgueil carbonaceous meteorite. The tests reveal the presence of pigments that are indistinguishable from esterified vanadyl porphyrins of terrestrial ancient sediments and petroleum. The pigments are present in the Orgueil meteorite stones either because they indigenous, or because the stones became contaminated with pigment-bearing substances.

Honda, M., and Arnold, J.R., "Effects of Cosmic Rays on Meteorites," Science, Vol. 143, No. 3603, 17 Jan. 1964, NASA Grant NsG-321.

Unlike the earth's atmosphere, the meteorites are physically and chemically stable targets. They are more suitable than terrestrial targets for an extended study of the fossil record of cosmic radiation. The topics discussed include: (1) course of radiation in a meteorite; (2) history of meteorites; (3) secular equilibrium; (4) time variations of the cosmic radiation; (5) meteorite samples; (6) measurement technques; (7) cosmic-ray age; (8) production rates; and (9) the analysis of recovered artificial satellites.

III,
D. METEOROIDS (CONT.)

Kaiser, T.R., The Distribution of Interplanetary Particles, Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Ed. by Muller, P., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964.

Kalinov, M.,"Meteor Magnitude Distribution,"Soviet Astronomy, Astrophysical Journal, Vol. 8, No. 2, Sept.-Oct. 1964.

The distribution of meteors with respect to magnitude is given; it is not generally constant.

Kaplin, I.R., Degens, E.T., and Reuter, J.H., "Organic Compounds in Stony Meteorites," Geochim. Cosmochim. Acta, Vol. 27, 1963, NASA Grant NsG-347.

Eight carbonaceous chondrites, five noncarbonaceous chondrites, and one achondrite were examined for organic constituents.

Keil, Klaus, and Fredriksson, K., The Iron, Magnesium, and Calcium; Distribution in Coexisting Olivines and Rhombic Pyroxenes of Chondrites, Grants NsG-322-63, (NASA-TM-X-54037), 1964.

Iron, magnesium, and calcuim were analyzed in olivines and pyroxenes of 95 chondritic meteorites with an electron microprobe. Of these, 86 were "ordinary" chondrites, each of which has constant iron-magnesium ratios in olivine and pyroxene. Between different meteorites these ratio vary within three narrow ranges, which reflect the H- and L-group chondrites, as well as a third group, designated the LL-group. The ratio of iron in olivine to that in coexisting pyroxene is nearly constant (1.1), particularly within the groups mentioned. Based on the amount of iron in silicates and metal, a classification of stony meteorites is proposed.

Keil, K., "Possible Correlation Between Classifications and Potassium-Argon Ages of Chondrites," Nature, Vol. 203, Aug.1, 1964.

Consideration of the existence of a relationship between classifications and ages of chondrites, as supported by recent uranium-helium measurements. Attention is directed to the apparently more frequent, substantial degassing of L-group chondrites in comparison to H-group chondrites, and the necessity is emphasized for more potassium-argon gas retention age measurements of chondrites, for which the classification into L- and H-groups is well know.

III,
D. METEOROIDS (CONT.)

Kolomenskiy, V.D., "An X-Ray Study of the Fused Crust of the Kunashak Stone Meteorite," Meteoritics, No. 19, June 1964.

This is a continuation of a study of the Kunashak stony meteorite. Two samples of the meteorite were subjected to detailed X-ray study. All samples of the fused crust are powder of a dark gray color in which rare small grains of nickeliferous iron of a light gray were seen under a reading glass. The magnetic fraction consisting of nickeliferous iron, oxymagnetite, and josite was separated with a magnet. The magnetic fraction amounted to about 0.5% of the total quantity of powder. The nickeliferous iron was in the form of small, irregular, symmetrical grains of angular shape, measuring up to 0.1 mm. When the magnetic fraction was placed on a biscuit, an outline of black color characteristic of magnetite was obtained.

Krinov, E.L., "Meteorite Craters on the Earth's Surface," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, Ed. by Middlehurst, B.M., and Kuiper G.P., 1963.

Study of meteoric craters found on the surface of the Earth, in terms of their two main types: explosion craters and impact craters. The results of theoretical studies of the fall of giant meteorites and their circumstances are reviewed. Examined are the characteristic features of a number of (iron-meteorite) craters of proved meteoric origin. Data on these craters are tabulated.

Krinov, E.L., "Meteorites," Forty Yr. of Astronomy in the USSR, 1917-1957 (Pt. 1) 20 Jan. 1964.

This is a general review of facts and history concerning meteorites, especially work done in the U.S.S.R. The vast expanse of Soviet territory has been host to large quantities of meteoric materials, a decided advantage in making the study of meteorites a Russian scientific speciality.

Krinov, E.L., "The Tunguska and Sikhote - Alin Meteorites," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, Ed. by Middlehurst, B.M., Kuiper, G.P., Chicago and London, University of Chicago Press, 1963.

Description of the circumstances and the effects accompanying the fall of an explosion-type meteorite in 1908 and of an asteroid, in the form of an iron meteoric shower, in 1947. The phenomena accompanying the fall are discussed in the light of eyewitness reports, seismographic recordings, and evaluations of the scientific material collected, in each case. Photographs of some recovered meteorite fragments and of the devastating effect of meteorite impact are presented.

III,
D. METEOROIDS (CONT.)

Kronse, H.R., and Folinsbee, R.E., "The S^{32}/S^{34} Ratio in Troilite from the Bruderheim and Peace River Meteorites," Journal of Geophysical Research, Vol. 69, No. 19, Oct. 1, 1964.

Two meteorites falling at different times are both geologically similar and isotopically identical (within a 0.01% uncertainty in isotopic ratio).

Kvasha, L.G., "Some New Data on the Structure of Chondrites," Meteoritika, No. 20, 1961 (Translation).

The results of research related to two problems in the study of the structure of chondrites are presented in the first problem, the structure of particles of metallic iron and, to some extent, of troilite was investigated. The structure of metallic particles and of some sulfides in chondrites, which differ in structure and in metallic-iron content, was compared. The second problem considered is the relation between the content of metallic iron and the iron content of silicates in chondrites, and the possibility of using that relationship for systematic investigatory purposes. A graph is included that shows: (1) the relationship between the content of nickel-iron w/o and the magnitude of the average index of refraction of silicates (olivine and rhombic pyroxene) in common chondrites; and (2) the content w/o of troilite in the same chondrites.

Lazarev, A.I., "Suggestion About the Nature of Luminous Particles Observed by Astronauts," Dokl. Akad. Nauk SSSR, Geofiz. (Moscow) Vol. 156, No. 2, 11 May 1964, Contract NAS5-2078, NASA-TT-F-8916.

It is assumed that the luminous particles, observed by astronauts, when entering the earth's shadow, are probably incandescent micrometeorites at their collision with the spacecraft's surface, or possibly particles of that surface, torn out by collision. This aprticle considers the radiation of a heated particle formed at collision. It is indicated that particles of a 1μ diameter will be practically unobservable; those of a 10μ diameter, moving with an angular velocity of 10^4 deg/sec^{-1}, will be practically visible. Particles with a 50μ diameter, moving with angular velocities of 10^5 deg/sec^{-1} will be well visible during tens of milliseconds; at angular velocities of 10^6 deg/sec^{-1}, particles of a 50μ diameter will be visible during 4 to 5 milliseconds.

Lee, T.W., Study of Phenomena Resulting from Hypervelocity Impact, Contract (AF 08(635)-3154), March 1964.

Some of the problems pertaining to the feasibility of detecting an impact flash in space are discussed. Criteria are derived for detection of radiation when it is assumed that a detector of several square cm at 1-km distance or several square meters at 100-km distance is used. The impact flash radiation is investigated experimentally for different regions of the electromagnetic spectrum.

III,
D. METEOROIDS (CONT.)

Lovering, J.F., and Morgan, J.W., "Uranium and Thorium Abundances in Stony Meteorites," Journal Geophysical Research, Vol. 69, No. 10, May 15, 1964.
Information on U and Th abundances is given for various chondritic types of meteorites.

Manuel, O.K., and Kuroda, P.K., "Isotopic Composition of the Rare Gases in the Fayetteville Meteorite," Journal of Geophysical Research, Vol. 69, April 1, 1964, NSF Grant No. G-17161; AEC Contract No. AT-(40-1)-1313.
The abundance pattern of the rare gases in the light and dark phases of the Fayetteville meteorite were determined and compared to that of the Pesyanoe and other meteorites rich in primordial rare gases.

Mark, H., Goldberg, G., Mirtich, J., "Determination of Cratering Energy Densities for Metal Targets by Means of Reflectivity Measurements," AIAA Journal, Vol. 2, No. 5, (1964), (NASA-RP-240).
A brief review of an experimental and theoretical investigation to determine the damage to surface optical properties of satellites or satellite components due to impact with high-speed micron-size particles is given. Equations developed for calculating values of cratering energy density are presented, and the calculated values are compared tabularly to those determined experimentally.

Meinschein, W.G., "Hydrocarbons in Terrestrial Samples and the Orgueil Meteorite," Space Sci. Rev., Vol. 2, 1963, (NASA Contract NASw-508).
Meteorites contain extraterrestrial carbonaceous materials.

Moore, H.J., Gault, D.E., and Mac Cormack, R.W., Fluid Impact Craters and Hypervelocity-High Velocity Impact Experiments in Metals and Rocks, NASA-CR-56359, Nov. 1962.
The impact phenomena of hypervelocity and high velocity projectiles with rock and metal targets are being studied.

Morgan, J.W., and Lovering, J.F., "Rhenium and Osmium Abundances in Stony Meteorites," Science, Vol. 144, May 15, 1964.
Presentation of neutron activation measurements. The studies show no fractionation of these elements between five different chondrite types. The average abundances are given, showing an osmium/rhenium ratio of 11.5. It is considered that this indicates most of the rhenium and osmium in the enstatite chondrites is in the metallic phase.

III,
D. METEOROIDS (CONT.)

Morgan, J.W., and Lovering, J.F., "Uranium and Thorium Abundances in Stony Meteorites, II- The Achondritic Meteorites," Journal of Geophysical Research, Vol. 69, May 15, 1964.
Neutron activation determinations of U and Th abundances in two diogenites (Ellemeet, Johnstown), a howardite (Binda), a eucrite (Moore County), a nakhlite (Nakhla), and an angrite (Angra dos Reis) are in agreement with the hypothesis that these achondrites have formed as a result of differentiation of an ordinary chondrite magma. The Bishopville enstatite achondrite (aubrite) has U and Th abundances consistent with an origin directly from an enstatite chondrite of the Hvittis type by simple melting and gravity separation of metal and sulfide phases.

Nagy, B., Murphy, M.T.J., Modzeleski, V.E., Rouser, G., Claus, G., Hennessy, D.J., Colombo, U., Gazzarrini, F.,"Optical Activity in Saponifield Organic Matter Isolated From the Interior of the Orgueil Meteorite," Nature, Vol. 202, April 18, 1964, Grants No. NsG-341; NsG-541, (NASA-CR-53660).
Spectropolarimetric investigation of an optically active fraction obtained by saponification of solvent extracts from a stone of the Orgueil carbonaceous meteorite.

Nagy, B., Fredriksson, K. Kudynowski, J., and Carlson, L., Ultraviolet Spectra of Organized Elements in the Orgueil Meteorite Determined with the Ultramicrospectrograph, Grants NsG-317-63; NsG-341; NsG-98-60, (NASA-CR-55366).
An examination of the meteorite microstructures (organized elements) in petrographic thin sections and in powdered preparations of two stones of the Orgueil carbonaceous meteorite is discussed.

Nininger, H.H., "Meteorite Distribution on the Earth," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, Ed. by Middlehurst, and Kuiper, G.P., Chicago and London, University of Chicago Press, 1963.
Discussion of the observed peculiarities and irregularities of the distribution of meteorite falls on the surface of the Earth. Some considerations on the random unsystematic nature of meteorite recoveries and on the associated difficulties of explaining the apparent nonuniform distribution of meteorite falls in various regions of the globe are followed by a discussion of the occurrence of meteorites in early formation and of the distribution patterns of meteorite showers.

III,
D. METEOROIDS (CONT.)

O'Keefe, J.A., Lowman, P.D., Jr., and Dunning, K.L., "Gases in Tekitite Bubbles," Science, Vol. 137, July 20, 1962.
Investigation of the gases in a tektite bubble, bediasite No. 1876 of the U.S. National Museum collection, by subjecting it to an electrodeless discharge. Spectroscopic analysis of the light produced in the bubble showed the main gases to be neon, helium, and oxygen. It is suggested that the neon and helium probably diffused in from the atmosphere, while the oxygen may be atmospheric gas incorporated in the tektite during its formation.

O'Keefe, J.A., "Tektites and Impact Fragments from the Moon," Scientific American, Vol. 210, Feb. 1964.
Presented in a broad outline of evidence favoring the lunar origin of tektites. Origin of tektites in the impact of a meteorite on the Moon is depicted. Studies of the australite button indicate that it was given its final form while traveling at high speed through the atmosphere. Terrestrial origin of such spheres is impossible because of extremely high deceleration rates at low altitudes. A possible clue for determination of how tektites made the trip from the Moon to the surface of the Earth is presented by the meteor shower of February 9, 1913.

O'Keefe, J.A., "Water in Tektite Glass," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964.
Investigation of the low water content of tektites. It is stated that tektites contain about 20 ppm of water, whereas plausible terrestrial source materials contain about 10,000 ppm. Reduction of the water is not feasible and does not solve the problem of the removal of the end product. It is concluded that tektites are probably not the result of impact on the Earth.

Parker, E.N., "The Perturbations of Interplanetary Dust Grains by the Solar Wind," Astrophysical Journal, Vol.139, No. 3, April 1, 1964.
A photoelectric charging of 10 volt/grain in a reversing interplanetary magnetic field can have a great perturbing effect. Lorentz force will greatly increase the orbital inclination of particles smaller than 10^{-4} cm. The importance of this effect increases away from the sun.

Pottasch, S.R., "A Comparison of the Chemical Composition of the Solar Atmosphere with Meteorites," Annales d'Astrophysique, Vol. 27, May-June 1964.
Presentation of a method of comparison of the compositions by normalizing the comparison to the mean of the trace elements in the photosphere and in meteorites. A comparison can then be directly made between the major elements in the meteorites and the photosphere and, through the hydrogen content, with the solar corona.

III,
D. METEOROIDS (CONT.)

Rae, W.J., A Study of Meteoroid Impact Phenomena, Quarterly Progress Report, 14 June - 14 Sept. 1962, Contract NAS3-2121, NASA-CR-58059.

Modern blast-wave theory is applied in an examination of the phenomena that occur when meteoroids collide with satellites and other space vehicles. The blast-wave is developed and includes the strong interactions between fluid dynamic effects and material properties during very high energy collisions. The nature and extent of the processes that result in crater formation are discussed.

Rae, W.J., "Meteoroid Impact - A Study in the Fluid Mechanics of Solids," Research Trends, Spring 1964.

Description of light-gas gun experiments to fire small particles into targets of various kinds, with some theoretical approximations. It is shown that the depth of penetration varies roughly as the 2/3 power of the impact speed, which is of the order of 10 km/sec. The program of research being carried out is based on the fact that many features of material deformation due to high-speed impact bear a remarkable resemblance to certain problems in hypersonic gas flow whose solutions have long been known. In the case of high velocity impact, the pressure forces so completely dominate the shearing forces that the deforming target behaves like an inviscid, compressible fluid during much of its response to the impact.

Revah, I., Spizzichino, A., and Cohen M., "Study of the Altitude of Meteoric Echoes Received on a Link by Forward Diffusion," Academie des Sciences (Paris), Comptes Rendus, Vol. 257, No. 25, Dec. 16, 1963 (In French).

Discussion of the possibility of determining the altitude of the reflection point of electromagnetic waves on the trail, by studying the decrease in the meteoric echo of the "sub-dense" type received by a radar. The same method, suitably adapted, may be extended to meteoric echoes received by forward diffusion, on a radioelectric link in metric waves.

Reynolds, B.W. and Emmons, R.H., A New System of Protection from Hypervelocity Particles, Presented at the 6th Hypervelocity Impact Symp., Cleveland, April 30- May 2, 1963.

Rigid and foldable meteoroid protection systems for space structures have been experimentally evaluated. These experimental tests and data do not support the conclusion of other investigators that the penetration resistance of polymeric materials (flexible fabrics) cannot compare with metals. Significant trends in materials and techniques for protecting against hypervelocity impacts are exhibited.

III,
D. METEOROIDS (CONT.)

Reynolds, J.H., and Turner, G., "Rare Gases in the Chondrite Renazzo," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Analysis of the rare-gas content of the chondrite Renazzo, in order to study the anomaly pattern of xenon concentration in meteorites. The abundance and isotopic composition of the gases in Renazzo are similar to those in carbonaceous chondrites, which generally have xenon contents of more than an order of magnitude greater than ordinary chondrites.

Rosen, J.M., "The Vertical Distribution of Dust to 30 Kilometers," Journal of Geophysical Research, Vol. 69, No. 21 (Nov. 1, 1964).

The source of stratospheric aerosols is shown to be above 85 km. The inferred particle flux between 1/2 and 2 microns is $.036/cm^2$ sec, or an annual deposition of order 10^{10} lb.

Rowe, M.W., Anderson, E.C., and Van Dilla, M.A., "Radioactivity of the Bogou Siderite," Journal of Geophysical Research, Vol. 69, No. 3 (Feb. 1, 1964).

Measured activities were 439 ± 22 dpm/kg Mn^{54}, $< 14 + 6$ dpm/kg Sc^{46}, < 145 dpm/kg Cr^{51}, < 32 dpm/kg Co^{56}, 165 ± 60 dpm/kg Co^{56+58}, 66 ± 24 dpm/kg Co^{57}, and $< 7 \pm 4$ dpm/kg Co^{60} for the Bogou iron meteorite. These activities are compared with Aroos.

Ruskol, E.L., "On the Formation of Interplanetary Dust Condensation Around the Earth," Artifical Earth Satellites, No. 12, 1962 (MH-Transl. 462).

Two mechanisms for the condensation of dust particles around the earth are proposed namely: (1) that the capture of the interplanetary dust particles by the earth is associated with their nonelastic collisons among themselves in the neighborhood of the earth; and (2) that the upper atmosphere causes deceleration of the dust-particle velocities.

Rowe, M.W. and Manuel, O.K., "Radioactivity in the Fayetteville Meteorite," Journal of Geophysical Research, Vol. 69, No. 9, May 1, 1964.

The gas retention age is 4.4×10^9 year. The cosmic ray exposure age is 29×10^6 year.

Sandorff, P.E., "A Meteoroid Bumper Design Criterion," Firestone Tire and Rubber Co. Proc. of the 6th Symp. on Hypervelocity Impact, Cleveland, April 30- May 2, 1963, Vol. 3, Aug. 1963.

The design concept and the principles of operation of a "Whipple" meteor bumper are reviewed, the importance of material properties is investigated, and the importance of material properties is investigated, and the physical process of hypervelocity impact is analyzed. The density of both projectile and target was found to be the most important material property affecting bumper performance, but other properties, at extreme pressures, influence the performance to a noticeable degree.

III,
D. METEOROIDS (CONT.)

Sauval, A., "Collisions of the West Ford Needles with Micrometeorites," Bull. Soc. Roy. Sci. (Belgium), Vol. 32, No. 1-2, 1963.

Collisions of micrometeorites with West Ford Project needles are sufficiently numerous to break the needles in several years. These collisions may affect the lifetime of the orbit (predicted period of eight years) and of the experiment.

Schmitt, R.A., Abundances of Na, Sc, Cr, Mn, Fe, Co, and Cu in 18 Meteorites and 146 Individual Chondrules, Quarterly Progress Report, Dec.1, 1963-Feb. 29, 1964, (NASA Contract NASw-843) (NASA CR-53776; GA-4997).

Abundances of seven elements - Na, Sc, Cr, Mn, Fe, Co, and Cu — were determined through instrumental-neutron-activation analysis (INAA) in 18 meteorites and 146 individual chondrules separated from seven meteorites. Cumulative frequency distributions for abundances were plotted, using linear probability paper.

Schmitt, R.A., and Smith, R.H., Abundances of Na, Sc, Cr, Mn, Fe, and Co, and Cu in 92 Meteorites, 9 Terrestrial Specimens, and 90 Individual Chondrules, Quarterly Progress Report, Sept. 1- Nov. 30, 1963, NASA Contract NASw-843,(NASA CR-53779; GA-4782), 17 December 1963.

Element abundances were determined by the technique of instrumental neutron-activation analysis. Histograms and tables are given showing the results. The abundances determined for each element are discussed, as are individual meteorites with "abnormal" abundances, and the homogeneity of chondrites.

Schmitt, R.A., Smith, R.H., and Olehy, D.A.,"Astronomy and Astrophysics," Geochim. Cosmochim, Acta, Vol. 27, 1963 (NASA Contract NASw-579).

Abundances of cadmium have been determined by neutron-activation analysis in 31 meteorites. Abundances of cadmium and other chalcophilic elements are discussed in terms of chondritic parent models.

Schmidt, R.A., "A Survey of Data on Microscopic Extraterrestrial Particles," Geophysical and Polar Research Center, University of Wisconsin, (Res. Report 63-2), Jan. 1963.

A survey of data on the following particles is presented: cosmic dust, meteorite dust, micrometeorites, meteoric dust, and interplanetary dust. The objective of this survey was to bring together as much available data as possible. Principal attention was devoted to the following information about these particles: description, size, physical properties, chemical composition, occurrence, location of samples, annual deposit, and theories of origin.

III,
D. METEOROIDS (CONT).

Schmitt, R.A., and Smith, R.H., "Implications of Similarity in Rare-Earth Fractionation of Nakhlitic Meteorites and Terrestrial Basalts," Nature, (London) Vol. 199, No. 4893, 10 August 1963 (NASA Contract NASw-579).

Information is presented on the following: (1) the absolute and normalized abundances of the rare-earth elements scandium and yttrium in Nakhlitic achondrites, as determined by neutron activation; (2) the ratios of the average normalized weight percent of the rare-earth elements yttrium and scandium in Nakhla and Lafayette, to those in 16 chondrites, as a function of ionic radius; and (3) the ratios of the normalized weight percent of the rare-earth elements yttrium and scandium in 3 calcium-poor achondrites, and in 3 calcium-rich achondrites to those in 16 chondrites, as a function of ionic radius.

Schmidt, R.A., Microscopic Extraterrestrial Particles from the Antarctic Peninsula, Presented at the Cosmic Dust Conf., N.Y., 21-22 Nov. 1963, (NASA-TM-X-51131).

While several types of particles were recognized, black, metallic spherules and yellowish, glassy spherules were most common. Direct relations of frequency of spherule occurrence and annual snow deposit were suggested by the data, while an inverse relation between snow accumulation and mean spherule size was discovered. The cumulative rate of deposition of metallic spherules was found to be essentially uniform for the area of the Antarctic Peninsula Traverse, although at individual stations the rates were divergent because of local factors.

Schmidt, R.A., and Cohen, T.J., "Particle Accretion Rates-Variation with Latitude," Science, Vol. 145, Aug. 28, 1964.

Estimate of the rate of accretion of microparticles by the Earth. Reported accretion rates for cosmic spherules ranging in diameter from 1 to 400 μ appear to increase with increasing latitude of the collecting site. The apparent variation is most closely related to geomagnetic latitude.

Schmitt, R.A., Smith, R.H., and Olehy, D.A., "Rare-Earth, Yttrium and Scandium Abundances in Meteoritic and Terrestrial Matter - II," Geochim. Cosmochim, Acta, Vol. 28, No. 1, 1964. Previously published as NASA CR-50173 (NASA Contract NASw-579).

Abundances and selected isotopic ratios of the 14 rare-earth elements (REE), yttrium, and scandium have been determined by neutron-activation analysis in 13 meteorites and 2 terrestrial specimens.

III,
D. METEOROIDS (CONT.)

Schmitt, R.A., Bingham, E., and Chodos, A.A., Zirconium Abundances in Meteorites and Implications to Nucleosynthesis, (NASA CR-56189; FA-5164) (Contract NASw-843), 6 May 1964.

The atomic abundance of Zr was established at 16 ± 5 Zr atoms/10^6 Si atoms in 17 ordinary chondrites, which agrees well with Aller's (1962) solar value of 14 Zr atoms/10^6 Si atoms. Abundance values of Zr and other nearby elements indicate Fe^{56} seed nuclei were exposed to different neutron fluxes. The atomic ratio Zr/Hf of 100 in meteorites compared with 106 in the terrestrial crust indicated no serious fractionation between these two very similar chemical elements.

Schnetzler, C.C., and Pinson, W.H., "A Report on Some Recent Major Element Analyses of Tektites," Geochim. Cosmochim. Acta, Vol. 28, 1964 (Grant NsG-222-61; Contract AF 19(604)-6135) (NASA-RP-291).

Forty-two tektites and two "amerikanites" were partially or completely analyzed for major elements.

Shima, M., "The Distribution of Germanium and Tin in Meteorites," Geochim. et Cosmochim. Acta, Vol. 28, 1964 (Grant NsG-323; Contract AT(11-1)-34).

Germanium and tin in 17 chondrites were analyzed by a colorimetric method using germanium-dimethyl-aminophenyl fluorone complex and tin-dithol complex. Analytical data on whole samples emphasize the siderophile properties of germanium and tin and to some degree the chalcophile properties of germanium. A discussion of this point is presented and extended to the evolution of meteorites.

Shima, N., "Isotopic Composition of Germanium in Meteorites," Journal Geophysical Research, Vol. 68, No. 14, 15 July 1963 (NASA Grant NsG-323; Contract AT(11-1)-34).

The isotopic composition of germanium in eight meteorites was measured by solid-source mass spectrometer and compared with a sample of terrestrial origin. No differences were found in the isotopic composition of germanium from meteorites, and the terrestrial sample was found outside of the error.

Slattery, J.C., Micrometeorite Impact Studies, Final Report, (Contract NAS3-3569) (NASA-CR-54057; STL-8447-6010-SU-000), 30 June 1964.

The burst of free charge produced by a hypervelocity particle impact was investigated. The hypervelocity particles were iron spheres with diameters ranging from 0.1 μ to 10 μ. Self-sustaining electrical discharges have been initiated in simulated ion engines by hypervelocity particle impacts.

III,
D. METEOROIDS (CONT.)

Slattery, J.C., Friichtenicht, J.F., and Hamermesh, B., "Interaction of Micrometeorites with Gaseous Targets," AIAA Journal, Vol. 2, March 1964, Contract No. NASw-561.

Starik, I.Y., Sobotovich, E.V., and Lovtsyus, G.P., "Determination of the Lead Content in Iron Meteorites," Meteoritics, No. 19, June 1964.

The lead content in iron meteorites was determined by many investigators. The results obtained vary over very wide limits from n x 10^{-5} to n x 10^{-7} g/g. The results obtained for some iron meteorites are presented in this article. A new method was applied for separating lead that will eliminate the shortcomings of the conventional chemical methods; it consists essentially of chemical decomposition of the sample with subsequent pyrochemical separation of the lead.

Stulov, N.N., "An X-Ray Study of the Composition of Certain Meteorites," Meteoritics, No. 19, June 1964.

The application of X-ray methods to the study of meteorites makes it possible to determine their composition more accurately and to establish patterns in the structure of meteoritic minerals in connection with their chemical composition. This makes it possible to interpret mineral associations in meteorites and in the earth's crust and to establish their crystallographic and mineralogical patterns. This article contains the results obtained from processing the X-ray diffraction patterns of a number of iron meteorites and some carbonaceous chondrites.

Sun, M.S., "Comments on the Paper by Dean R. Chapman and Howard K. Larson 'On the Lunar Origin of Tektites'," and Dean R. Chapman, Reply, letters in Journal of Geophysical Research, Vol. 69, No. 9, 1937-1940 (May 1, 1964).

Objections of an explosion atmosphere, entry trajectories, etc., are debated. Chapman considers the Asian-Australian tektites to be of lunar origin.

Tardif, H.P., Space Debris and Space Flight, Canadian Armament Research and Development Establishment, Valcartier, (CARDE TM-720/63; AD-408253).

This memorandum is essentially a literature survey on the problem of space flight in a meteoritic environment. It covers in a general manner the fields of meteoritic environment. The deterioration of the skin of a spaceship under impacts by meteoroids, and the methods published to date for the prevention of such damage.

III,
D. METEOROIDS (CONT.)

Taylor, H.W.,"Gamma Radiation Emitted by the Peace River Chondrite," letter in Journal Geophysical Research, Vol. 69, No. 19, Oct. 1, 1964.

The percentage K^{40} in the Peace River chondrite is 0.094 ± 0.017% by weight, Al^{26}, Na^{22}, and probably Mn^{54} (though possibly and/or Co^{56} +Co^{58} or Sc^{46}) have also been identified. The argon retention age is not far from 1.0×10^9 years.

Tschermak, G., "The Microscopic Properties of Meteorites," Smithsonian Contributions to Astrophysics, Vol. 4, No. 6, 1964. (In English and German).

This work is considered to be the most comprehensive collection of photographs of the microstructures of stony meteorites in the literature. One hundred half-tone microphotographs appear, with descriptive paragraphs for each figure. The body of the test describes and classifies meteorite types extensively, with the exception of iron meteorites.

Tilles, D., "Stable Silicon Isotope Ratios in Tektites," Geochimica et Cosmochimica Acta, Vol. 28, 1964.

Review of the author's earlier measurements of silicon isotope ratios in tektites. Data on silicon isotope content in tektite samples from different locations are tabulated. A diagram summarizing the silicon isotope content in other materials is presented for comparison. The observed small differences in silicon isotope ratios for tektites parallel the isotopic differences between silicic and basis terrestrial igneous rock and are considerably smaller than the corresponding oxygen differences.

Tobak, M., and Peterson, V.L., Theory of Tumbling Bodies Entering Phanetary Atmospheres with Application to Probe Vehicles and the Australian Tektites, (NASA-TR-R-203) NASA July 1964.

The tumbling motion of aerodynamically stable bodies entering planetary atmospheres is analyzed considering that the tumbling, its arrest, and the subsequent oscillatory motion are governed by the equation for the fifth Painleve transcendent. Results based on the asymptotic behavior of the transcendent are applied to study the oscillatory behavior of planetary probe vehicles in relation to aerodynamic heating and loads and the dynamic behavior of the Australian tektites on entering the earth's atmosphere, under the hypothesis that their origin was the moon.

III,
D. METEOROIDS (CONT.)

Tolansky, S., "Resemblance Between Macro-Impact with a Great Meteorite and Micro-Impact with a Drop or Sphere," Nature, Vol. 202, April 4, 1964.

Comparison of a macro-contour map computed by G.G. Johnson and others, on the meteoritic impact crater Ries Kessel, in Germany, with the optical interferometric microphotographical contours observed in experiments made in 1956 on the damage done to moving surfaces by a collision at speed either between a suspended water droplet, or when a surface at rest is struck by a small high-speed polythene sphere.

Tschermak, G., "The Microscopic Properties of Meteorites," Astrophysics, Vol. 4, No. 6, (Translation), Smithsonian Institution 1964.

Concerned with mineralogy and petrography, this book is a summary of the author's extensive work with meteorites. Its value lies in its comprehensive collection of 101 photographs of the microstructures of stony meteorites. The author comments on the general characteristics of meteorites and gives detailed descriptions of specific meteorite types.

Verniani, F., "On the Density of Meteoroids. II - The Density of Faint Photographic Meteors," Nuovo Cimento, Vol. 33, Aug. 16, 1964.

Computation of the density of 359 photographic meteors, reduced by Hawkins and Sothworth. The procedure uses the height of maximum light and does not require the use of the deceleration. The reliability of the method is discussed. It is shown that neither fragmentation nor other known causes can have a large effect on the results.

Villee, F., Duchesne, J., and Depireux, J., "Free Radicals in Carbonaceous Meteorites," Academie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 8, Feb. 24, 1964 (In French

Electron spin resonance study of the carbonaceous meteorites Alais and Cold Bokkeveld. By menas of a Varian type V 4502 spectrometer with a magnetic field modulated at a frequency of 100 kc, a narrow-band signal (approximately 10 oersteds; g= 1.96) is obtained which is attributed to the presence of free organic radicals in a concentration on the order of 10^{16} per g of carbon. The possible origin of these free radicals is discussed.

Vlasek, J., "Multiple Fall of Pribram Meteorites Photographed. VI- Some Results of Aerodynamic Measurements," Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 14, No. 6, 1963.

Description of a method for measuring the aerodynamic characteristics of meteorites recovered near Pribram, Czechoslovakia, on April 7, 1959. The results of measurements are given in the form of diagrams, showing the relationship between the coefficient of the tangential component of the resulting aerodynamic force and Mach numbers. The measurement equipment is described, together with the technology involved in the construction of a model.

III,
D. METEOROIDS (CONT.)

Vorob'yev, G.G., "The Problem of Tektites and Silica-Glasses," Meteoritics, No. 19, June 1964.

Tektites and silica glasses are reviewed in terms of their local names and synonyms. The history of their discovery, and their nomenclature are discussed. The various tektites are examined individually; their chemical composition is given, and their shapes are illustrated. The geographical distribution, the scales of localization, and their geological sites are reported.

Voshage, H., and Hess, D.C.,"The Radiation Age of Several Iron Meteorites," Zeitschrift für Naturforschung, Vol. 19a, March 1964 (In German)

Determination of the cosmic-ray exposure ages of eight iron meteorites, using the $^{40}K/^{41}K$ method.

Vronskiy, B.I., and Florenskiy, K.P., "Cosmic Cust on Earth," Noctilucent Clouds and Cosmic Dust on Earth, 10 June 1964.

Discussion of the complex aspects of the problem of studying the average composition of meteoric dust, and of determining the quantity of its fallout on the Earth. The methods used to identify the meteoric origin of particles are noted, and the results of various investigators are reviewed.

Vronskiy, B.I., "On the Discovery of the Susman Iron Meteorite," Meteoritics, No. 19, June 1964.

Background is given on the Susman iron meteorite; its discovery, location, shape, weight, composition, age, and other pertinent data are discussed. The site of the meteroite is also described.

Vronskiy, B.I., and Florenskiy, K.P., "The Cosmic Dust on Earth," Transl. into English from Priroda (Moscow), No. 3, 1964, (Contract NAS5-2078) (NASA-TT-F-8698; ST-ID-10138).

Earth's accretion of interplanetary matter varies from protons and nuclei of elements that are part of cosmic rays to large meteroites and comets. This article discusses the element interchange processes, investigations of the character and distributions of extraterrestrial matter in upper-atmosphere layers, the genesis of meteoritic balls, and the Tungusska fall. A comparison of computed data from past studies on the amount of cosmic dust falling annually demonstrates the large discrepancies and the need for further research.

III, D. METEOROIDS (CONT.)

Vsessviatskii, S.K., The Ring of Comets and Meteorites Surrounding Jupiter, Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liege, Belgium, July 9-12, 1962.

Observations of the existence of the hypothetical Jupiter ring. The assumption is made that Jupiter's equator band is the shadow of the ring encircling the planet. This assumption is confirmed by the examination of the location of the band on the planetary disk, and by other observations.

Wetherill, G.W., "Isotopic Composition and Concentration of Molybdenum in Iron Meteorites," Journal Geophysical Research, Vol. 69, No. 20, (Oct. 15, 1964).

Ratios of Mo^{92}/Mo^{100} were within 1% of terrestrial Mo. Samples were of meteoritic iron. Mo concentrations were 6 to 30 ppm.

Wilson, R.H. Jr., "Temperature of Metallic Objects in Space," Science, Vol. 144, April 3, 1964.

Brief consideration of the temperature of an iron meteoroid just before entering the Earth's atmosphere, taking into account the effect of the shadow of the Earth. It is suggested that the temperature of an iron meteoroid just before atmospheric penetration, may be anywhere from about 90°C down to much below the freezing point of water, depending upon its size and the duration of its proceding eclipse in the Earth's shadow.

Wood, J.A.,"Physics and Chemistry of Meteorites," The Moon, Meteorites, and Comets, Vol. IV - The Solar System, Ed. by Middlehurst, B.M., and Kuiper G.P., Chicago and London, University of Chicago Press, 1963.

Survey of the classification of recovered meteorites on the basis of mineralogy and macroscopically observable morphology. The classification and estimated fall frequency of meteorite types are presented in tabular form. Examined are: the physical properties of meteorites, their chemical composition, mineralogy, petrography, and metallography.

Yavnel', A.A., "Composition, Structure, and Conditions of Crystallization of Iron Meteorites," Meteoritika (Moscow) No. 22, 1962. (Translation), 28 July 1964.

A correlation of various studies on the composition, structure, and conditions of crystallization of iron meteorites.

III,
D. METEOROIDS (CONT.)

Yavnel, A.A., "Some Problems of the Chemistry of Meteorites," Meteoritics, No. 19 June 1964.

Chemical studies elucidating the formation and evolution of meteors in interplanetary space are presented in detail. Information from chemical studies related to movements of meteoric bodies in the atmosphere, to meteoric collisions with the earth's surface, and to changes in meteoritic material under terrestrial conditions is briefly discussed.

Zahringer, J., "Isotope Chronology of Meteorites," Annual Review of Astronomy and Astrophysics, Vol. 2, Ed. by Goldberg, L., Deutsch, A.J., and Layzer, D. Palo Alto, Annual Reviews, Inc., 1964.

Recent observations on the isotopic abundance of elements in meteorites. Emphasis is on the rare gases because they are separated to a large extent from the solid material during meteorite formation and also because methods are available for their detection in very small amounts. The anomalous occurrence of large amounts of rare gases in meteoritic material continues to pose an enigma. Explanations on the basis of primordial gas incorporation are presented.

III. INTERPLANETARY SPACE
E. INTERPLANETARY RADIATION

Anastassiades, M., "Middle Latitude Observations by Riometer Techniques," (Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of the Atmosphere, Corfu, Greece, June 1962), Radio Astronomical and Satellite Studies of the Atmosphere, Edited by Jules Aarons, Contract AF 61(053)-261.

Discussion of measurements of the atmospheric absorption of solar radiation, made using riometers at Stanford, Calif., Athens, Greece, and New Delhi, India, which are different in longitude, but situated practically on the same latitude of 38°N. Absorption values in middle lattitudes are found to vary between 1 and 5 dB; corresponding values measured in polar regions exceed 10 dB.

Andrews, J. L., Estimated Nuclear Radiation Environment Radiation Effects, General Electric Co., Oklahoma City, Okla., 10 Feb. 1964.

This report is an investigation of the penetrating radiation environment incident upon Nimbus B satellites in several possible orbits. A general survey of the energetic radiation environment near the earth is presented. Fluxes are determined for five 6-month, polar, circular orbits at altitubes from 540 to 1,500 n.mi. Estimates are given for fluxes and absorbed doses within spherical aluminum shields of 100- and 200-mil thickness (typical minimum protection for electronics); additional estimates of the absorbed dose from one extreme-size nuclear detonation similar to the Starfish one are also presented.

Andronov, A. A. and Trakhtengerts, V. Iu., "Kinetic Instability of the Earth's Outer Radiation Belt (Kineticheskaia Neustoichivost' Vneshnego Radiatsionnogo Poiasa Zemli), Geomagnetizm i Aeronomiia, Vol. 4, Mar.-Apr. 1964. In Russian.

Arnoldy, R. L., Hoffman, R. A., and Winckler, J. R., "Observation of the Van Allen Radiation Regions During August and September, 1959. 4: The Outer-Zone Electrons," J. Geophys. Res., Vol. 67, No. 7, Jul. 1962, (NASA Contract NASw-56).

A study is reported of the data from the radiation detectors aboard the Explorer VI earth satellite as the spacecraft passed through the outer zone, during a period when the count rate time variations and the geomagnetic activity were low. The radiation detectors aboard the satellite were an ionization chamber, a Geiger counter, a proportional counter telescope, and a scintillator. Extensive calibrations were made to determine the response of these detectors to monoenergetic electrons when inside a spare payload. In using these calibrations and fitting assumed power-law spectra of electrons to the data, it is seen that the spectrum is flat and must extend to several Mev at the small ranges, with the ion chamber and Geiger counter responses there due primarily to direct electron detection.

III,
E. INTERPLANETARY RADIATION (CONT.)

Antonov, R. A., Smorodin, Iu. A., and Tulinova, Z. I., "Formation of High Energy Gamma Quanta in Extensive Air Showers with Energies 10^{14}-10^{15} Ev in the Upper Third of the Atmosphere," (Zhurnal Eksperimental' noi i Teoreticheskoi Fiziki, Vol. 46, Jan. 1964.) Soviet Physics - JETP, Vol. 19, July 1964.

Presentation of experimental data on the energy spectra of gamma quanta in extensive air showers containing 10^5-10^6 particles, for 10^{12}-10^{13} ev, at depths of 311 and 197 g/cm^2 in the atmosphere. A comparison of the spectrum of gamma quanta, in a density layer of 311 g/cm^2, with the analogous spectrum of the 197-g/cm^2 density layer shows that the overwhelming majority of gamma quanta are generated in the upper strata of the atmosphere.

Astling, E. G., and Horn, L. H., "Some Geographical Variations of Terrestrial Radiation Measured by Tiros II," Journal of the Atmospheric Sciences, Vol. 21, Jan. 1964, Contract No. Cwb 10240; U. S. Weather Bureau Grant No. 10, Project 4.

Application of infrared radiation observations made by Tiros II during 27 days between 26 November 1960 and 6 January 1961 to obtain mean latitudinal profiles of outgoing long-wave radiation. The mean profiles revealed an insufficient estimate of limb darkening in the data. Finally, the means obtained from the Tiros II data are found to agree well with estimates of the terrestrial radiation based on theoretical considerations and indirect quantitative estimates.

Bailey, D. K., "Polar-Cap Absorption," Planetary and Space Science, Vol. 12, May 1964.

Discussion of the relation of energetic solar particles to the ionosphere, with particular attention to the problems of PCA (polar-cap absorption). Several techniques now in use for determining and observing polar-cap absorption are discussed and compared. They are divided into two groups: (1) direct techniques that observe the effects of the PCA ionization on the propagation of radio waves or that observe the photon emission from the mesosphere or lower ionosphere resulting from interactions of the photon flux with the air; and (2) more indirect techniques that detect, identify, and measure the flux of incoming solar particles. Relationship between optical flares on the Sun and PCA and between the solar radio-noise emission and PCA are examined. A review is given of the current state of knowledge of PCA beginning with the generation of the responsible ionizing particles at the Sun, and concluding with their interactions in the atmosphere of the Earth.

Bakos, G. A., Measures of the Earthshine, 14 Aug. 1964, (Grant NSFY/8.11-236) (SAO Special Rept. 162).

An attempt was made to correlate the brightness of the earthshine with worldwide weather data for 1958. Although no positive relation has been found, some problems in connection with the fluctuations of the brightness of the earthshine have been clarified, and the mean albedo of the earth has been computed.

III,
E. INTERPLANETARY RADIATION (CONT.)

Bandeen, W. R., Conrath, B. J., and Hanel, R. A., "Experimental Confirmation From The Tiros VII Meteorological Satellite of the Theoretically Calculated Radiance of The Earth Within the 15-Micron Band of Carbon Dioxide," Journal of the Atmospheric Sciences, Vol. 20, Nov. 1963.

Presentation of results of the preliminary data reduction of measurements of a medium resolution radiometer on the Tiros VII (1963 24A) satellite. These data are found to confirm theoretical radiance values of the Earth and their independence of cloudiness, the predicted seasonal effects, and a small amount of limb brightening. The minimum and maximum blackbody temperatures observed agree well with theoretical predictions.

Bandeen, W. R., Samuelson, R. E., and Strange, I, Tiros III. Radiation Data Users' Manual Supplement. Correction Models for Instrumental (NASA-TM-X-51825), 1 Dec. 1963.

This manual supplement discusses the additional evidence about the apparent degradation of the response of the five-channel, medium-resolution radiometer, and elaborates on the discussion of instrumental degradation in Section VI of the TIROS III Manual. This evidence arose from several different investigations using the radiation data from TIROS III.

Baryshev, V. A., and Krylov, G. N., "Utilization of the Concept of a Standard Model of the Outgoing Radiation Field of the Earth as a Planet in the Scheme of Solving the Inverse Radiation Problem," Cosmic Res., 27 Apr. 1964 (N64-23852 16-29).

Several methodological questions encountered in development of schemes for solution of the inverse problems of radiation are examined by statistical methods. The utilization of the introduced concept of a terrestrial radiation model makes it possible to apply known mathematical methods of treatment of experimental results. A simplified method for determining the vertical to the earth's surface is examined as an illustration.

Bell, J. E., Radiation Effects on Guided Missile Electronic Equipment, Final Technical Report, 15 Jul., 1963 - 15 Jan. 1964 (Contract NOw-63-0486-d)

This report includes (1) electron and gamma correlation and a definition of the laboratory environment; (2) radiation effects on thin film devices, bulk semiconductor integrated devices and circuits, silicon controlled rectifiers, resistors, and the correlation of transistor response with electrical parameters; (3) general circuit hardening techniques, and the development of a silicon controlled rectifier equivalent model for radiation prediction techniques; and (4) radiation effects on nonlinear circuits employing silicon controlled rectifiers, four layer diodes, trigisters, and gate turnoff switches.

III,
E. INTERPLANETARY RADIATION (CONT.)

Blanchard, R. C., and Hess, W. N., Solar Cycle Changes in Inner Zone Protons, Mar. 1964, (NASA-TM-X-55013; X-640-64-50).

Time-dependent calculations of the inner Van Allen belt proton population show that large changes of the population up to a factor of 50 will take place during the solar cycle. The effect is most pronounced for the region of B-L space corresponding to minimum altitudes of 300 to 700 km. Because different energy protons respond to the changing solar cycle at different rates, the proton energy spectra will change with time also.

Bonetti, A., Bridge, H. S., Lazarus, A. J., Rossi, B., and Scherb, F., "Explorer X Plasma Measurements," Vatican, Pontificia Acad. Sci., 1963, Semaine d' Etude sur le Probleme du rayonnement cosmique dansl' espace interplanetaire (NASA Grant NsG-386).

Plasma measurements were made with a detector aboard the Explorer X satellite, launched on a highly elongated elliptical trajectory with the line of apsides about 33° to the antisolar direction. A plasma moving with a velocity of about 300 km sec^{-1} was first observed when the satellite reached a distance of about 22 earth radii. During the remainder of the observations (which terminated about 40 hours later, at a distance of 42 earth radii) periods in which substantial plasma fluxes were recorded alternated with shorter periods in which the plasma flux was below or just above the detection limit. There was a striking correlation between the plasma flux and the magnetic field.

Borisenkov, E. P., Doronin, I. P., and Kondratiev, K. I. "Structural Characteristics of the Radiative Field of the Earth as a Planet," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Analysis of the structural characteristics of outgoing-radiation fields, on the basis of the Radiation Data Catalogs of Tiros 2 (1960 Pi 1) and Tiros 3 (1961 Rho 1). The characteristics include: the structural and autocorrelation functions of the radiative field in the spectral regions from 6-6.5 μ and from 8-12 μ, the integral reflection radiation in the spectral regions between 0.2 and 6.0 μ and between 0.55 and 0.75 μ, and the spectral density of the radiation field in the 8-30 μ region of the spectrum. Tables are presented showing the errors in the radiation measutements, the average dispersion of the radiation fields, and the mean values of the radiative fluxes in the various spectral regions.

Braginskii, V. B., and Rukman, G. I., "Experimental Study of the Possibility of Observing the Gravitational Radiation From Extraterrestrial Sources (Eksperimental'noe Issledovanie Vozmozhnosti Nabliudeniia Gravitatsionnogo Izlucheniia Vnezemnogo Proiskhozhdeniia), Moskovskii Universitet, Vestnik, Seriia III - Fizika, Astronomiia, Vol. 18, July-Aug. 1963. In Russian.

III,
E. INTERPLANETARY RADIATION (CONT.)

Brown, W. L., Gabbe, J. D., and Rosenzweig, W., "Results of the Telstar Radiation Experiments," Telstar I, Vol. 2, Jun. 1963.

The data from the particle experiments of the Telstar satellite have been analyzed to provide maps of the distribution of electrons and protons as measured in three of the Telstar detectors. For the protons between 26 and 34 Mev and >50 Mev, the particle distributions are stable in time, but for the electron distribution there is a time decay of the electron flux over most of the region explored by the Telstar orbit. The connection of these observations to the high-altitude nuclear explosion of July 9, 1962 is discussed.

Daigarno, A., Planetary Aeronomy XVI: Corpuscular Radiation in the Upper Atmosphere (NASA Contract NASw-701), October 1963.

The efficiencies of fast electrons and protons in producing luminosity and heating by collisions with the atmosphere are discussed, and upper limits to the fluxes of corpuscular radiation are obtained. A possible explanation of high-altitude red auroras is advanced. The effects of the photoelectrons produced in the ionization of the atmosphere by extreme solar ultraviolet radiation are examined, and it is noted that the electron temperature at high altitudes may be anomously large at dawn, the phenomenon being accompanied by a red glow.

Das Gupta, M. K., and Basu, D., "Effect of the Earth's Orbital Eccentricity on Incident Solar Flux At 10·7 CM," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Jan. 1964.

Evaluation of preliminary results of an attempt to obtain, from radioastronomical data, a direct evidence of the annual variation of the intensity of the incident solar radiation arising from the Earth's orbital eccentricity. For the purpose of this inquiry, the monthly mean values of the solar radiation flux at 10·7 cm, as measured at Ottawa, were examined. For any particular month, the eleven observed, monthly mean values of the solar radio noise flux during the entire solar cycle 1949-59 were plotted against the respective monthly mean values of the Zürich relative sunspot number. Each of these twelve plots confirmed the now established fact that the solar radiation flux and sunspot number are linearly related.

Davis, J. R., Headrick, W. C., and Ahearn, J. L., "A HF Backscatter Study of Solar Eclipse Effects Upon the Ionosphere," Journal of Geophysical Research, Vol. 69, Jan. 1, 1964.

Review of an oblique ionospheric sounding experiment during the partial solar eclipse of July 20, 1963. Three eclipse-associated ionospheric effects are noted: (1) a decrease of D-region ionization as evidenced by the gradual rise and subsequent decline of the E- and F-layer echo amplitudes; (2) an extensive decrease in E_s-layer ionization accompanied by a possible rise in altitude of the E_s layer, as indicated by the increase in range of the point from which the maximum amplitude of the E_s echo is returned; and (3) a marked separation of the F_1 and F_2 layers, as demonstrated by the split F-layer echo that occurs during the eclipse.

III,
E. INTERPLANETARY RADIATION (CONT.)

Donahue, T. M., "Lyman α Scattering in The Earth's Hydrogen Geocorona. III - The Extrageocoronal Contribution," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964, NSF Grant No. G-21999.

Further analysis of the high-altitude Lyman α experiment of Chubb et al. which measured the altitude variation of Lyman α brightness between 500 and 1100 km showing that the results are not inconsistent with as many as 15×10^{12} atoms/cm^2 above 120 km. The altitude variation can be interpreted in terms of 0.7×10^{-3} erg/cm^2 sec ster in a broad line originating outside the geocorona and 1.5×10^{-3} erg/cm^2 sec ster from multiple scattering at 120 km. The extrageocoronal component is the same as that called for by the absorption cell measurement of Morton and Purcell, in which 15% of the signal from overhead at 25° angle of solar depression passed through an absorption cell.

Donahue, T. M., and Fastie, W. G., "Observation and Interpretation of Resonance Scattering of Lyman α and OI (1300) In The Upper Atmosphere," (COSPAR, International Space Science Symposium, 4th Warsaw, Poland, June 3-11, 1963, Paper), Space Research IV; International Space Science Symposium, 4th Warsaw, Poland, June 4-10, 1963, Proceedings, Edited by P. Muller, NSD-NASA-supported research.

Dulk, G. A., "Faraday Rotation Near the Transverse Region of The Ionosphere," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963.

Demonstration that some of the equations used to describe Faraday rotation are often misinterpreted in the case of propagation through an anisotropic magnetic field when the cosine of the angle between the magnetic field and the wave normal changes sign along the ray path. A set of modified equations is given, and these are shown to be consistent with measured Faraday rotation. Using the modified equations in a ray-tracing program, errors are analyzed resulting from the use of several approximations near the transverse region. The approximations investigated are: (1) quasi-longitudinal propagation, (2) straight line propagation, and (3) use of an effective ionospheric height.

Dungey, J. W., "Some Effects of Electromagnetic Disturbances on The Radiation Belts," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Theoretical treatment of the effects. All collision processes and local injection processes are neglected. It is noted that in the Fokker-Planck formulation, Coulomb effects, though negligible, are equivalent to the effect of thermal noise. Within the terms of reference discussed, the disturbances are not noise in the strict sense, but when their effects are calculated statistically, the result is formally similar to the Fokker-Planck equation. The objective of the treatment is the derivation of such an equation. As yet the derivation is at the stage of order-of-magnitude calculations. The effect of a particular disturbance on an individual particle is calculated as a first step.

III,
E. INTERPLANETARY RADIATION (CONT.)

Egeland, A., Gustafsson, G, Olsen, S., Barron, W., and Katz, A., "An Investigation of The Natural Electro-Magnetic Radiations Between 10 c/s and 10 kc/s" -(Scientific Report No. 5), 20 Feb. 1964 (Contract AF 61(052)-678) (AFCRL-64-304; AD-437820).

Naturally occurring electromagnetic radiation in the audio-frequency range was studied. The results were compared with similar measurements at Sagamore Hill, Mass. Several emission bands, distinct from the normal background-signals, and obtained as strong enhancements in portions of the spectrum were recorded.

England, F. E., The Time Dependence of Radiation Belt Life-Times and Some Applications, 1964 (Grant NsG-58-60)(NASA-CR-56828).

The lifetimes of particles in the radiation belt vary as a consequence of fluctuations of the loss processes such as produced by variations of atmospheric density with time. The time scale of atmospheric variations affects the averaged atmospheric density to which trapped particles are exposed and therefore determines the time dependence of the radiation lifetimes as set by the atmosphere. Since observations are usually made of the radiation flux rather than of lifetime, a number of models of injection and loss, which determine the resultant flux, are examined. Special cases of injection and removal are considered.

Ershkovich, A. I., "Electron With Energy Higher Than 1600 Kev in Radiation Zones of the Earth," (Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, Sept. 1963), Academy of Sciences (USSR), Bulletin, Geophysics Series, Sept. 1963. Translation.

Ershkovich, A. I., "On the Role of Solar Cosmis Rays in the Formation of the Electronic Component of Radiation Zones of the Earth" (Akademiia Nauk SSSR, Izvestiaa, Seriia Geofizicheskaia, No. 10, 1963, Academy of Sciences USSR, Bulletin, Geophysics Series, Oct. 1963, Translation.

Fitzenreiter, R. J., and Blumle, L. J., "Analysis of Topside Sounder Records," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.

Discussion of methods of interpreting the data obtained by the Alouette, launched on September 29, 1962, and outline of a technique for reducing the topside sounder satellite data to electron density distributions with height. The most useful feature for the calculation of electron density profile is the extraordinary trace; however, to achieve accurate results, the effect of the geomagnetic field must be carefully considered in the data reduction process.

III,
E. INTERPLANETARY RADIATION (CONT.)

Flamm, E. J., and Lingenfelter, R. E., "Neutron and Proton Dosages in The Upper Atmosphere From Solar Flare Radiation," Science, Vol. 144, June 26, 1964.

Calculation of the radiation dosage from secondary neutrons as well as from primary and secondary protons in the Earth's atmosphere during solar particle events as a function of the solar proton flux, atmospheric depth, and geomagnetic-cutoff rigidity. The dosage in rems from secondary neutrons exceeds the dosage from protons below 30 g/cm^2 of residual atmosphere. Neutron dosages in rads are less than the dosage from primary photons at all depths above 100 g/cm^2.

Frank, L. A., Van Allen, J. A., and Hills, H. K., An Experimental Study of Charged Particles in The Outer Radiation Zone, Jan. 1964 (NASA Grant NsG-233-62) (NASA CR-53169: SUI 64-1) OTS.

Studies of the charged-particle fluxes near the magnetic equatorial plane in the vicinity of the outer-radiation zone, based on five months of data from Explorer XIV, are presented. The spectra, fluxes, radial distributions, and temporal variations of the charged particles detected are discussed and presented graphically. The effects of Soviet nuclear bursts of late October and early November 1962 on the natural radiation fluxes are discussed.

Frank, L. A., Van Allen, J. A., and Hills, H. K., "A Study of Charged Particles in The Earth's Outer Radiation Zone With Explorer 14," Journal of Geophysical Research, Vol. 69, No. 11, 1 Jun. 1964 (Grant NsG-233-62).

A comprehensive study of the intensities of electrons and protons near the equatorial plane in the earth's outer radiation zone is presented. The data were obtained from Explorer 14 during the five-month period October 1962 through February 1963. Emphasis is on the radial distribution of absolute intensities of protons and electrons and on the time variations of the energy spectrum and radial distribution of electrons. Artificial radiation belts produced by the Soviet nuclear bursts at high altitudes during late October and early November 1962 are also detected, and their time decays are plotted.

Freden, S. C., and Paulikas, G. A., "Trapped Protons at Low Altitudes in the South Atlantic Magnetic Anomally," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964, Contract AF 04(695)-169.

Measurement of the fluxes of protons from 5 to 20 Mev and 60 to 120 Mev in September and October 1962 at low altitudes over the South Atlantic magnetic anomaly. The ratio of the fluxes in these two energy intervals is essentially independent of B and is independent of L below $L \simeq 1.4$ but changes rapidly for L 1.4. The flux in the 5- to 20-Mev interval indicates that the spectrum turns back up below the local minimum (at $L \gtrsim 1.5$) near 20 Mev. This result is consistent with an increased absorption in the atmosphere for the albedo neutrons near 20 Mev. The integral flux about 31 Mev appears to have increased by a factor of about 3 at the lower L values and higher B values since the Explorer 4 measurements. This would

be expected if the source had stayed essentially constant and the atmospheric density had decreased in these regions of space as the distance from the period of solar maximum was increased.

Freeman, J. W., Jr., "The Morphology of The Electron Distribution in The Outer Radiation Zone and Near the Magnetospheric Boundary as Observed by Explorer 12," Journal of Geophysical Research, Vol. 69, No. 9, 1 May 1964 (Grant NsG-233-62).

The elliptic orbit satellite Explorer XII made possible the routine survey of the heart of the outer radiation zone as well as the region of transition between the magnetosphere and interplanetary space on the sunward side of the earth by means of a variety of particle and magnetic field detectors. The data received from the SUI detectors during the entire 112-day lifetime were comprehensively analyzed.

Galperin, Iu. I., and Boliunova, A. D., "The Study Of the Drastic Changes of The Radiation in The Upper Atmosphere in July, 1962," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Review of the measurements, by Cosmos 5 (1962 Upsilon 1), of the high-altitude thermonuclear explosion above Johnston Island on July 8, 1962. Recordings were made largely from the signals of an electron counter and a shielded Geiger counter. The changes in the recordings with time and position are described.

Galperin, Iu. I., and Temnyi, V. V., "Atmospheric Scale Height in the 200-400 KM Range According to Radiation Belt Data," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Consideration of the thermal energy balance of the upper atmosphere at low altitudes. It is stated that the most intense energy absorption of radiation belt particles at low latitudes occurs in the region of the Brazilian (or South Atlantic) anomaly. The atmospheric parameters deduced from the satellite deceleration are stated to be relatively insensitive to such local effects in comparison with regular solar time variations. It is noted that the comparison of data on global mean atmospheric parameters including direct measurements of trapped particles at low altitudes over the Brazilian anomaly with data from indicators on Cosmos 3 and Cosmos 5 satellites shows that additional thermal flux in this region from the trapped particles' precipitation is not significant.

III,
E. INTERPLANETARY RADIATION (CONT.)

Gintsburg, M. A., "The Head Shock Wave in Front of The Earth and Its Effect on The Radiation Belts," 16 Jan. 1964. Trasl. into English of an article from Geomagnetizm i Aeronomiya (Moscow), Vol. 6, No. 3, Nov.-Dec. 1963.

An explanation of the results from Pioneer I concerning the pulses of the magnetic field between 12 and 14 R_e (where R_e is the earth's radius) is presented. It is indicated that the system of pulses observed as these distances by means of Pioneer I and Pioneer V, is nothing other than the front of a noncolliding head shock wave. Also the acceleration of electrons in the radiation belts by plasma waves, which are continuously generated by a head shock wave is discussed.

Golitsyn, G. S., "The Influence of Radiative Transfer on The Propagation of Sound in The Atmosphere," (Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, June 1963.) Academy of Sciences (USSR), Bulletin, Geophysics Series, June 1963. Translation.

Goody, R. M., Atmospheric Radiation. Volume 1 - Theoretical Basis, Oxford, Clarendon Press, 1964.

Quantitative treatment of the fundamental processes involved when electromagnetic energy from the Sun comes in contact with a planetary atmosphere. Not being limited to terrestrial meteorology, the theories advanced are seen to be applicable to studies of Mars and Venus and to have some relevance to studies of the outer planets. The theory of radiative transfer is presented along with the corresponding numerical and approximate methods. Rotational, vibrational, and electronic bands are discussed in the theory of gaseous absorption, and the problems encountered in measuring the widths, and shapes of spectral lines in the infrared and microwave regions are examined.

Gringauz, K. I., Balandina, S. M., Bordovskii, G. A., and Shiutte, N. M., "On The Results of Tests With Three-Electrode Charged Particle Traps in The Second Radiation Belt and In The Outermost Belt of Charged Particles," (Iskusstvennye Sputniki Zemli, No. 15, 1963, Planetary and Space Science, Vol. 12, Feb. 1964. Translation.

Gurnett, D. A., and O'Brien, B. J., "High-Latitude Geophysical Studies With Satellite Injun 3. V - Very-Low-Frequency Electromagnetic Radiation," Journal of Geophysical Research, Vol. 69, Jan. 1, 1964, Contract No. N9 onr 93803; Grant No. NsG 233-62.

Presentation of preliminary results of VLF electromagnetic radiation measurements made by the Injun 3 satellite (1962 Beta Rau 2) in the altitude range of 250 to about 2,000 km over North America from December 1962 to March 1963. The radiation is received by a loop antenna on the magnetically oriented satellite. Amplitude is measured with narrow-band filters at six frequencies, the lowest being 0.7 kc and the highest being 8.8 kc. A wide-band amplitude over the frequency band from 0.5 to 7.0 kc is also measured. In addition, the VLF signal modulates the telemetry transmitter so that a detailed spectral analysis can be made on the ground.

III,
E. INTERPLANETARY RADIATION (CONT.)

Harang, O., "Excitation of AlO Bands in the Sunlit Atmosphere and The Determination of The Temperature From The Distribution Among The Vibrational Levels," Planetary and Space Science, Vol. 12, June 1964, Contracts No. AF 61(052)-252; AF 61(052)-680.
Study of the emission from a luminous cloud produced by a TNT explosion, indicating that the temperature in the 200-220 km region of the twilight atmosphere is about 1250°K or less.

Hennes, J. P., Fowler, W. B., and Dunkelman, L., "Middle Ultraviolet Day Radiance of The Atmosphere," (American Geophysical Union, Western National Meeting, 2nd, Dec. 27-29, 1962), Journal of Geophysical Research, Vol. 69, July 1, 1964.
Presentation of photoelectrical measurements, at 2 middle UV wavelengths, of the day radiance of the atmosphere. The measurements were made by rocket-borne photometers. Filters and collimators provided an effective field of view of 1.4×10^{-2} ster, and bandpasses of approximately 100 Å at 2600 Å and 230 Å at 2200 Å. At a height of 146 km, nadir radiance values of about 0.5 erg/sec cm^2 ster 100 Å were obtained at both wavelengths. There is good agreement between the radiance values measured and those which have been calculated on the basis of single Rayleigh scattering in the presence of ozone.

Hess, W. N., "The Effects of High-Altitude Explosions," Space Physics, Edited by Donald P. LeGalley and Alan Rosen, 1964.
Discussion of artificial radiation from nuclear explosions. The subjects considered are a bomb as a source of charged particles, the neutron source, particle motion, early history of Project Starfish, synchrotron radiation, satellite data on the Starfish high-altitude nuclear explosion, radiation damage, effects on the natural radiation belt, the Soviet high-altitude explosions, changes of the electron energy spectrum with L, and decay of the electrons.

Hess, W. N., Bloom, S. D., Mann, L. G., Seward, F. D., and West, H. I., Jr., Electron Loss Rate From The Outer Radiation Belt, 1962 (NASA-RP-307).
The rate of loss of electrons from the outer radiation belt is obtained by using recent electron flux measurements on Discovered satellites and by assuming that the coulomb scattering dominates as the loss process. This results in an average lifetime of the order of 100 years for outer belt electrons.

Hess, W. N., "Lifetime and Time Histories of Trapped Radiation Belt Particles," (COSPAR, International Space Science Symposium, 4th Warsaw, Poland, June 3-11, 1963, Paper.) Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963 Proceedings. Edited by P. Muller, 1964.

III,
E. INTERPLANETARY RADIATION (CONT.)

Hill, G. E., "Sudden Enhancements of F-Layer Ionization in Polar Regions," Journal of The Atmospheric Sciences, Vol. 20, Nov. 1963, Contract No. AF 30(602)-2809.

Description of the morphology of sudden enhancements of F-layer ionization in polar cap regions, especially during winter. The disturbances are shown to be caused by a horizontal movement of F-layer ionization associated with E-region electric currents. This connection arises from electric fields which are set up by these currents and then transferred to the F-region along an essentially vertical magnetic field. Under the influence of the electric and magnetic fields, a horizontal drift of ionization may become sufficiently strong to cause the development of sporadic F. Drift velocities obtained from synoptic analyses range between 2000 and 5000 km/hr and agree with theoretical estimates. Criteria are presented for the development of sporadic F events, and the general diurnal and seasonal variations in the frequency of occurrence are inferred.

Hogrefe, A. F., Near Earth Ionizing Radiation and Electronic Circuitry, Jul. 1963 (Contract NOw-62-0604-c).

A survey of data on surface- and bulk-damage effects on transistors and diodes in an ionizing radiation environment was made. Circuits designed in such a manner that they are sensitive to surface effect, and incorporating nonplanar transistors, tend to exhibit large increases in leakage current at flux dosages of about 10^5 rads. Circuits drawing significant continuous collector current are inherently immune from the surface effect. Planar transistors are generally considered to be immune from surface effect, but exceptions to this have been noted. Bulk damage becomes significant at higher integrated dosages than surface effect, and for near-earth payloads, it could be ignored prior to the nuclear events of 1962.

Hrach, F. J., "Proton Fluxes Along Low-Acceleration Trajectories Through The Van Allen Belt," AIAA Journal, Vol. 2, Apr. 1964.

Presentation of an estimate of the time-integrated flux for trajectories having a constant acceleration in the range of 5×10^{-4} to 10^{-2} miles/sec^2 and an inclination angle between the vehicle orbit plane and the equatorial plane in the range of 0° to 90°. Considered are spatial flux distribution, vehicle trajectory, and calculation procedure. Shown is the effect of acceleration. Curves of equivalent hours at the heart of the belt vs acceleration are drawn for inclinations of 0°, 28.4°, 60°, and 90°. It is stated that an orbit plane of 28.4° would be achieved by launching a rocket due East from Cape Kennedy.

Imhof, W. L., and Smith, R. V., "Proton Intensities and Energy Spectrums in The Inner Van Allen Belt," Journal of Geophysical Research, Vol. 69, Jan. 1, 1964, Contracts No. AF 19(604)-8028; AF 04(647)-564.

Analysis of data obtained from proton intensities and energy spectra in the inner Van Allen belt, measured with shielded plastic scintillators

on three satellites and an Atlas pod. Integral proton fluxes with energy greater than 59, 95, and 148 mev are given at the magnetic equator for L values of 1.25 and 1.48 to 1.60. Contours of constant proton flux are presented in B and L space. Data from the scintillators, which have threshold energies of 46, 76, and 128 mev, are analyzed in terms of two commonly assumed spectral formulas. For the theoretical spectral shapes of Lenchek and Singer, cutoff energies are derived from the ratios of counting rates in the three detectors. The results are in moderately good agreement with the calculations of Singer.

Iudovich, L. A., "Temporal Regularities of the Appearance of Anomalous Ionization in The F2 Layer at High Latitudes," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov.-Dec. 1963. In Russian.

Kholodnyi, I., "Ionization of The Upper Atmosphere by Short-Wave Solar Radiation, Feb. 1963, Transl. into English from Geomagnetizm i. Aeronomiia (Moscow) 2(4), 1962, Contract AF 19(604)-8505.

Taking into account new data about the energy and spectrum of short-wave solar radiation, the absorption of radiation and the rate of ion-formation in the atmosphere at heights of 100 to 800 km were calculated for different times of the day.

Kaplan, S. A., Katiushina, V. V., and Kurt, V. G., "Intensity Measurements of Scattered Ultraviolet Radiation (1216 Å and 1300 Å) in Upper Atmosphere, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Analysis of scattered UV radiation measurements made in the upper atmosphere with rocket-borne photon counters. The counters recorded radiation at 1216 and 1300 Å. In analyzing the data, it is assumed that the scattering occurs only in the direction that is colinear with the line joining the nadir and zenith at the point of observation. The measured radiation flux at the solar angle of -17° is 10 to 20 times lower than at 3°. The intensity of the radiation is greater when the measuring instruments are oriented towards the zenith than when they are directed towards the nadir.

Kawano, M., and Nakatani, S., "Some Properties of Natural Radioactivity in The Atmosphere," The Natural Radiation Environment, Edited by John A. S. Adams and Wayne M. Lowder, University of Chicago Press, 1964.

Comparison of atmospheric radioactivity measurements taken simultaneously with an electrostatic precipitator and with an ionization chamber. The chambers used to determine concentrations of radioactive substances in the atmosphere, and the filters and precipitators used to measure the concentration of radioactive dust, are described. The diurnal variations of concentrations of radioactive substances are studied.

Kern, J. W., Magnetosphere and Radiation Belts, Rand Corporation, Santa Monica, Calif., Sept. 1964.

Observations and theories on the interactions among the geomagnetic field, charged particles, and neutral ionized gases are reviewed. Copious references are given. The motions of individual charged particles in a non-uniform magnetic field are outlined in a discussion of the behavior of energetic particles moving in the geomagnetic field. These dynamic processes are important in the interpretation of geomagnetic effects of trapped radiation and in relation to detailed theories of geomagnetic storm phenomena. Although it is now possible to formulate models of the earth's immediate environment that closely approximate the observed phenomena, a number of unsolved problems remain.

Kistler, V. E., A Discussion and Bibliography of Current Literature Concerning Van Allen Belts For Use in Snap Space Environmental Studies, 15 Feb. 1963 (Contract AT(11-1)-GEN-8) (NAA-SR-7849)

This report presents a bibliography of theoretical and experimental papers concerning the Van Allen trapped radiation belts. Also, a general discussion of past history and conclusions from some experimental and theoretical work are presented. This information is applicable to the evaluation of space radiation influences upon SNAP reactor systems.

Knecht, D. J., "Measurement of Trapped Proton Fluxes in The Inner Radiation Belt With a Scintillation Telescope Spectrometer," International Symposium on Space Technology and Science, Tokyo, Japan, August 27-31, 1962, 4th, Proceedings, Edited by Tamiya Nomure, 1963.

Instrumental measurement of the proton fluxes expected at altitudes of 1000 km and above to aid the theoretical interpretation of nuclear weapon phenomenology above the atmosphere. It is noted that a new belt of soft ionizing radiation in the upper ionosphere appears to have been detected with instruments flown aboard two high-altitude sounding rockets, one of which was launched from Wallops Island. Intensities are observed at about 400 km or below. This radiation produces a different instrumental response than that of the usual inner belt of trapped radiation above about 800 km.

Knuth, R., and Lauter, E. A., "Effects of Trapped Particles in Lower Ionosphere at Medium Latitudes," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Edited by P. Muller, 1964.

Discussion of observed correlations between trapped radiation and low-frequency ionospheric absorption anomalies at medium latitudes. It is concluded that the significant after effects of strong magnetic disturbances in low-frequency propagation are probably caused by electrons dumped from the inner part of the outer radiation belt during periods of intense refilling activity. The statistics of such low-frequency absorption anomalies (1949-1962) indicate a strong dependence on season, sunspot cycle, and geomagnetic latitude.

III,
E. INTERPLANETARY RADIATION (CONT.)

Kondrat'yev, K. Y., and Fedorova, M. N., "Outgoing Radiant Fluxes Onto Variously Oriented Surfaces at a Height of 300 km," Cosmic Res., 14 February 1964.

This article gives the results of calculating outgoing long-wave and short-wave radiant fluxes onto variously oriented plane surfaces at a height of 300 km. The calculations were made from the angular distribution of the intensity of the outgoing radiation. Conclusions were reached on the feasibility of using an isotropic approximation for calculating the outgoing long-wave radiation.

Kondrat'yev, K. Ya., and Yakushevskaya, K. Ye., The Spectral Distribution of Outgoing Radiation, Transl. into English from Probl. Fiz. Atm. Sb. 2, Izd. Leningr. Univ., (USSR), 1963 (NASA-TT-F-210).

In some problems the intensity of outgoing radiation and the distribution of this intensity over the spectrum are of interest. To obtain data of this sort, the intensities of outgoing radiation were calculated at the nadir in 27 spectral sectors of the 1μ to 18μ range.

Krasovskiy, V. I., Gal'perin, Yu. I., et al., "Some New Results of Geophysical Investigations With The Aid of The Satellites Kosmos 3 and Kosmos 5, Transl. into English from Geomagnetism i Aeronomiya (Moscow), Vol. 3, No. 3, 1963

Results are given of corpuscular radiation measurements of the upper atmosphere that were made with the aid of the satellites Cosmos 3 and Cosmos 5.

Lazarev, V. I., "Ionizing Radiation and Warming of The Upper Atmosphere," (Geomagnetizm i Aeronomiia, Vol. 3, No. 5, 1963, Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963. Translation.

Investigation of the warming of the upper atmosphere by wave corpuscular ionizing radiation. Examination of the photochemical processes in the upper atmosphere makes it possible to deduce its vertical temperature distribution.

Lazarev, A. I., "Infrared Radiation of Matter in Space About the Sun," Astronomicheskii Zhurnal, Vol. 41, Mar.-Apr. 1964. In Russian.

Lingenfelter, R. E., and Flamm, E. J., "Neutron Leakage Flux From Interactions of Solar Protons in The Atmosphere," Journal of Geophysical Research , Vol. 69, June 1, 1964, NSF Grant No. G-13575.

Results of calculations of the equilibrium distributions of neutrons produced by solar proton interactions in the atmosphere, extended to include the neutron leakage flux up to 10 Mev, expressed as a function of energy and angle. Within the limits of uncertainties in the data employed, the calculated neutron albedo and equilibrium flux agree with available measurements.

Malkevich, M. S., "Some Questions About The Interpretation of Radiation Measurements From Satellites," Cosmic Res., Vol. 2, No. 2, 8 Jun. 1964.

Methods are examined for determining some physical parameters of the atmosphere and of the underlying surface with respect to the measurements of radiation in different regions of the spectrum which were obtained by satellites. The calculation of the atmospheric "noise" when determining the space structure of the underlying surface is discussed.

Mariani, F., Evidence For The Effect of Corpuscular Radiation on The Ionosphere, May 1963, (NASA TM X-51058; X-615-63-94).

The correlation of maximum electron density of F region at noon with solar activity is carefully investigated, during the years 1937 to 1957 for both long-term and month-to-month variations, in all existing observatories. On the basis of noon-equilibrium between electron loss and ion production by solar radiation, the presence of an ionizing effect, strongly dependent of the solar activity and peaked at latitudes of 55° to 65°, is shown. This latitudinal variation suggests a corpuscular origin of such ionizing effect. The possible source of a corpuscular flux is discussed. The energy of the ionizing particles is in the range of Kev. Quantitative evidence is given that Van Allen belts could be an important, or possibly the main source.

McDiarmid, I. B., and Burrows, J. R., "Diurnal Intensity Variations in The Outer Radiation Zone at 1000 KM," Canadian Journal of Physics, Vol. 42, June 1964.

Report of observation of a diurnal variation at 1,000 km in the outer radiation zone in the average intensity of trapped electrons with energies greater than 40 kev.

McDiarmid, I. B., and Burrows, J. R., "High-Latitude Boundary of The Outer Radiation Zone at 1000 KM," Canadian Journal of Physics, Vol. 42, Apr. 1964.

Description of data obtained from particle detectors on the Alouette satellite used to determine the average high-latitude boundary of the outer radiation zone at 1000 km as a function of local time.

McIlwain, C. E., "The Radiation Belts, Natural and Artificial," Science, Vol. 142, Oct. 18, 1963, Contract Nos. NAS 5-3063 and NASr-116.

Review of results obtained by Explorer XV (1962 Beta Lambda 1) concerning geomagnetically trapped radiation.

Millard, J. P., and Neel, C. B., "Albedo and Earth Radiation Deduced From Emissivity Sensors on The First Orbiting Solar Observatory," American Institute of Aeronautics and Astronautics, Annual Meeting, 1st, Washington, D.C., June 29-July 2, 1964, Paper 64-317.

Determination of the Earth-reflected solar energy (albedo) and the Earth-emitted IR radiation, based on data from an emissivity experiment on the first Orbiting Solar Observatory. The operation of the experiment

is described, as is the radiometric technique used to deduce the values for the albedo and the Earth radiation. These values are compared with other reported data, and the possible errors associated with the results are analyzed.

Nakada, M. P., "Synchrotron Radiation Calculations For The Artificial Radiation Belt," Journal Geophysical Research, Vol. 68, No. 13, July 1, 1963 (NASA RP-67).
Synchrotron radiation from the artificial radiation belt is calculated in some detail. Results are compared with measurements.

Nakada, M. P., Dungey, J. W., and Hess, W. N., "Theoretical Studies of Protons in The Outer Radiation Belt," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.
Description of a simple model proposed to explain spectral changes with variations of L space and the equatorial pitch angle α_0 of the protons in the outer radiation belt.

Naugle, J. E., and Kniffen, D. A., "Variations of the Proton Energy Spectrum With Position in The Inner Van Allen Belt," Journal of Geophysical Research, Vol. 68, No. 13, 1 Jul. 1963 (NASA RP-11).
A cylindrical stack of nuclear emulsions was flown in the payload section of a research rocket into the northern edge of the inner part of the Van Allen radiation region. Five points along the trajectory were chosen for analysis, and the differential and integral proton energy spectrums were obtained from each point.

Naumann, R. J., Directional Dependence of Counting Rates From Explorer IV (Satellite 1958 Epsilon) (NASA-TR-R-168), Dec. 1963.
Inspection of the directional scintillation counter data from Explorer IV revealed fluctuations in the counting rate that appeared to be due to the body motions of the satellite and the anisotropy of the radiation flux. The body motions and the angular dependence of the radiation flux could be determined from the data available.

O'Brien, B. J., "The Trapped-Radiation Zones," Space Physics, Edited by Donald P. Le Galley and Alan Rosen, 1964.
Summary of the knowledge of Van Allen radiation, considering particles with energies of more than about 1 kev.

Odintsova, I. N., "Effects in The F2 Layer of The Ionosphere During Solar Flares," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov.-Dec. 1963. In Russian.

Paolini, F. R., Giacconi, R., Waters, J. R., Katz, L., and Smart, D., "Measurements in The Radiation Belts From Hitch-Hiker I," COSPAR Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper, Contract AF 19(628)-2392.

Simultaneous investigation of the energy spectra and angular distributions of protons and electrons in the Earth's magnetosphere over a broad range of energies, using six radiation detection instruments carried by the Hitch-hiker I (1963 25B) subsatellite.

Rosser, W. G. V., "The Van Allen Radiation Zones. I - The Theory of Trapping and The Inner Zone," Contemporary Physics, Vol. 5, Feb. 1964.

Presentation of the theory of the trapping of charged particles by the Earth's magnetic field. Provided are accounts of the trapping of particles following high-altitude nuclear explosions, and of the nature and intensity of particles trapped in the inner radiation zone. Also shown is the motion of a charged particle trapped by the Earth's magnetic field.

Rosser, W. G. V., "The Van Allen Radiation Zones. II - The Outer Zone, The Geomagnatic Cavity, and Magnetic Storms, Contemporary Physics, Vol. 5, Apr. 1964.

Description of the nature and intensity of the particles trapped in the outer radiation zone. The properties of the zone are described in terms of measurements carried out with the satellite Explorer 12 (1961 Upsilon 1). The results obtained on a typical pass through the zone following a period of no pronounced geomagnetic activity are analyzed. The geomagnetic cavity created in the solar wind by the Earth's magnetic field is described. the outer boundary of the zone and the lifetime of particles in it are discussed.

Savenko, I. A., Pisarenko, K. F., Shavrin, P. I., and Nesterov, B. E., Measurement of The Aggregate Radiation Dose Aboard Soviet Spaceships - Satellites "Vostok-5" and "Vostok-6," 11 May 1964 (Contract NAS5-2078).

Devices designed for the registration of penetrating radiation, primary cosmic radiation, and particles of the radiation belts and of solar cosmic rays, all generated during some chromospheric flares, were installed aboard Vostoks V and VI for operational dosimetric control. Discussed is the measurement of the aggregate radiation dose over a 70-hr portion of flight.

Savenko, I. A., Shavrin, P. I., Pisarenko, N. F., Nesterov, V. Ye., and Tel'tsov, M. V., et al., "Measuring Soft Radiation in The Equatorial Latitudes on Cosmos-4," Cosmic Res., 27 Apr. 1964.

A scintillation counter on the Soviet artificial earth satellite Cosmos-4 recorded soft corpuscular radiation in the region of the cosmic ray equator. Analysis of the data shows that this is electrons with energies greater than $3 \cdot 10^4$ ev. The intensity of the recorded fluxes varied within 10^2 to 10^5 particles $\cdot$ cm^{-2} $\cdot$ sec^{-1}.

III,
E. INTERPLANETARY RADIATION (CONT.)

Savenko, I. A., Pisarenko, N. F., Shavrin, P. I. and Nesterov, V. Ye., "Radiation Monitoring During The Flight of Vostok-3 and Vostok-4," Cosmic Res.,29 Oct. 1963.
The results of monitoring the radiation situation during the flight of the Vostok-III and Vostok-IV are described. The total doses of radiation received by the cosmonauts are given.

Savenko, I. A., Shavrin, P. I., Nexterov, V. Ye., Pisarenko, N. F., and Tel'tsov, M. V., "The Radiation Situation in Space on The Eve of The Flight of Vostok-3 and Vostok-4," Cosmic Res., 29 Oct. 1963.
The results are given of the radiometric measurements carried out on Cosmos-IV and Cosmos-VII. A brief description of the installed apparatus is given.

Schaefer, H. J., "Radiation Monitoring on Project Mercury - Results and Implications," Aerospace Medicine, Vol. 35, Sept. 1964, NASA-sponsored research.
Discussion of problems which arose on Missions MA-8 and MA-9, and which called for closer attention to radiation exposure than was the case with earlier missions, which orbited for limited times and altitudes. The problems are related to the artificial radiation belt of electrons created in the high-altitude nuclear explosion of July, 1962 (Starfish Test), and the residual proton flux of the inner Van Allen belt reaching down to satellite altitudes in the South Atlantic Anomaly.

Schulte, H. J., Models For Space Environmental Hazards: Radiation, Jan. 31, 1963.
Engineering design models are proposed for the penetrating radiation hazards of space. Charged-particle and electromagnetic radiation in galactic and solar cosmic rays are discussed, as well as trapped particles in natural and artificial belts.

Sehnal, L., "The Effect of The Re-radiation of The Sunlight From The Earth on The Motion of Artificial Satellites," The Use of Artificial Satellites for Geodesy, Edited by G. Veis, 1963.
Study of the effect of the sunlight reflected from the Earth's surface on the motion of an artificial satellite. Formulas are presented for determining the pressure density and its effect on the satellite orbit.

Serafimov, K., and Nestorov, G., "A Method For The Determination of The Electron Density Profile in The D Region of The Ionosphere," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov.-Dec. 1963. In Russian.

III,
E. INTERPLANETARY RADIATION (CONT.)

Shvets, M. Ye., "Calculation of Outgoing Long-Wave Radiation Using Artificial Earth Satellite Data," Cosmic Res., Vol. 2, No. 2, 8 Jun. 1964.

A method is presented for calculation of outgoing long-wave radiation flux that is averaged for a small area. This method uses radiation-measurement data from an artificial earth satellite that is equipped with a wide-angle device.

Tarasova, T. M., "On Airglow of The Atmosphere Above 200 KM," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Edited by P. Muller.

Presentation of data obtained in Sept. 1962 with a photometer installed in a rocket. The photometer operated in the range of 64-200 km. Data from that part of the trajectory in which the instrument was slowly scanning the sky from zenith to horizon are discussed.

Temnyi, V. V., "An Atlas of Corpuscular Intensity Levels, Registered With The Aid of The Cosmos-3 and Cosmos-5 Satellites," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Presentation of data obtained with Cosmos satellites on the flux of charged particles penetrating aluminum and lead shields that surround the satellites' Geiger counters. The geomagnetic field expansion obtained by Jensen and Cain is used to determine the particle intensity levels. The obtained distribution of experimental points is used for plotting the average values of intensity.

Trakhtengerts, V. Iu., "The Mechanism of Generation of Very Low Frequency Electromagnetic Radiation in The Earth's Outer Radiation Belt," (Geomagnetizm i Aeronomiia, Vol. 3, No. 3, 1963), Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963. Translation.

Development of a theoretical mechanism to account for the generation of very low frequency (VLF) noise. It is demonstrated that the distribution of electron velocities in the outer radiation belt can be unstable as compared to low-frequency electromagnetic oscillations.

Tsytovish, V. N., "Electron Acceleration in The Earth's Radiation Belts," (Geomagnetizm i Aeronomiia, Vol. 3, No. 4, 1963), Geomagnetism and Aeronomy, Vol. 3, No. 4, 1963. Translation.

Investigation of the possibility of attributing electron acceleration to radiation, considering whether an accelerating mechanism could exist that would (a) ensure a density of accelerated particles of the order of magnitude observed, (b) ensure acceleration of electrons from energies of several ev, actually a "non-injection" acceleration, (c) ensure the absence of fast electrons in the inner zone, especially in the region of the first radiation belt, and (d) explain the stability of the outer radiation belt and the restoration of the radiation level after a

magnetic storm. Discussion of the factors involved leads to the conclusion that the radiation hypothesis can, with future refinement, explain the principal characteristics of the outer electron radiation belt.

Tverskoi, B. A., "On The Acceleration of Electrons in Magnetosphere During Magnetic Storms," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Analysis showing the existence of three groups of fast particles in the Earth's magnetosphere.

Tverskoi, B. A., "On The Nature of The Earth's Radiation Belts," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Discussion of the behavior of fast electrons in the Earth's magnetosphere. It is shown that the variations in intensity of relativistic electrons in the outer radiation belt are reversible and caused by the betatron effect.

Van Allen, J. A., "Lifetimes of Geomagnetically Trapped Electrons of Several Mev Energy," Nature, Vol. 203, Sept. 5, 1964, Contract No. Nonr-1509(06).

Report of investigations of the histories of nine artificial radiation belts which were produced by US and USSR high-altitude nuclear explosions in 1958 and 1962. Particular emphasis is given to the decay of the Starfish radiation belt resulting from the nuclear explosion of July 9, 1962. Observations were obtained with Injun 1 (1961 Omicron 2) and Injun 3. Loss rates for energetic particles are said to be almost certainly dependent on the general level of solar activity and on the consequent level of geomagnetic activity. Graphs are included to illustrate intensities, counting rates, and lifetimes.

Vernov, S. N., Savenko, I. A., Tverskaia, L. V., Tverskoi, B. A., and Shavrin, P. I., "Conjugated Points at Small Heights," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Discussion of the dynamics of the Earth's radiation belts on the basis of the asymmetry of radiation intensities at points of specular reflection, caused by the strong scattering of particles during one oscillation period between reflection points, as is observed for electron densities at very low altitudes.

Vernov, S. N., Erofeeva, V. N., Nesterov, V. E., Savenko, I. A., and Shavrin, P. I., "Geographic Location of Particle Intensity Maxima in The Outer Radiation Belt at Low Altitudes," Cosmic Res., Vol. 2, No. 2, 8 Jun. 1964.

The location of intensity maxima was determined in the outer radiation belt at the flight altitudes of the second and third spaceships and Cosmos-4.

III,
E. INTERPLANETARY RADIATION (CONT.)

Vernov, S. N., Nesterov, V. E., Savenko, I. A., Shavrin, P. I., and Sharvina, K. N., "Geographic Radiation-Intensity Distribution in The Region of the Brazilian Magnetic Anomaly at Heights Near 300 KM," Kosmicheskie Issledovaniia, Vol. 2, May-June 1964. In Russian.

Vernov, S. N., Savenko, I. A., Shavrin, P. I., Nesterov, V. E., Pisarenko, N. F., Tel'tsov, M. V., Pervais, T. I., and Erofeeva, V. N., "Some Results of Radiometric Measurements at Heights of 200 to 400 KM in The Period Between 1960 and 1963," Kosmicheskie Issledovaniia, Vol. 2, Jan.-Feb. 1964. In Russian.

Vernov, S. N., Savenko, I. A., Shavrin, P. I., and Tverskaia, L. V., "Structure of The Earth's Radiation Belts at a Height of 320 KM," (Geomagnetizm i Aeronomiia, Vol. 3, No. 5, 1963), Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963. Translation.

Investigation of the radiation belt intensity distribution in drifing shells at an altitude of 320 km. Calculations are made on the basis of data from Sputnik 2 (1957 Beta 1).

Vlasov, A. A., and Khakimov, F. Kh., "Steady-State Properties of The Completely Ionized Plasma Surrounding The Earth," Soviet Physics - Doklady, Vol. 8, Feb. 1964. Translation.

Brief analysis of the structure and some properties of the radiation belts surrounding the Earth. The system of equations is presented which describes the distribution functions for the nuclei and electrons in this region. A steady-state temperature distribution is found from the equations which contain the rotation of the system.

Webber, W. R., and Freier, P. S., "Electron Density Profiles in The Lower Ionosphere Due to Solar Cosmic Rays," Journal of Geophysical Research, Vol. 68, Dec. 1, 1963.

Comparison of the ionospheric electron density profiles recently measured by multiple frequency radio absorption technique with those profiles deduced from particle measurements at balloon altitudes.

Weir, R. A., and Brown, R. R., "On The Contribution of Solar-Flare Alpha Particles To Polar Cap Absorption Events," Journal of Geophysical Research, Vol. 69, June 1, 1964, NSF-USAF-supported research.

Results of calculations to determine the relative importance of ionization from solar-flare α particles to polar cap absorption events. Freier and Webber's exponential rigidity spectra and typical fluxes and particle ratios from major events are used. It is indicated that α particles produce as much as 75% of the ionospheric absorption when the proton-α particle ratio approaches unity.

III,
E. INTERPLANETARY RADIATION (CONT.)

West, H. I., Jr., Mann, L. G., and Bloom, S. D., Some Electron Spectra in The Radiation Belts in The Fall of 1962, 13 Apr. 1964 (Contract W-7405-ENG-48).

A five-channel magnetic electron spectrometer was flown on USAF satellite 1962 βk. Energy channels were provided at 325, 955, 1,630, 2,400, and 3,250 Kev. Background was determined from two background channels and from the pitch-angle distributions of the data. Representative spectra were obtained for most of the regions of the geomagnetosphere.

Williams, D. J., and Bostrom, C. O., "The Earth's Albedo Neutron Flux," APL Technical Digest, Vol. 3, Mar.-Apr. 1964.

Discussion of an important source of the particles that constitute the inner radiation zone, represented by the albedo neutron flux that leaks out from the Earth's atmosphere.

Zaytsev, V., "Magnetic Armor Protects Against Cosmic Showers," Transl. into English from Tekhn. Molodezhi (Moscow), No. 3, 1963.

The feasibility and advantages of shielding spacecraft from radiation by using superconducting solenoids to create a magnetic field around the spacecraft are discussed.

III. INTERPLANETARY SPACE

F. MAGNETIC FIELDS

Adam, N.V., Ben'kova, N.P., Orlov, V.P., and Tiurmina, L.O., "The Western Drift of the Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Survey of methods for calculating the velocity of the western drift of the geomagnetic field. It is shown that different drift velocities are associated with different depths at which current vortices occur in the Earth's core. The western drift cannot be associated with processes in the mantle, due to its large velocities and their regular character.

Adam, N.V., Ben'kova, N.P., Orlov, V.P., Osipov, N.K., and Tiurmina, L.O., "Spherical Analysis of the Main Geomagnetic Field and Secular Variations," (Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963 (Translation).

Description of the spherical analyses of the main geomagnetic field and the field of secular variations for a number of epochs in the period 1932-1958. Isoporic maps for three of these periods of time are also analyzed. The time changes of the geomagnetic field coefficient are found to be in good agreement with the coefficients for secular variations. A study of secular variations of the dipole field for recent decades reveals a slowdown in the decrease of the value of the Earth's magnetic moment in the period 1940-1950. The predominantly westerly direction of the longitudinal drift of harmonic terms was maintained during the entire period 1830-1960, but its rate was dissimilar for different harmonic terms and not constant. An easterly drift is noted for certain harmonics.

Adam, N.V., Ben'kova, N.P., Orlov, V.P., Osipov, N.K., and Tiurmina, L.O., "Spherical Analysis of the Constant Geomagnetic Field for the Epochs 1955 and 1958. II," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).

Presentation of the coefficients of two spherical analyses of the constant geomagnetic field. The analyses are for the 1955 epoch based on observations at 99 points and the 1958 epoch based on data from 150 points. These coefficients are compared with earlier results of spherical analyses based on other initial data for the same epochs.

Afanas'ieva, V.I., "Classification of Geomagnetic Storms Using the Energy Character Figure," Geomagnetism and Aeronomy, Vol. 3, No. 4, 1963 (Translation).

Presentation of a method to ensure objective classification of geomagnetic storms. In place of arbitrary and subjective individual estimates, an energy character figure E is proposed. This is calculated from an empirical equation based on the vector deviation of the field from S_q variations. The results of a classification of geomagnetic storms during the IGY period using the energy character figure are given.

III,
F. MAGNETIC FIELDS (CONT.)

Afanas'eva, V. I., "Families of Geomagnetic Storms During the IGY," Geomagnetism and Aeronomy, Vol. 2, No. 3, 1962 (Translation).

Presentation, in tabular form, of a catalog of families of geomagnetic storms during the International Geophysical Year. The methods used for the verification of this catalog, which was initially compiled from the magnetograms of two Soviet observatories, are described.

Afanas'yeva, V. I. and Kalinin, Yu. D., "Very Large and Large Geomagnetic Storms and Some Problems in Their Theory," Geomagnetic Disturbances, Dec. 1963 (N64-11657 03-12)

A number of questions on the theory of geomagnetic storms has been considered, using the catalogs of geomagnetic storms for 1878 to 1959 as a basis. Besides the well-known cycle (11-year) variations, 30 year variations of moderate storms have been detected. Corpuscular streams cause turbulence in the interplanetary medium, and the storm field (which is to a considerable extent an interplanetary magnetic field) is a thousand time intensified by turbulent movement caused by the stream.

Afanas'eva, V. I., "Energy of Geomagnetic Storms of September 1957," Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963 (Translation).

Investigation of a number of problems concerning the structure of solar corpuscular streams. For this purpose, an energy characteristic of the form $E = aoH + b(oH)^2 + C\Delta H$ is examined, where oH is the variation at the equator and ΔH is the variation created in the auroral zone by currents in the ionosphere.

Afanas'eva, V. I., "Geoactivity and Its Possible Causes," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963 (Translation).

Consideration of the effect of solar activity on geophysical phenomena. Note is made of the correlation of the 11-year solar phenomena cycle with geomagnetic phenomena, and it is demonstrated that a cyclic regime exists for geomagnetic, seismic, and other tectonic phenomena not directly due to electromagnetic solar influences. It is concluded that this cyclic geoactivity is the result of the motion of matter in the Earth's core.

Afanas'eva, V. I., "Families of Geomagnetic Storms During the International Geophysical Cooperation," Geomagnetism and Aeronomy, Vol. 3, No. 5 (Translation).

Tabulation of a list of geomagnetic storm families that occurred during the period of the IGC (1959). This is a continuation of the IGY catalog published earlier. The place of the SC (Sudden Commencement) in the family of storms is discussed. An examination of the seasonal variations in the number of SC storms shows that they occur most frequently in summer.

III,
F. MAGNETIC FIELDS (CONT.)

Agrawal, D. P., "Radio Observation of the Electromagnetic Emission from Warm Clouds," Science, Vol. 143, Feb. 28, 1964.
Investigation of the suggestion that the intermittent nature of radio emission at 30 Mc and 50 Mc may be due to microdischarges within a cumulus cloud. These discharges appear from within cumulus clouds at an early stage of their development, whether the internal cloud temperatures are above or below 0°C. In addition to making measurements by means of airborne radio equipment, the audio output derived from the higher frequency emission was monitored.

Akasofu, Syun-Ichi, "The Development of Geomagnetic Storms After a Negative Sudden Impulse," Planetary and Space Science, Vol. 12, June 1964 (Grant No. NsG 201-62).
Investigation showing that the solar plasma flow by itself may be a necessary condition for the development of geomagnetic storms, but not a sufficient condition. Additional factors are needed for the ring current and auroral activity. Examples are given to show that appreciable geomagnetic storms sometimes do not develop until after an abrupt reduction of the plasma pressure to the level prevailing before the SSC-value. Results obtained by Mariner 1962 Alpha Rho 1 are also discussed.

Akasofu, S. I., "On the Asymmetric Development of Magnetic Storm Fields in Low and Middle Latitudes," Planetary and Space Science, Vol. 12, June 1964 (Grant No. NsG 201-62).
Analysis of the disturbance field of certain magnetic storms, including that of 13 September 1957, showing that there must be a fairly steady current system, partly external and partly ionospheric, which contributes a substantial portion of the asymmetry in the low and middle latitude storm field, independent of the growth and decay of auroral electrojets. A new model electric current system is presented to account for such an asymmetry.

Akasofu, Syun-Ichi, "The Development of Geomagnetic Storms After a Negative Sudden Impulse," Planet. Space Sci., Vol. 12, 1964 (Grant NsG 201-62).
The solar plasma flow by itself may be a necessary condition for the development of geomagnetic storms, but not a sufficient condition. Additional factors are needed for the ring current and auroral activity. Examples are given to show that appreciable geomagnetic storms sometimes do not develop until after an abrupt reduction of the plasma pressure to the level prevailing before the SSC-value. Results obtained by Mariner II are also discussed.

Alfvén, H., "Hydromagnetics of the Magnetosphere," Space Science Reviews, Vol. 2, December 1963.
Critical examination of various models of the magnetosphere. The models fall into two groups: the case where the impinging interplanetary plasma has no initial magnetization, as in the Chapman-Ferraro theory, and the case where prior magnetization exists. The first case leads to a closed model in which there is a sharp boundary between the magnetosphere and the plasma, and the other gives an open model with field lines running from Earth to infinity. Which is the correct model is seen to be an open question.

III,
F. MAGNETIC FIELDS (CONT.)

Anderson, Kinsey A., "Solar Cosmic Ray Events During Late August 1957," Journal of Geophysical Research, Vol. 69, No. 9, May 1, 1964.
Gives good diagrams for two different solar flare events.

Axford, W. I., "Viscous Interaction Between the Solar Wind and the Earth's Magnetosphere," Planet. Space Sci., Vol. 12, 1964 (NASA Grant NsG-382).
Order-of-magnitude calculations are used to show that viscous interaction between the solar wind and the earth's magnetosphere can satisfy the energy requirements of a typical magnetic storm. The viscous interaction is considered to be due mainly to turbulence of a compressible nature in the solar wind, and it is shown that this can provide the necessary drag forces, although other mechanisms are not excluded.

Axford, W. I., "Rotation of the Magnetosphere," Journal of Geophysical Research, Vol. 68, Oct. 15, 1963 (Grant No. NsG-382.)
Brief comparison of two models of the topology of the geomagnetic field - Chapman and Ferrar's model, in which the high latitude field lines constituting the geomagnetic "tail" completely enclose the low-latitude field lines, and Johnson's model, in which the geomagnetic tail shelters the lee of the low-latitude field lines. The comparison is in terms of the ability of the models to account for the suggestion, by Axford and Hines, that the viscous interaction between the solar wind and the surface of the magnetosphere is a basic mechanism in magnetic storms and auroras.

Axford, W. I., "Some Aspects of the Structure and Dynamics of the Terrestrial Magnetosphere," presented to NATO Inst. on Extremely Low Freq. Emissions, Bad Hamburg, Germany, Aug. 1963 (NASA Grant NsG-382).
A discussion is presented of the solar wind, its interaction with the earth, and the resulting formation of the earth's magnetosphere. The discussion is divided into the following topics: (1) the magnetosphere, (2) motions in the magnetosphere, and (3) disturbance phenomena in the outer magnetosphere.

Badlewar, G. D., "Isotopic Composition of Low Energy Hydrogen Nuclei in the Primary Cosmic Radiation," Journal of Geophysical Research, Vol. 69, 21, November 1964.
H/D and H/T ratios at the top of the atmosphere are of order $1 \cdot 10^{-2}$ and $0.5 \cdot 10^{-2}$. (Statistical significance is not good.) It appears that deuterons are absent in the primary radiation and that the primary radiation traverses no more than 7 gm/cm^2 of hydrogen.

Bartels, J., Romana, A., and Veldkamp, J., "Geomagnetic Data 1960. Indices K and C," (IAGA-Bull.-1201).

Barthel, J. R. and Sowle, D. H., "A Mechanism of Injection of Solar Plasma Into the Magnetosphere," Planetary and Space Science, Vol. 12, March 1964.

Demonstration that the interface betwen the geomagnetic field and the solar plasma stream is subject to instabilities of the Rayleigh-Taylor type when a solar plasma burst of sufficient intensity and suddenness reaches the magnetosphere following a solar flare. The existing data on the solar wind and the magnetospheric boundary are summarized. An approximate nonlinear theory is employed to predict the wavelength and growth rate of a very large disturbance.

Bash, F. N., Drake, F. D., Gundermann, E., and Heiles, C. E., "10-CM Observations of Jupiter, 1961-1963," Astrophysical Journal, Vol. 139, 3 (April 1, 1964).

The mean equivalent disk brightness temperature was about 690°K. Total 10 cm emission varied less than 3%. The rotation period for the decimeter system is 9 hour, 55 min, 29.70 sec $\pm$ .04 sec. The magnetic axis is inclined 24.3°, with north pole at 186.8° longitude, by 10 cm measurements. Good comparison with other investigators is given.

Beard, David B., "The Effect of an Interplanetary Magnetic Field on the Solar Wind," Journal of Geophysical Research, Vol. 69, 1 (April 1, 1964).

Calculations are made and diagrams are shown of the magnetic fields outside the magnetosphere. Intermittant plasma streams are considered. It is stated that the solar wind particles travel smoothly around to the dark side of the earth, where they close the magnetic hollow (i.e., no long unsteady magnetospheric tail is deemed to exist).

Bell, B., and Defonw, R. J., "Concerning a Lunar Modulation of Geomagnetic Activity," Journal of Geophysical Research, Vol. 69, 15 (August 1, 1964).

There is a statistically significant increase in Kp after full moon.

Bednářová-Nováková, Bohumila, "The Active Solar Region and Its Relation to Geomagnetic Activity in the Period Around the Minimum of 1954," Geofysikální Sborník, Vol. 11, 1963.

Application of Kiepenheuer's diagram, showing the development of the active center of the Sun, to study of the stages of development and conditions in which the center of solar activity may provide an indication for the occurrence of a goemagnetic storm. The position, shape, and type of solar prominences is studied to explain the difference in the relation between geomagnetic activity and the various stages of the active region.

III,
F. MAGNETIC FIELDS (CONT.)

Bednářová-Nováková, Bohumila, Bucha, Václav, Halenka, Jaroslav, and Konečný, Mojmír, "On the Problems of the Origin of Geomagnetic Storms," Geofysikální Sborník, Vol. II, 1963.

Analysis seeking to clarify the relation between geomagnetic and solar activity. Among the principal topics discussed are the relations between sunspots, flares, and prominences; the conditions in interplanetary space and exosphere; the time variations of the geomagnetic field; a classification of geomagnetic storms; and an attempt at reclassification of sudden-commencement storms. An outline of the state of the art of present knowledge, based on a survey of the literature, is included.

Ben'kova, N. P., Zaguliaeva, V. A., Katsiashvili, N. A., Martynova, K. V., and Marderfel'd, B. E., "L-Variations of the Geomagnetic Field and Ionosphere Based According to Data from Soviet Observations," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Presentation of the results of a calculation of the L-variations of the geomagnetic field and ionosphere, using data from several Soviet observatories. It is found that the L-variations of the geomagnetic field and ionospheric parameters are anomalous in Eastern Siberia. An attempt is made to establish a connection between the phases of the H-component and the active altitude of the F_2-layer.

Bernstein, W., Fredericks, R. W., and Scarf, F. L., "A Model for a Broad Disordered Transition Between the Solar Wind and the Magnetosphere," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).

The nature of magnetic instability in front of the magnetopause is discussed.

Bird, G. A., "A Gas-Dynamic Model of the Outer Solar Atmosphere," Astrophysical Journal, Vol. 139, 2 (Feb. 15, 1964).

Starting at the base of the chromosphere a constant shock-strength hypothesis is used to derive a model of the outer solar atmosphere. There is some experimental support. At earth orbit a solar wind of $2.5 \cdot 10^8$ proton/cm^{2}sec at velocities of order 100 km/sec (but quite variable) is predicted.

Biswas, S, and Fichtel, C. E., "Nuclear Composition and Rigidity Spectra of Solar Cosmic Rays," Astrophysical Journal, Vol. 139, 3 (April 1, 1964).

The abundances of helium and neon are 107 ± 14 and $.13 \pm .02$ relative to oxygen. Energy and rigidity spectra are presented for different dates; none of the simple correlations proposed is adequate for both protons and alphas.

III,
7. MAGNETIC FIELDS (CONT.)

Blanchard, Robert C. and Hess, Wilmot N., "Solar Cycle Changes in Inner-Zone Protons," Journal of Geophysical Research, Vol. 69, 19 (Oct. 1, 1964).

Calculations show that the Van Allen belt proton population varies up to a factor of 50 over the solar cycle. The effect is most pronounced for minimum altitudes of 300 - 700 km. The energy spectrums will change also.

Blum, Ronald, "A Neutral-Point Expansion of the Ideal Magnetosphere," Journal of Geophysical Research, Vol. 69, 9 (May 1, 1964).

The field around the signular (neutral) point is analytically investigated. Less than a 4% correction is required due to multiple reflections of particles.

Bobrov, M. S., "Magnetic Disturbances at Conjugate Points as a Source of Data on the Upper Atmosphere and Solar Corpuscular Radiation," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963 (Translation).

Comparison of magnetograms for Murchison Bay and Mirny (conjugate observatories on the North and South Polar Caps) with those for Wellen and Macquarie (conjugate observatories in the North and South Auroral Zones) in UT (Universal Time) for 92 successive days during the International Geophysical Year (IGY) from August 1 to October 31, 1958.

Bobrov, M. S., Koroleva, N. F. and Novikova, R. M., "Solar Wind Properties Obtained from Permament Geomagnetic Disturbances in Days with Very Low Kp's," Geomagnetizm i Aeronomiia, Vol. 4, Mar - Apr 1964 (In Russian).

Investigation of the problem of permanent geomagnetic disturbances of polar caps in days with a very low planetary magnetic activity (P_0 disturbances). It is shown that the P_0 disturbances are generated by the sold wind. Sources of the solar wind are distributed approximately uniformly along the heliocentric longitudes without any visible connection with formations on the Sun.

Bondarenko, A. P., "A Method for the Use of Mean-Period Pulsations of the Vertical Components of the Geomagnetic Field and the Horizontal Component of Earth Currents for Geophysical Exploration," Recent Soviet Progr. in Magneto-Telluric Methods, 6 Mar 1964 (See N64-16513 08-12)

The method is based on the ratio of the time derivative of the vertical component of the magnetic field (H'_z) to the modulus of the horizontal component of the electric field. The phase difference of these values is not dependent on the geological structure of the area, but the ratio of the amplitudes is proportional to the resistance value. This ratio has been used as the principal exploratory parameter. The first experimental data, obtained at several points on the Russian platform and in the Carpathian foredeep, have confirmed these assumptions.

III,
F. MAGNETIC FIELDS (CONT.)

Bouška, Jan, "Latitude Dependence of Characteristics of Initial Phase of Geomagnetic Storm," Studia Geophysica et Geodaetica, Vol. 8, No. 2, 1964.
Discussion of the relation between amplitude and duration of the initial phase that follows directly on the onset of an SSC storm, and lasts up to 7 min. Statistical data processing at different stations showed a wide discrepancy between the correlation coefficients obtained for the two factors.

Bouska, Jan, "Commencement of Geomagnetic Storm," Geofysikalni Sbornik, Vol. 11, 1963.
Investigation of the spectrum of commencements of geomagnetic storms to gain insight into the relation between the characteristics of sudden-commencement and gradual-commencement storms. The analysis is based on the results of previous geomagnetic studies and the evaluation of the magnetograms obtained over a large period of time.

Bostrom, Rolf, "Geomagnetic Effects on Anisotropic Cosmic Radiation," Journal of Geophysical Research, Vol. 69, No. 7, April 1, 1964.
Geomagnetic effects on detection of anisotropically emitted cosmic rays are discussed theoretically.

Briggs, Benjamin R., and Spreiter, John R., Theoretical Determination of the Boundary and Distortion of the Geomagnetic Field in a Steady Solar Wind, Dec. 1963 (NASA-TR-R-178).
An approximate formulation of the steady-state Chapman-Ferraro problem is used to calculate the coordinates of the complete boundary of the geomagnetic field. Field lines are then computed in the magnetic meridian plane containing the free-stream direction of the solar wind, taking into account the distorting effects of current flowing in the boundary. Numerical results are given for the case where the geomagnetic dipole axis is perpendicular to the direction of the solar wind.

Briunelli, B. E., "Electric Field of a Polar Magnetic Disturbance," Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963 (Translation).
Investigation of the electric field that develops in the ionosphere during a polar geomagnetic disturbance.

Brown, W. L., Davidson, L. W., and Medford, L. V., The Energetic Particle Environ- of Relay I: Bell Telephone Laboratories Experiments, Bell Telephone Laboratories, Inc., (ca. Jan 1964).
Data for electrons >1 Mev and protons 2.5 to 8 analyzed. It is the low energy protons which have the highest damage rate to solar cells.

III,
F. MAGNETIC FIELDS (CONT.)

Burrows, J. R. and McDiarmid, I. B., "A Study of Electrons Artificially Injected Into the Geomagnetic Field in October, 1962," Canadian Journal of Physics, Vol. 42, August 1964.

Presentation of data from the Alouette satellite particle detectors, first, for the time shortly after injection, and, secondly, for the long-term decay characteristics of the trapped belt of electrons. Effects of geomagnetic conditions on the electron precipitation are measured, and an estimate is made of the total precipitation at L $\sim$2.95.

Cahill, Laurence J., Jr., "The Geomagnetic Field," Space Physics, 1964.

Brief outline of the history of geomagnetic field studies, of theories of the origin of the field, and of studies of the main field and its variations, based on surface observations. An account of rocket, satellite, and space-probe measurements of the geomagnetic field is provided, together with their interpretation. The subjects considered are source of the main geomagnetic field, the main field and its variations, ionospheric currents, satellite mapping of the geomagnetic field, the search for the ring current, the outer geomagnetic field, and future magnetic experiments.

Cahill, Laurence J., "Preliminary Results of Magnetic-Field Measurements in the Tail of the Geomagnetic Cavity," IG Bulletin, No. 79, Jan. 1964. (NASA-supported research).

Discussion of preliminary results from the University of New Hampshire's Explorer XIV experiment to measure the Earth's magnetic field at a distance of 3 to 10 Earth radii; to investigate the boundary region of the geomagnetic field; and to determine the existence of postulated extraterrestrial current systems and magnetic disturbances, particularly in relation to solar events and to changes in particle intensities.

Cain, Joseph C., and Wright, Christopher D., A Compilation of Magnetic Observatories, NASA-TM-X-55017; X-612-64-73, 5 March 1964.

This compilation of current and past magnetic observatories should be useful in assessing data accrued during the IQSY and for studying variations and secular changes of the field from past data. The tables of observatories are presented in order of geographic latitude, sponsoring country, and mnemonic code.

Cain, Joseph C., and Neilon, James R., "Automatic Mapping of the Geomagnetic Field," J. Geophys. Res., Vol. 68, No. 16, August 15, 1963 (NASA RP-68).

Spheric harmonic representations are used to illustrate the application of the U.S. Weather Bureau machine-mapping system for drawing charts of the geomagnetic field. This technique is also applied to the representation of the model S_q fluctuations by maps of electric current flow in the ionosphere.

III,
F. MAGNETIC FIELDS (CONT.)

Calvert, W., Rishbeth, H., and VanZandt, T. E., "Alouette Ionic, Magnetic-Field, and Plasma Studies," IG Bulletin, No. 83, May 1964.

Description of investigations by scientists of the National Bureau of Standards' Central Radio Propagation Laboratory, based on Alouette soundings of the topside of the ionosphere. The results are said to show that the observed electron densities are in good agreement with computed densities for middle latitudes, but are inconsistent with the computed densities at latitudes above 45°.

Campbell, W. H., "Natural Electromagnetic Field Fluctuations in the 3.0- to 0.02-CPS Range," IEEE Proceedings, Vol. 51, October 1963.

Review of the properties of upper atmosphere geomagnetic micropulsations. Data taken at a number of world stations indicate a division into three contributing phenomena for the frequency range of 3.0 to 0.02 cps: (1) very regular oscillations of 2.0 to 0.2 cps, most likely of outer-atmospheric origin, but apparently unrelated to solar-terrestrial disturbances; (2) sudden bursts of large-amplitude field fluctuations spread throughout the frequency range, closely related to high-latitude particle precipitation, enhanced ionospheric absorption, and auroral luminosity (these fluctuations seem to be of ionospheric origin); and (3) regular oscillations between 0.2 and 0.03 cps appearing over broad sections of the Earth with related phase on days of high solar-terrestrial activity.

Cantrell, G. W., and Knecht, David J., "Design of an Experiment to Investigate the Solar Wind and Its Interaction with the Magnetosphere," International Symposium on Space Technology and Science, Tokyo, Japan, August 27-31, 1962, 4th Proceedings, edited by Tamiya Nomura.

Description of an experiment designed to take advantage of the capability of multi-stage solid-propellant sounding rockets that carry lightweight payloads to the extreme altitudes required for solar wind studies. A very-low energy proton spectrometer uses electrostatic deflection between crylindrical plates for energy analysis and windowless electron multiplier structures as particle detectors. A three-axis magnetometer is of the saturable-core type and measures fields from about 1 to 1000 gamma. A separate plasma probe is used to measure the energy of the ambient electrons and the potential of the payload skin relative to the plasma.

Carpenter, D. L., and Smith, R. L., "Whistler Measurements of Electron Density in the Magnetosphere," Reviews of Geophysics, Vol. 2, August 1964 (Contracts No. AF 18(603)126; No. AF 49(638)-1060; Grants No. NSF 17037; No. NSF 17217.)

Appraisal of the whistler method of studying the equatorial profile and measuring electron density in the magnetosphere. Published data on the subject, deduced from whistlers, are reviewed and found to be in general agreement and also to agree with the ion-trop method and radar incoherent backscatter techniques. The temporal variations in magnetospheric electron density, such as diurnal, magnetic-storm, semi-annual, annual, and solar cycle variations are investigated. Calculating techniques for the equatorial values of electron density and the profile analysis method are discussed.

III,
F. MAGNETIC FIELDS (CONT.)

Carr, T. D., Brown, G. W., Smith, A. G., Higgins, C. S., Bollhagen, M., May, J., and Levy, J., "Spectral Distribution of the Decametric Radiation from Jupiter in 1961," Astrophysical Journal, Vol. 140, 2 (August 15, 1964).

A 5 to 85.5 Mc/sec spectral band of sporadic radiation was measured. Peak densities at 5 and 10 Mc/sec were about 10^{-19} W/meter^{2}cps, which is two or three orders-of-magnitude higher than average, and six-orders-of-magnitude higher than decimeter radiation. Efficiency of conversion of solar-wind power incident on the Jovian magnetosphere into decametric radiation is estimated around 10^{-5}.

Chandra, S. and Goldberg, R. A., "Geomagnetic Control of Diffusion in the Upper Atmosphere," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Analytical investigation of the basic physical mechanisms governing diffusion and the existence of the geomagnetic anomaly in the ionosphere. A formula is provided for representing the equinox geomagnetic anomaly, u using an empirical boundary condition which fits nearly all vertical electron density profiles measured to date. A study of the neutral atmosphere distribution indicates that geomagnetic control of neutral particles occurs in any region of the ionosphere where interactions of neutral with charged particles becomes important, as is likely to occur in the lower F-layer.

Chapman, Sidney, "The Energy of Magnetic Storms," Geophysical Journal, Vol. 8, July 1964. (NBS-USAF-sponsored research).

Analytical investigation of the magnetic field energy added during a magnetic storm to the field energy normally present in and around the Earth. The "joint" energy of the two fields is shown to be zero. The disturbance field energy is considered for both the first and the main phase of the storm, on the basis of idalized models of the electric currents that cause the disturbance. The magnetic field of the ring current is also considered.

Chapman, Carroll W., Fannin, Bob M., and Gray, Billy G., Calculated Refractive Indices for Small-Amplitude Geomagnetic Disturbances, 15 Dec. 1963 (Contract AF 19(604)-8038) (Rept 6-58; AFCRL-64-228; AD-430888).

The results of numerical computations of the refractive indices for the three modes of hydromagnetic wave propagation existing in the earth's upper ionosphere and outer atmosphere in the frequency range 10^{-3} to 10 cps are presented. Also included are: (1) the dispersion relation for a homogeneous medium; (2) some results of numerical calculations of the refractive indices in terms of dimensionless parameters; (3) the refractive indices for selected altitudes in a quiescent earth atmosphere; and (4) consideration of some elementary aspects of the ray-tracing problem.

III,
F. MAGNETIC FIELDS (CONT.)

Chernosky, E. J., Collins, J. M., and Hagan, M. P., "Equatorial Loci of the Earth's Magnetic Field and Cosmic Ray Parameters," Environ. Res. Papers, No. 5, March 1964.

In addition to the magnetic dip and geomagnetic dipole equators, other magnetic field parameters can be used to define other equators. A total intensity minimum and the horizontal intensity maximum mark equators that differ notably from the dip and dipole equators. The locus of points where the orientation of the magnetic field lines is referred to the mean noon alitutude of the sun at equinox, rather than to the earth's surface as is ordinarily done, coincides well with the dip equator and the Katz, Meyer, and Simpson aircraft cosmic ray equator. Other loci referred to the noon sun at solstice indicate the possibility of a seasonal latitudinal change in the cosmic ray equator. A numerical evaluation of the variability and separation of the different equators is also made.

Chisholm, J. H., and James, J. C., "Radar Evidence of Solar Wind and Coronal Mass Motions," Astrophysical Journal, 140, 1, July 1, 1964.

Coronal mass motions of $\pm$ 35 km/sec are detected somewhere in the corona. A solar wind velocity of about 16 km/sec at 1.5 solar radii is inferred from Doppler shift data.

Chukanin, K. I., "Some Characteristics of the Atmospheric Circulation and the Earth's Magnetic Field," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, March 1964 (In Russian).

Qualitative analysis of the observation results on the state of the Earth's magnetic field and the atmospheric circulation at high latitudes in the northern hemisphere. A hypothesis is proposed to explain the connection between the atmospheric circulation and the magnetic field.

Cladis, J. B., Miller, T. D., and Baskett, J. R., "Interaction of a Supersonic Plasma Stream with a Dipole Magnetic Field," Journal of Geophysical Research, Vol. 69, June 1, 1964.

Description of a laboratory experiment simulating solar wind-geomagnetic field interaction. A Mach-2 hydrogen plasma from a pulsed coaxial gun is directed against a dipole magnetic field. Time-resolved photographs reveal drifts of the plasma near the interface layer and penetration of the plasma into the magnetic cavity. The shape of the windward side of the cavity and the circulation of the sheet currents in the boundary are found to be in good agreement with the single-particle model; the other results suggest a supersonic fluid model.

Clarke, W. B., and Thode, H. G., "The Isotopic Composition of Krypton in Meteorites," Journal of Geophysical Research, Vol. 69, 17, September 1, 1964.

The isotopic composition is sometimes found to be different from the earth-atmospheric composition.

III,
F. MAGNETIC FIELDS (CONT.)

Cole, K. D., "On the Depletion of Ionization in the Outer Magnetosphere During Magnetic Disturbances," Journal of Geophysical Research, Vol. 69, 17, September 1, 1964.

The plasma in the outer magnetosphere is depleted. It is suggested that it is caused by random curl-free electric fields of period > 100 sec causing diffusion radially inward.

Coleman, Paul J., Jr., and Farley, Thomas A., Charged Particle Research and Magnetic Research, Semiannual Report, Jan 1 - June 30, 1964 (Grant NsG-249-62).

Work on space-instrument development has concentrated on charged-particles and magnetic-fields research. The charged-particle research program involves both trapped Van Allen radiation and interplanetary cosmic rays and are listed.

Coleman, Paul J., Jr., "Characteristics of the Region of Interaction Between the Interplanetary Plasma and the Geomagnetic Field: Pioneer 5," Journal of Geophysical Research, Vol. 69, 15, August 1, 1964.

Data are consistent with usual magnetosphere and shock wave location. Evidence is given for an interaction region to at least 25.6 Re.

Corcuff, Yvonne and Delaroche, Michel, "The Increase of the Ionization Gradient in the Nearby Magnetosphere During Periods of Strong Magnetic Activity," 17 July 1964 (Trans. into English from Compt. Rend. Acad. Sci. Ionosphere (Paris), Vol. 258, No. 2, 11 Jan. 1964. (Contract NAS 5-2078).

Analysis of some multiple whistlers, recorded at Poitiers (geomagnetic coordinates: 49.5° N to 81.8°E), during the recovery phase of magnetic storms, allows the derivation of the existence of strong ionization gradients at geocentric distances less than three earth's radii.

Cox, Allan, Doell, Richard R., and Dalrymple, G. Brent, "Reversals of the Earth's Magnetic Field," Science, Vol. 144, June 26, 1964.

Discussion of the present state of knowledge about geomagnetic field reversals. The observational basis for field reversals has been greatly extended in recent years as a result of improvement in techniques of determining the stability and reliability of rock magnetism as a means to determine past geomagnetic field directions, and also as a result of the increase in paleomagnetic data available. Early discoveries, and the worldwide extent of reversals are reviewed. Self-reversal, the stratigraphic relations of reversals, and paleomagnetic-geochronometric studies are discussed.

Dahanayake, C., Kaplon, M. F., and Lavakare, P. J., "Isotopic Composition and Energy Spectrum of Low-Energy Helium Nuclei in Primary Cosmic Radiation," Journal of Geophysical Research, Vol. 69, 17, September 1, 1964.

The supposition is that low energy primary radiation (ions) travels 6 ± 2 gm/cm^2 through interstellar space and that high energy primary radiation travels around 2 gm/cm^2. Preferential trapping in the source region is suggested.

III,
F. MAGNETIC FIELDS (CONT.)

Davidson, T. W., and Martyn, D. F., "A Supposed Dependence of Geomagnetic Storminess on Lunar Phase," Journal of Geophysical Research, Vol. 69, 19, October 1, 1964.

The geomagnetic variations are random with respect to lunar phase (either monthly or daily).

Davis, J. R., and Headrick, J. M., "A Comparison of High-Altitude Nuclear Explosion Effects in the E Layer with Variations in Geomagnetic Field Strength," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Analysis of data obtained from a high-frequency ground-back-scatter study conducted during the period of the July 9, 1962, high-altitude nuclear explosion over Johnston Island which has yielded information which indicates that short-period fluctuations in E-layer ionization occurred over the eastern United States within the first few seconds after the detonation. The onset time, periodic structure, and duration of the E-layer ionization disturbance have been found to bear a striking similarity to variations in the geomagnetic field measured by observers throughout the western hemisphere.

Dessler, A. J., and Walter, G. K., "Hydromagnetic Coupling Between Solar Wind and Magnetosphere," Planetary and Space Science, Vol. 12, March 1964. (Contract AF 19(628)-3858).

Presentation of a model by which changes in the direction of the interplanetary magnetic field can cause energy from the solar wind to be coupled to the magnetosphere. A mechanism is proposed by which the energy is transferred by hydromagnetic waves generated by the wagging of the tail of the magnetosphere.

Dessler, A. J., "Length of Magnetospheric Tail," Journal of Geophysical Research, Vol. 69, 19 (October 1, 1964).

It is argued that the magnetosphere cannot close in tens of earth radii, but that the tail goes out some 20 to 50 AU. The tail can close in the charge-exchange boundary shell where the solar wind is terminated and ion-atom collisions are relatively frequent.

Dordrecht, J. P. Heppner, Reidel, Holland D., "The World Magnetic Survey," Repr. from Space Sci. Rev. (Dordrecht), Vol. 2, 1963).

The mathematical and graphical description of the earth's main field has been, and is, a data-limited problem. The World Magnetic Survey (WMS) is an endeavor to minimize this limitation by rapidly and comprehensively blanketing the earth with magnetic field measurements. Satellite surveys, which will play a key role in the WMS, are the principal topic of this paper. Existing magnetic field descriptions, the expected results from new surveys, and the methods of obtaining these results with the POGO satellite are emphasized.

III,
F. MAGNETIC FIELDS (CONT.)

Dowden, R. L., "Effect of Magnetic Anomalies on Very Low Frequency Discrete Emissions, Australian Journal of Physics, Vol. 16, December 1963.
Suggestion that the frequency vs time shapes of discrete VLF emissions can be explained as Doppler-shifted cyclotron radiation from electrons spiralling along a geomagnetic field line away from the observer. The distorted emissions observed on the spectrogram indicate the effect of magnetic anomalies in a predominantly dipole magnetic field. From emissions an idea of the shape and size of the anomaly can be obtained.

Dwarkin, Martin Lester, Magnetic Effects of Geomagnetically Trapped Particles, May 1962 (NsG-184-60; Contract AF 49(638)-915).
Particle motion around the equatorial plane in the trapping region is the principal source of magnetic field due to trapped particles. The magnetic field throughout the earth is due to particles trapped on dipole shells for which a > 2.5 is essentially uniform. It seems likely that the major of particles responsible for magnetic storms are trapped on dipole shells for which $1.3 \leq a \leq 2.5$ with a maximum concentration of particles around the dipole shell with a $a \approx 1.7$.

Edwards, P. J., and Reid, J. S., "Effects of Nuclear Explosion Starfish Prime Observed at Hobart, Tasmania, July 19, 1962," Journal of Geophysical Research, Vol. 69, 17 (Sept. 1, 1964).
Enhanced ionospheric absorption is not primarily due to atmospheric precipitation of electrons.

Fairfield, Donald H., "Trapped Particles in a Distorted Dipole Field," Journal of Geophysical Research, Vol. 69, 19 (Oct. 1, 1964).
Analytical approximation of geomagnetic field distorted by solar wind. (Based on closure of magnetosphere at 10 earth radii.) Shows shifts of mirror points.

Fan, C. Y., Simpson, J. A., and Stone, Edward C., "Magnetospheric Cutoff for 1.5-MeV Extraterrestrial Protons," Phys. Rev. Letters, Vol. 12, No. 11, 16 March 1964 (Grand NsG-179-61).
Results are reported from an oriented satellite whose orbit passed over the geomagnetic pole carrying detectors that were sensitive to 1.5-Mev protons from both the vertical and horizontal directions and were insensitive to electrons. It is concluded that protons detected in high latitudes are from solar flares, and that magnetosphere interaction with the solar wind gives rise to cutoff energy discrepancies and to the diffuse cutoff on the sun side.

Fatkullin, M. N., "The Nature of Irregular Fluctuations in Diurnal Magnetic Variations," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov-Dec. 1963. (In Russian).

Fediakina, N. I., "Type-II Absorption and Its Relationship to Magnetic Field Disturbance," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963 (Translation).

Study of anomalous absorption on the basis of cosmic noise observational data taken at Tixie Basy, USSR, compared with data obtained at Reykjavik, Iceland. At nighttime, absorption is observed during decreases of the H component of the magnetic field. The coincidence of absorption and magnetic field disturbance is best observed around midnight, local time. In the morning, absorption was observed simultaneously or with a small lag relative to disturbance of the magnetic field on the nighttime side (Reykjavik).

Fejer, J. A., "Atmospheric Tides and Associated Magnetic Effects," Reviews of Geophysics, Vol. 2, May 1964 (Grant NSG-269-62).

Discussion of all periodic magnetic variations whose periods are related to the solar or lunar day, and consideration of theories proposed for their explanation. The review is intended to serve as a basis for further investigations, both theoretical and observational. Gravitational effects are believed to be responsible for lunar tidal geomagnetic variations. To obtain observational checks of proposed theories, it is considered that satellite observations will be useful, but more can probably be learned from ground-based magnetic observations and analysis of existing magnetic records.

Fejer, J. A., "Theory of the Geomagnetic Daily Disturbance Variations," Journal of Geophysical Research, Vol. 69, Jan 1, 1964 (Grant NSG 269-62).

Calculation of the worldwide ionospheric current system predicted by a previously developed theory in order to examine the reaction of the electric fields necessary to drive the current system in the ionosphere on the original magnetospheric motions that were assumed to cause the current system. It is shown that the interaction of trapped energetic protons with magnetospheric rotation in a geomagnetic field distorted by the solar wind could cause the observed D_s disturbance variations of the magnetic field.

Field, George B. and Henry, Richard C., "Free-Free Emission by Intergalactic Hydrogen," Astrophysical Journal, 140, 3 (Oct. 1, 1964).

The temperature of the intergalactic medium must be less than 4×10^6°K (steady-state model) or 3×10^6°K (closed evolving model with $q_o = 1/2$ or 1). Good review included.

Fitzenreiter, R. J. and Blumle, L. J., "Analysis of Topside Sounder Records," Journal of Geophysical Research, Vol. 69, 3 (Feb 1, 1964).

Though primarily an instrument analysis, some electron density data is given up to 1000 km.

III,
F. MAGNETIC FIELDS (CONT.)

Fontaine, Maxime, Le Borgne, Eugene, Le Mouel, Jean, and Plessard, Claude, "Anomalies in Variations of the Terrestrial Magnetic Field in Corsica," Academie des Sciences (Paris), Comptes Randus, Vol. 258, No. 5, Feb. 3, 1964. (In French).

Frank, L. A., Van Allen, J. A., and Craven, J. D., "Large Diurnal Variations of Geomagnetically Trapped and of Precipitated Electrons Observed at Low Altitudes," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964 (Contract No. N9onr-93803; Grant No. NsG 233-62).

Analysis of the diurnal variation of the intensities of trapped and of precipitated electrons at high latitudes, based on measurements by the low-altitude Injun 3 satellite for the period Dec. 1962 - Sept. 1963. Plots of the median omnidirectional intensities ($\geq$40 kev) of trapped and of precipitated electrons are presented as functions of local time and of the McIlwain shell parameter L.

Frank, L. A., Van Allen, J. A., Hills, H. K., "A Study of Charged Particles in the Earth's Outer Radiation Zone with Explorer 14," Journal of Geophysical Research, Vol. 69, 11, June 1, 1964.

Electron and proton intensities and variations are measured in the outer radiation zone from Oct. 1962 to Feb. 1963.

Frank, L. A. and Van Allen, Measurements of Energetic Electrons in the Vicinity of the Sunward Magnetospheric Boundary with Explorer XIV, Aug. 1964 (Grant NsG-233-62; Contract Nonr-1509(06).

This report summarizes observation made with Explorer XIV of the intensities of electrons $E_e > 40$ Kev near the magnetospheric boundary and within the transition region, on the generally sunward side of the earth during the period May-August 1963, and considers the significance of the results obtained.

Frank, L. A., Freeman, J. W., and Van Allen, J. A., "Recent Observations of Electron Intensities in the Earth's Outer Magnetosphere and Beyond," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller. Grant No. NsG 233-62.

Frank, L. A., Van Allen, J. A., and Craven, J. D., "Large Diurnal Variations of Geomagnetically Trapped and of Precipitated Electrons Observed at Low Altitudes," Journal of Geophysical Research, Vol. 69, 15 (Aug. 1, 1964).

Injun 3, between 237 km and 2795 km, was used to obtain data on electron trapped fluxes and precipitation into the atmosphere. Important flux changes occur through the day and reasons are discussed. A significant paper.

III,
F. MAGNETIC FIELDS (CONT.)

Fraser, B. J., McNabb, P. W., and Ellyett, C. D., Geomagnetic Micropulsations at Christchurch, New Zealand, Aug. 1963 (Contract Nonr(G)-00027-62).

Fraser, B. J. and Ellyett, C. D., "Man-Made Magnetic Pulsations," Journal of Geophysical Research, Vol. 69, 17, (Sept. 1, 1964).

The rate of occurrence of micropulsations of the geomagnetic field is strongly influenced at 15 miles distance by such things as an urban electrical network or an isolated dc electric train system.

Freden, S. C., and Paulikas, G. A., "Trapped Protons at Low Altitudes in the South Atlantic Magnetic Anomaly," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).

For $L < 1.4$, proton fluxes from 5 to 20 Mev and 60 to 120 Mev are independent of L and B. Other features of the South Atlantic magnetic anomaly are also discussed.

Freeman, J. W., Jr., "The Morphology of the Electron Distribution in the Outer Radiation Zone and Near the Magnetospheric Boundary as Observed by Explorer 12," Journal of Geophysical Research, Vol. 69, 9 (May 1, 1964).

There is a layer of quasi-thermal plasma immediately outside the magnetosphere. Constant counting rate electron contours above 40 kev protrude outward near 90° from the subsolar point, but draw inward on the night side. There is also a region on the night side beyond 8 R_e dominated by very low energy electrons.

Gaines, E. E. and Glass, R. A., "Satellite Measurements of the Decay of the Artificial Electron Belt," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).

The Starfish explosion increased the daily radiation dose 1000 times over the normal 10^{-2} rad from cosmic rays. In the region of the South Atlantic anomaly a time-decay curve of $t^{-1.5}$ gives a good fit over 9 months time. The initial half-life was around 10 days.

Gajewski, R., "Alfven Waves in a Dipole Magnetic Field," Space Research, IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller. Interscience Publishers, 1964.

Gaustad, J. E., "The Solar Helium Abundance," Astrophysical Journal, Vol. 139, 1 (Jan 1, 1964).

Arguments are adduced to show that the composition of the sun is close to $X = .72$, $Y = .26$ $Z = .02$ (hydrogen, helium, and heavier elements). Flaws in other determinations are discussed.

III,
F. MAGNETIC FIELDS (CONT)

Gendrin, R. and Stefant, Robert, "Magnetic Records Between 0.2-30 C/S," AGARD Propagation of Radio Waves at Frequencies Below 300 kc/s, 1964 (Centre Natl. des Etudes Spatiales Contract 62-CNES-025).

A magnetometer was used that is designed to record and analyze the geomagnetic field fluctuations in the frequency range 0.2 to 30 cps. Between 5 and 30 cps the earth-ionosphere cavity resonsances at 8, 14, 20, and 26 cps were obtained. Preliminary results about the diurnal variation of the intensity of the peaks are given. The effect of the high-altitude thermonuclear explosion, which produced a sudden lowering of the resonance frequencies, has also been analyzed, and some conclusions drawn. Between 0.2 and 3 cps, discrete oscillations, lasting from 20 min to 7 hr, are often observed. An empirical law, relating themean frequency of the oscillation to this repetition time, is given.

Gendrin, R., "On a Theory of Structured Fast Pulses of the Terrestrial Magnetic Field," Annales de Geophysique, Vol. 19, July-Sept. 1963 (In French, with summaries in English and Russian).

Description of a recently advanced theory on the motion of bunches of trapped particles, based on tests which have brought to light the fine structure of some fast oscillations of the terrestrial magnetic field. The correlation found between the mean frequency of emission and the repetition period of the pattern is explained by the bounce frequency and the drift period. Correct orders of magnitude are obtained only for protons, the energy of which is between 4 and 35 Mev, situated on magnetic shells with McIlwain's L between 4 and 1.5. Number and distribution of particles, as function of L, agree with recent satellite and rocket measurements on the low energy component of the first Van Allen zone. Expected consequences of this theory are discussed and other experiments suggested.

Golton, E., "Calculations and Local Models of the Near Geomagnetic Field," Planetary and Space Science, Vol. 11, Nov. 1963.

Calculation of the value of the Earth's magnetic field at epoch 1955, using a sixth-order spherical harmonic model. The results are presented in the form of maps showing, for a height of 2,000 km, the deviations from the ground-level values of dip, declination and total field. The coefficients of the harmonic model have been extrapolated to 1960. The accuracies of various simpler models of the field are considered, particularly for use in the case when field values are required in a limited region only.

Gosling, J. T., "A Study of the Relationship Between Absorption-Time Profiles of Polar-Cap-Absorption Events and Forbush Decreases of Cosmic-Ray Intensity," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).

PCA events are accompanied by Forbush decreases roughly in proportion to the strength of solar particle trapping and in inverse proportion to the delay time from flare to SC storm.

III,
F. MAGNETIC FIELDS (CONT.)

Graziano, E. E., and McCormick, H. B., The Geomagnetic Field: An Annotated Bibliography, Aug. 1963 (Contract AF 04(647)-787)

This bibliography consists of 183 selected references to recent literature on all aspects of the geomagnetic field, and to planetary and interplanetary fields. Actual measurements of magnetospheric phenomena were of particular interest. The time period covered in the literature survey was June 1962-June 1963, with selective coverage from 1958.

Gringauz, K. I., "Remarks on Papers by J. W. Freeman, J. A. Van Allen, and L. J. Cahill, 'Explorer 12 Observations of the Magnetospheric Boundary and the Associated Solar Plasma on September 13, 1961,' and by L. A. Frank, J. A. Van Allen, and E. Macagno, 'Charged-Particle Observations in the Earth's Outer Magnetosphere," letter in Journal of Geophysical Research, Vol. 69, 5 (March 1, 1964) and James A. Van Allen, "Remarks on Accompanying Letter by K. I. Gringauz," Journal of Geophysical Research, Vol. 69, 5 (March 1, 1964).

Gringauz gives some hitherto unpublished details of Lunicks I and II and of Mars I. There is a squabble over whether Gringauz had called the particles of the outermost belt "trapped." There is general agreement as to the existence of a concentration of low-energy electrons outside the second radiation belt. There is also agreement that many obscurities remain.

Gringazus, K. I., "Some Notes on the Outermost Belt of Charged Particles," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

Supplement to the author's earlier report on measurements made in the Earth's magnetosphere by the Mars-1 probe and a remark on a paper by Freeman, Van Allen, and Cahill.

Gringauz, K. I., Bezrukikh, V. V., Musatov, L. S., Rybchinski, R. E., and Sheronova, S. M., "Measurements Made in the Earth's Magnetosphere by Means of Charged Particle Traps Aboard the Mars 1 Probe," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

Presentation of measurements made on Nov. 1, 1962, during the passage of the Mars-1 probe through the Earth's magnetosphere. It is observed that these measurements confirm data obtained during the Lunik experiments in 1959. The extension of the Earth's ionized gas envelope to heights of about 18,000 to 20,000 km is studied. New data are presented on the outermost belt, which contains soft electrons.

Hagfors, T., "Backscattering from an Undulating Surface with Applications to Radar Returns from the Moon," Journal of Geophysical Research, Vol. 69, 18 (September 15, 1964).

Only those surfaces tilted normal to the incident radiation are effective in backscattering. Therefore previously accepted formulas must be modified.

III,
F. MAGNETIC FIELDS (CONT.)

Halenka, Jaroslav, "On the Character of the Connection Between Geomagnetic Activity and Chromospheric Flares," Studia Geophysica et Geodaetica, Vol. 8, No. 3, 1964.

Hayakawa, S., and Obayashi, H., "A Loss Mechanism of Geomagnetically Trapped Particles by Magnetic Disturbances," COSPAR Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Description of the device considered for the static dipole field used in the discussion of an effect of the nonadiabaticity on the loss of geomagnetically trapped particles. If there is any magnetic disturbance superposed on the static field, this also gives rise to a nonadiabatic effect, so that the migration of the reflection points becomes greater; hence the interaction with atmospheric matter increases and consequently the loss rate becomes larger than that in the static case.

Haymes, Robert C., "Fast Neutrons in the Earth's Atmosphere, 1 and 2," Journal of Geophysical Research, 69, 5 (March 1, 1964).

The mean-free-path absorption in the lower atmosphere is 169 ± 13 gm/cm^2. The flux maximum is 1.1 neut/cm^{2}sec at a depth of 90 gm/cm^2. A featureless differential energy spectrum of $E^{-1.3\pm.01}$ was measured. The observed latitude-dependence agrees with Lingenfelter's theory. The day-night flux ratios were $1.01 \pm .02$ and $1.00 \pm .01$. If the solar and terrestrial spectrums are similar, there is an upper limit of 0.02 neut/cm^{2}sec for solar flux at earth-orbit. No gammas (.47 to 3.50 Mev) from the sun or Crab Nebula were found. Two informative papers.

Heart, F. E., Karp, D., Mathiasen, A. A., Nagy, F., Jr., Crowther, W. R., and Smith, W. B., "Measured Physical Characteristics of the West Ford Belt," IEEE Proceedings, vol. 52, May 1964.

Presentation of some results of a program designed to measure the physical characteristics of the West Ford dipole belt. Three distinct kinds of experiments have been employed in the measurements program: monostatic radar experiments, bistatic path-loss experiments, and bistatic experiments to determine Doppler dispersion.

Hendricks, S. and Cain, J. C., World Magnetic Survey Data, Aug. 1963 (NASA TM X-51255; NASA-X-611-63-178)

The distributions of magnetic survey information available from all sources since 1900 are analyzed. The data are tallied according to the distribution by area and decade and by the component measured. The positions of observatory, possible repeat stations, and all other data are mapped on world charts. The deficiencies in coverage are noted, and recommendations for the IQSY are made.

III,
F. MAGNETIC FIELDS (CONT.)

Heppner, J. P., "The World Magnetic Survey," Space Science Reviews, Vol. 2, Sept. 1963.

Discussion of the possibility of making a "world magnetic survey" using complementary surface and space measurements. Land, sea, and air surveys are briefly considered, as are existing magnetic field analyses. Discussed are problems associated with satellite surveys, details of the magnetic survey to be made with the Polar Orbiting Geophysical Observatory (POGO), analysis problems to be expected in developing a description of the Earth's field and secular variations from the obtained data.

Hirshberg, Joan, "Motions of the Magnetospheric Boundary and Surface Magnetic Activity During the Flight of Explorer 10," Journal of Geophysical Research, Vol. 68, No. 1, 1963. NSF Grant No. GP-604.

Examination of worldwide magnetic events, in order to see if they show evidence of alterations between plasma and plasma-free regions during the flight of Explorer X (1961 Kappa 1), which could account for the recorded drops in the intensity of the magnetic field and changes in the field's direction.

Hood, P. J., "Magnetic Anomalies over the Mid-Labrador Sea Ridge," Nature, Vol. 202, June 13, 1964 (Research supported by Royal Canadian Air Force).

Presentation of a preliminary speculative interpretation of magnetic anomalies over an inferred mid-Labrador Sea ridge. It is stated that the lack of a magnetic anomaly on some traverses over the mid-Labrador Sea ridge is puzzling, but similar inconsistencies have occured in the case of the mid-Atlantic ridge.

Howard, H. T., Yoh, P., and Eshleman, V. R., "Radar Doppler Measurements of the Cislunar Medium," Journal of Geophysical Research, Vol. 69, 3 (Feb. 1, 1964).

Limited information on changes of electron concentration in cislunar space is given.

Hospers, J., "Preparation of Spherical Caps for Use on Terrestrial Globes in Investigations of Palaeomagnetism and Continental Drift," Nature, Vol. 203, July 25, 1964.

Description of a dry vacuum molding process used in the preparation of spherical caps particularly useful for fitting land forms and geology in investigations of continental drift and for plotting paleomagnetic results.

Howard, H. T., Jusignan, B. B., Yoh, P., and Eshleman, V. R., " Radar Doppler and Faraday Polarization Measurements of the Cislunar Medium During the July 20, 1964, Solar Eclipse," Journal of Geophysical Research, Vol. 69, 3 (Feb. 1, 1964).

Information is given on electron densities in the lee of the moon during a solar eclipse.

III,
F. MAGNETIC FIELDS (CONT.)

Hower, G. L., and Peterson, A. M., "Synchrotron Radiation from Auroral Electrons," Journal of Geophysical Research, Vol. 69, 19 (Oct. 1, 1964).
Particles spiraling about magnetic field lines in the auroral zone would produce signals in the upper HF to lower VHF band. But intensities would need to be greater than those indicated by satellite measurements to explain some previous observations of auroral noise during very severe disturbances.

Imhof, W. L. and Smith, R. V., "Proton Intensities and Energy Spectrums in the Inner Van Allen Belt," Journal of Geophysical Research, Vol. 69, 1 (Jan 1, 1964).
The proton flux for the inner radiation belt is fairly well defined as to B, L space and is roughly defined as to energy spectrum. A good contribution.

Iudovich, L. A., "The Influence of the Universal and Local Times on The Diurnal Variations of the Magnetic Activity," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov-Dec 1963. (In Russian).

Isaacs, J. D., and Bradner, H., "Neutrino and Geothermal Fluxes," Journal of Geophysical Research, Vol. 69, 18 (Sept. 15, 1964).
The solar neutrino flux (of order $4 \cdot 10^{10}/cm^2 sec$) could explain certain interesting phenomena of geothermal heat generation if it were to lose 1/300 to 1/8000 of its energy in passage through the earth. Although present experimental evidence does not rule out the possibility, it lacks theoretical support.

Ivanov, K. G., and Mikerina, N. V., "A Peculiarity in the Occurrence of the Preliminary Negative Impulse in SSC ," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963 (Translation).
Study of the occurrence of the preliminary negative impulse in a sudden commencement of a geomagnetic storm (SSC), based on the tellurograms for several Earth current stations. The reasons for this peculiarity in the appearance of the preliminary SSC impulse are discussed, together with the hypotheses advanced for the explanation of this impulse.

Ivanov, K. G., "The Influence of a Local Increase of Conductivity of the Ionosphere on S_q Variation of the Earth's Magnetic Field," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963. (Translation).
Consideration of the problem of disturbances of S_q currents and S_q variation of the Earth's magnetic field caused by a local homogeneous increase of ionization density of the E region of the ionosphere. The advantage of this method is that it takes into account the anisotropy of ionospheric conductivity in the Earth's magnetic field. Formulas are derived for the current function inside and outside the region of local increase of conducitivity at angles of inclination of about 90°.

III,
F. MAGNETIC FIELDS (CONT.)

Iwai, A., Outsu, J., and Tanaka, Y., "The Observation of VLF Emissions at Moshiri," Proc. of the Res. Inst. of Atmospherics, Nagoya U., Vol. 11, Jan 1964.

Methods of making observations are outlined, and some results obtained are presented. These results indicate that the VLF emissions are observable at geomagnetic latitudes as low as 34°, and that the majority of the VLF emissions are of the hiss type; however, during severe magnetic storms, choruses are also observed.

Jacobs, J. A., "Classification of Geomagnetic Micropulsations," Journal of Geophysical Research, Vol. 69, Jan 1, 1964.

Outline of a proposed classification and notation of geomagnetic micropulsations, in which a division of micropulsations into subgroups is based on their physical and morphological properties. The boundaries proposed are tabulated, and it is noted that they may have to be changed as further knowledge becomes available.

Kalashnikov, A. G., "Time Measurement of Three-Dimensional Gradients of Short-Period Variations of the Geomagnetic Field," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, May 1964. (In Russian).

Kalinin, Yu. D., ed., "Geomagnetic Disturbances. Collection of Articles," Transl. into English from IGY Program, Sect. 3, No. 4, 1960, Acad. of Sci., USSR.

Contents

1. Very Large and Large Geomagnetic Storms and Some Problems in Their Theory, V. I. Afanas'yeva and Yu. D. Kalinin, p. 1-14 refs (see N64-11658 03-12).
2. Analysis of Latitudinal Variations in the Yearly Course of Magnetic Activity, M. Mishin, N. A. Mishina, and G. P. Kalinoskaya, p. 15-25 refs (See N64-11659 03-12).
3. Synoptic Charts of Magnetic Disturbance in the Arctic, A.I. OI, p. 26-35 refs (See N64-11660 03-12)
4. Some Peculiarities of Variations in the Vertical Component of the Magnetic Field of the Earth in the Arctic Ocean, L. N. Zhigalov, p. 36-42 refs (See N64-11661 03-12)
5. On the Nature of the Coastal Effect, Ye. A. Ponomarev, p. 43-52, refs (See N64-11662 03-12)
6. Stationary Microvariation Station with Photoelectronic Amplification, N. V. Lipskaya, N. A. Deniskin, Yu. M. Yegorov, and V. F. Shel'ting, p. 53-60, refs (See N64-11663 03-13)
7. Secular Variations of the Geomagnetic Field of the East Antarctic S. M. Mansurov, p. 61-66, refs (See N64-11664 03-12).

III,
F. MAGNETIC FIELDS (CONT.)

Karpen, N. V., "The Origin of the Earth's Magnetism," Transl. from Studia Geophys. Geodaet. (Electromagnetics) Progue, V. 6. No. 4, 1963 (7 March 1963).

An attempt to theoretically elucidate the origin and manifestations of the internal geomagnetic field is discussed. A theory of geomagnetism is presented which explains: (1) the existence of the terrestrial magnetic field; (2) the quasi-constancy of the intensity of this field; (3) the inclination of the magnetic axis from the geographic axis of the earth; (4) the displacement toward the West of the terrestrial magnetic field; and (5) the secular variation of the terrestrial magnetic field. The theory is based on two hypotheses which assume: (1) the existence, far back in time, of a magnetic field H of exterior origin that produced Foucault currents in the core while traversing the earth in rotation: the mechanical couple produced by these currents retarded the speed of the core by establishing a relative speed ω_0' between core and crust and by inclining the axis of the core from the axis of the earth through imparting to it a gyroscopic precession Ω' around the axis of the earth; and (2) the existence of an apparently neutral charge $+q_n$ distributed over the surface of the core and of the adjacent spherical surfaces, and of a charge $-q_n$ distributed over the surface of the crust and the adjacent surfaces.

Kauttsleben, G., "Derivation of Expressions for the Potential of the Main Part of the Geomagnetic Field," Geomagnetizm i Aeronomiia, Vol. 4, Mar-Apr 1964, (In Russian).

Kautzleben, H., "Analytical Representation of the Geomagnetic Field and the Secular Variation," Transl. into English from Abhandl. Deut. Akad. Wiss. Berlin, Geomagnetisches Inst. Potsdam (E. Berlin), No. 32, 1963.

Topics discussed include representation of the vertical component on the terrestrial surface, representation of geomagnetic potential on the earth's surface, representation and analysis of total intensity and horizontal intensity, error in potential calculations, representation of the secular variation, formulas for spherical harmonics, and orthogonal polynomials for discrete distributions of value.

Kern, J. W., and Vestine, E. H., "Magnetic Field of the Earth and Planets," Repro. from Space Sci. Rev. (Dordrecht), Vol. 2, 1963 (Contract NASr-21(05)).

Knowledge of geomagnetism and its effects was recently much augmented during the IGY; when added to what is known of stellar fields, interplanetary fields, and meteoric magnetism and combined with magnetic theory, this knowledge provides a foundation for many inferences and rough estimates on the magnetic fields of other solar-system bodies.

III,
F. MAGNETIC FIELDS (CONT).

Kiianovskii, M. P., "The Relationship Between Geomagnetic and Ionospheric Disturbances at Middle Latitudes," Geomagnetism and Aeronomy, Vol. 3, No. 4, 1963 (Translation).

Investigation of the degree of relationship between the disturbances and the time displacement between them. It is confirmed that there is a close relationship between negative ionospheric disturbances and geomagnetic activity, but positive disturbances are not associated with magnetic activity.

Kitamura, Tai-ichi, "Geomagnetic Pulsations and the Exosphere. II-Analysis of Sliding Tones," Report of Ionosphere and Space Research in Japan, Vol. 18, No. 1, 1964.

Quantitative analysis of the cavity mechanism, based on an elastic string model analog.

Kitamura, Tai-ichi, "On the Propagation of Weak Hydromagnetic Shock Waves in the Exosphere and the Sudden Commencement of Geomagnetic Storm. II-Statistical Features of SSC Onset Time at High Latitudes," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 1, 1963.

Statistical analysis of the time differences of SSC onset at high latitudies.

Kitamura, Tai-ichi, "Geomagnetic Pulsations and the Exosphere. I-Statistical Results," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 2, 1963.

Frequencys-time analysis, based on IGY data, of the geomagnetic giant pulsations (Pg's). Several types of these pulsations are found, including those distinguished by: (1) an increased frequency with time (ascending tone), (2) a decreased frequency with time (descending tone), (3) a constant frequency with time, and (4) an irregular frequency with time.

Kimpara, Atsushi, "Lightning Flashes and Atmospherics," Proc. of the Res. Inst. of Atmospherics, Nagoya U., Vol. 11, Jan. 1964

Extensive studies on characteristics of atmospherics radiated from lightning discharges were made experimentally and theoretically; frequency spectra were obtained for almost all frequency ranges from ELF to UHF for every stage of ground and cloud discharges.

Kimpara, Atsushi, "Electromagnetic Energy Radiated from Lightning," Proc. of the Res. Inst. of Atmospherics, Nagoya U., Vol. 11, Jan. 1964.

The purpose of this paper is to survey the study recently developed on the electromagnetic energy radiated from lightning, i.e., atmospherics, not including propagation. Characteristics of the electrostatic, induction, and radiation fields of lightning are fully described, including the frequency spectrum in the neighborhood of the source.

III,
F. MAGNETIC FIELDS (CONT.)

Kleimenova, N. G., "Modern Concepts on the Nature of the High-Frequency Variations (1 cps to 1 kc) of the Earth's Electromagnetic Field," Akademiia Nauk SSSR, Izvestiia, Serlia Geofizicheskaia, Dec. 1963. (In Russian).

Kleimenova, N. G., "Present Ideas Regarding the Nature of High-Frequency Variations in the Electromagnetic Field of the Earth," Academy of Sciences, USSR, Bulletin, Geophysics Series, March 1964. Translation.

Kokourov, V. D., "Relationship Between Some Ionospheric Characteristics and Geomagnetic Activity," Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963. Translation.
Graphical analysis of the relationship between the average amplitude R of a reflected signal, and ionospheric turbidity β, ionospheric absorption L, and the degree of magnetoionospheric disturbance K.

Kolomeyets, Y. V., Sergeyeva, G. A., and Tarasova, K. F., "Investigation of Variations of Cosmic-Ray Intensity, The Earth's Magnetic Field, and Auroras During the Magnetic Storm of 25 March 1958," Cosmic Rays, June 1964.
The experimental data indicate that the decrease in cosmic-ray intensity occurring during a magnetic storm commences at all stations simultaneously.

Konečný, M., "Geomagnetic Pulsations at the Time of Bay Disturbances Observed by Induction Magnetometer at the Observatory of Budkov," Geofysikální Sborník, Vol. 11, 1963.

Konig, H. L., Elf Investigations, Summary Report No. 1, 1 April 1963-30 June 1963. (Contract AF 61(052)-603).
Two observation stations, one in Munich, Germany and the other in Kingston, R.I., are being used to observe the fluctuations of the earth's magnetic field in the frequency region around 10 cps.

Kovalevskii, A. F., "Characteristics of the Motion of Charged Particles in the Geomagnetic Field," Geomagnetism and Aeronomy, Vol. 3, No. 1. (Translation.)
Study of the motion of a charged particle in the magnetic field of the Earth.

Lamar, D. L. and Romig, Mary F., Electromagnetic Effects Associated with the San Francisco Fireball of November 7, 1963, June 1963 (P-2924;AD-601901).
A report of an investigation of a fireball seen in the San Francisco area is presented. Investigated were reports of explosions or sonic booms heard at the time, power failures, radio interferences, and visual sightings of the fireball.

Law, L. K., DeLaurier, J., Andersen, F., and Whitham, K., "Investigations During 1962 of the Alert Anomaly In Geomagnetic Variations," Canadian Journal of Physics, Vol. 41, Nov. 1963.

Analysis, by simple potential theory, of magnetic variations measured at three stations across the strike of the anomaly in electrical conductivity of the Earth's mantle, suggested by Whitham and Andersen, near Alert, Ellesmere Island.

Lees, L., "Interaction Between the Solar Plasma Wind and the Geomagnetic Cavity," AIAA Journal, Vol. 2, September 1964 (Contracts DA-31-124-ARO(D)-33; Nonr-1841(93).

Leonard, R. S., "Selection of a Model of the Earth's Magnetic Field," Journal of Geophysical Research, Vol. 68, December 15, 1963, Contract DA-49-146-XZ-137.

Review of observations made during the 1962 Johnston Island explosions, of the man-made aurora caused by particles guided into the southern conjugate region of the Earth's magnetic field, in order to evaluate several proposed methods for calculating the magnitude and direction of the Earth's magnetic field of locations above the Earth's surface.

Levy, R. H., Petschek, H. E., and Siscoe, G. L., "Aerodynamic Aspects of the Magnetospheric Flow," American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, New York, N.Y., Jan. 20-22, 1964, Preprint 64-87. (Contract Nonr 2524(00).

Discussion of the extent to which the flow of the solar wind can be analyzed by the techniques of continuum fluid mechanics in relation to the observational and theoretical evidence.

Liakhov, B. M., "The Earth's Main Magnetic Field," Geomagnetism and Aeronomy, Vol. 3, No. 4, 1963 (Translation).

Use of step-by-step approximation method to derive maps showing that the Earth's main magnetic field is represented by the sum of the fields of three eccentric, horizontal dipoles. Their parameters (magnetic moments, coordinates, and azimuths of the dipoles) are presented in a table.

Liemohn, H. B., Scarf, F. L., "Whistler Determination of Electron Energy and Density Distributions in the Magnetosphere," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Brief review of the theories of whistler propagation and extensive analysis of nose whistlers recorded at five stations between April 1958 and June 1962 have been used to test the validity of model magnetospheric electron distributions and two theories for the upper cutoff frequency on the whistler signal.

III,
F. MAGNETIC FIELDS (CONT.)

Liemohn, H. B., and Scarf, F. L., "Whistler Determinations of Electron Energy and Density Distributions in the Magnetosphere," Journal of Geophysical Research, Vol. 69, 5, March 1, 1964.

Electron densities were determined in the distance range 3 to 5 R_e. Energy and distance dependences are discussed.

Lincoln, J. V., "Geomagnetic and Solar Data," Journal of Geophysical Research, Vol. 68, December 15, 1963.

Tables of geomagnetic and solar data for August 1963. The geomagnetic planetary 3-hr range indices K_p, preliminary magnetic character figures C_i, magnetic character figures C_p, average amplitudes A_p, Fredericksburg 3-hr range indices K, and provisional sunspot numbers are given from August 1 to 31.

Lingenfelter, R. E., and Flamm, E. J., "Neutron Leakage Flux from Interactions of Solar Protons in the Atmosphere," Journal of Geophysical Research, Vol. 69, 11 (June 1, 1964).

Calculations are made for neutron albedo flux up to 10 Mev as a function of energy and angle.

Lomanyy, V. D., Prokof'yev, A. G., and Yanovskiy, B. M., "Measuring the Components of the Earth's Geomagnetic Field by the Proton Resonance Method," Recent Develop. in Geophys., Vol. 22, April 1963). Transl. into English from Uch. Zap. Leningr. Gos. Univ., Ser. Fiz. i Geol. Nauk (Leningrad), Vol. 303, No. 13, 1962.

The theory, instrumentation, and results of measuring the geomagnetic field by the proton resonance method are presented.

Lomanyy, V. D., Prokof'yev, A. G., and Yanovskiy, B. M., "Measurement of the Components of the Earth's Magnetic Field by the Proton Resonance Method," Sov. Res. on the Earth's Magnetic Field, October 29, 1963.

An apparatus for measurement of the vertical component Z of the earth's magnetic field is described. A Helmholtz coil, with radius sufficient to ensure the uniformity of the field in a volume which exceeds the volume of the sensor in the circuit used in the free nuclear-induction method, is used to compensate for errors inherent in other systems. Results are given in tabular form.

MacDonald, G. J. F., "Hydromagnetic Waves in Space," Space Physics, Edited by D. P. LeGalley and Alan Rosen.

Consideration of the propagation in a plasma of magnetohydrodynamic waves of frequency and wavelength large enough that the plasma will act as a continuum.

III,
F. MAGNETIC FIELDS (CONT.)

Maer, Kemp, Jr., and Dessler, A. J., "Comment on the Paper by Conway W. Synder et al, 'The Solar Wind Velocity and Its Correlation with Cosmic-Ray Variations and with Solar and Geomagnetic Activity," Journal of Geophysical Research, Vol. 69, 13 (July 1, 1964).

There appears to be a power-law dependence between solar wind velocity, V_s, and the geomagnetic Ap index, $A_p = 4.8 \cdot 10^{-12} V_s^{4.6}$.

MacLellan, D. C., Morrow, W. E., Jr., and Shapiro, I. I., "Effects of the West Ford Belt on Astronomical Observations," IEEE, Proceedings, Vol. 52, May 1964.

Discussion of observations made on the West Ford dipole belt to determine its effects on astronomical observations. It is felt that collisions between spacecraft and individual dipoles or clusters are improbable. The effects of the unsuccessful 1961 West Ford experiment are negligible.

Maeda, H., Shirgaokar, A. J., Yasuhara, M., and Matsushita, S., "On the Geomagnetic Effect of the Starfish High-Altitude Nuclear Explosion," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Evaluation of various phenomena associated with a high-altitude nuclear explosion, called Starfish, over Johnston Island on July 9, 1962, which produced a distinct geomagnetic effect at stations all over the world.

Makino, T., "On the Cosmic-Ray Cut-Off Rigidities and the Earth's Magnetic Field," Ionosphere and Space Research in Japan, Report, Vol. 17, No. 3, 1963.

Study of cosmic ray intensity and values of cut-off rigidity, and note made of deficiencies of existing methods of determining values when compared with observed values.

Mansurov, S. M., "Secular Variations of the Geomagnetic Field of the East Antarctic," Geomagnetic Disturbances, December 1963.

The secular geomagnetic variations for the 1957 to 1959 period have been drawn using the data of the USSR Antarctic magnetic observations. The attention was drawn to the great amplitude of the long-period variation in H-component, superimposed on general secular variations. The change of Z-secular variation signs at Mirnyy and Vostok observations has been noticed.

Mathews, T., and Kodama, M., "Magnetic Rigidity Dependence of Eleven-Year Variation in Cosmic Ray Intensity," Journal of Geophysical Research, Vol. 69, 21, (Nov. 1, 1964).

The fractional decrease of primary cosmic radiation from solar minimum to solar maximum is given as a function of magnetic rigidity up to 15 Gv. At 15 Gv the decrease is about 15 $\pm$5%, at 7 Gv about 25 $\pm$5%, at 3 Gv about 65 $\pm$10%. (Note: Cosmic ray intensity is less at solar maximum, due to the Forbush decrease mechanism.)

III,
F. MAGNETIC FIELDS (CONT.)

McDonald, J. E., "Atmospheric Exclusion Limits for Clouds of Water and Other Substances," Journal of Geophysical Research, Vol. 69, 17 (Sept. 1, 1964).
Shows that where atmospheric temperature exceeds melting-sublimation temperature of cloud-forming substance, clouds will not form.

McIlwain, C. E., Fillins, R. W., Valerio, J., and Dave, A., Relay I Trapped Radiation Measurements, Univ. of Calif., San Diego, California.
Gives relay measurements of Van Allen protons and electrons. Effects of a magnetic storm were also measured.

Mead, G. D., "Deformation of the Geomagnetic Field by the Solar Wind," Journal of Geophysical Research, Vol. 69, April 1, 1964.
Application of the three-dimensional numerical solution to the Chapman-Ferraro problem of a steady solar wind perpendicularly incident upon a dipole field to obtain a simple spherical harmonic description of the distorted field.

Mead, G. D., and Beard, D. B., "Shape of the Geomagnetic Field Solar Wind Boundary," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).
The shape of the magnetopause is calculated. (The shape of the magnetopause tail is not calculated.)

Mead, G. D. and Beard, David B., "Shape of the Geomagnetic Field Solar Wind Boundary," Repro. from J. Geophys. Res., Vol. 69, No. 7, April 1964 (NASA-RP-214).
The shape of the boundary of the geomagnetic field in a solar wind has been calculated by a self-consistent method in which, in first order, approximate magnetic fields are used to calculate a boundary surface.

Mead, G. D., "Deformation of the Geomagnetic Field by the Solar Wind," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).
The magnetic field within the magnetosphere is calculated, and approximate equations are given for convenience. No closure of the magnetopause is assumed. Many good figures. There is field compression on both the solar and anti-solar sides.

Medvedev, N. D., "Geomagnetic Investigations Along the Sledge-Tractor Traverse from the Pravda Coast to the South Geomagnetic Pole," Geomagnetism and Aeronomy, Vol. 3, No. 3 (Translation).
Investigation of spatial distribution of declination D, horizontal component H, and vertical component Z along the 1,410-km traverse. A summary table is presented, and the results have made it possible to correct errors in earlier navigation charts.

III,
F. MAGNETIC FIELDS(CONT.)

Michel, F. C., "K_p as a Planetary Index," Journal of Geophysical Research, Vol. 69, Oct. 1, 1963.
The K_p varies diurnally by slightly less than 3% and is for practical purposes a true planetary index.

Michel, F. C., Dessler, A. J., and Walters, G. K., "A Search for Correlation Between Kp and the Lunar Phase," Journal of Geophysical Research, Vol. 69, (Oct. 1, 1964).
There is no correlation between the geomagnetic planetary index, K_p, and the lunar phase.

Midgley, J. E., "Perturbation of the Geomagnetic Field - A Spherical Harmonic Expansion," Repr. from the J. of Geophys. Res., Vol. 69, No. 7, 1 April 1964. (Grants NsG-269-62; NsG-151-61).
The spherical harmonic expansion of the perturbation of the geomagnetic field is calculated, using the magnetopause shape and current system determined previously by the moment technique. The expansion coefficients are compared with those determined by another method by Mead.

Mihalov, J. D., Mozer, F. S., and White, R. S., "Artificially Injected Electrons at Low Altitudes," Journal of Geophysical Research, Vol. 69, 19 (Oct. 1, 1964).
Gives injection results and decay times after both USA and USSR high altitude nuclear explosions.

Miles, D. P. and Lepping, R. P., "Magnetic Disturbances Due to the High-Altitude Nuclear Explosion of July 9, 1962," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.
Description of observations made with a rubidium vapor magnetometer during the five high-altitude nuclear detonations over Johnston Island as a part of a program of measurements of the geomagnetic field conducted at the U.S. Naval Air Development Center in 1962.

Mishin, V. M. and Zhulin, I. A., "Some Problems Concerning Geomagnetic Activity. I." Geomagnetism and Aeronomy, Vol. 2, No. 3, 1962. (Translation)
Brief review of the patterns of the space-time distribution of geomagnetic activity. Various physical interpretations of some patterns of irregular geomagnetic disturbance, D_i, are discussed, and critical arguments are presented concerning the theoretical concept of Nikol'skii - i.e., the applicability of Stormer's theory to the explanation of geomagnetic activity data.

III,
F. MAGNETIC FIELDS (CONT.)

Mishin, V. M., Mishina, N. A., and Kalinoskaya, G. P., "Analysis of Latitudinal Variations in the Yearly Course of Magnetic Activity," Geomagnetic Disturbances, Dec. 1963.

The main regularities of annual variations of magnetic activity obtained from the data of 1955 to 1956 are analogous to those obtained from the 11 IGY and IPY materials.

Mogilevski, E. I., "On the Interaction of the Solar Corpuscular Stream with the Earth's Magnetosphere," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. (edited by P. Muller.

Discussion of the energy aspect of the interaction between the solar corpuscular stream and the magnetosphere of the Earth. A semiqualitative model of the energy transfer from the magnetic field of the solar stream to the magnetosphere of the Earth is discussed.

Mogilevskiy, E. I., "On a Possible Magnetic Field Structure of the Geoeffective Corpuscular Flux According to Measurements on "Mariner-II," (29 May 1964) Transl. into English from Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No. 2, 1964. (Contract NAS 5-2078).

A spatial model of the geomagnetic field of a geoeffective solar corpuscular flux during a geomagnetic disturbance is presented on the basis of magnetic field measurements on Mariner II. Qualitative considerations and certain quantitative estimates showed that the observed magnetic field pattern agrees satisfactorily with the model of a solar corpuscular stream with a force-free magnetic field.

Mogilevskii, E. I., "The Nature of Influence of the Solar Corpuscular Stream on the Earth's Magnetic Field," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov-Dec 1963. (In Russian.)

McIlwain, C. E., "Redistribution of Trapped Protons During a Magnetic Storm," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper. (Contracts NAS 5-1683; NASr-116; NSG-538.

Observation of the first change in the distribution of high-energy geomagnetically trapped protons which can be definitely attributed to the breakdown of adiabatic motion. The character of the changes was such that previous events of this type could have produced the anomalous characteristics of the initial distribution.

Morris, D., and Berge, G. L., "Direction of the Galactic Magnetic Field in the Vicinity of the Sun," Astrophysical Journal, Vol. 139, 4 (May 15, 1964).

The longitude of the galactic magnetic axis in the vicinity of the sun is $70^{\circ} \pm 20^{\circ}$, as compared with a value of about 75° for the longitudinal axis of the local spiral arm. (The sun is above the galactic plane by some 25 pc; the magnetic field is here directed outward).

III,
F. MAGNETIC FIELDS (CONT.)

Mrazek, J., "Propagation of Ultralong Electromagnetic Waves in the Magnetosphere," Transl. from Studia Geophys. Geodaet. (Electromagnetics) (Prague), Vol. 6, No. 4 (1962).

A discussion is presented of findings which were determined from an analysis of the rules of propagation of electromagnetic waves with acoustic frequencies in the magnetosphere.

Mrazek, J., et al., Translations from Studia Geophysica et Geodaetica (Electromagnetics) (Prague), Vol. 6, No. 4, 1962 (JPRS-18010;OTS-63-21273) (Translation).

Contents:

1. Propagation of Ultralong Electromagnetic Waves in the Magnetosphere, J. Mrayek, p. 1-7 refs (See N64-11618 03-12)
2. The Origin of the Earth's Magnetism, N. V. Karpen, p. 8-25 refs (See N64-11619 03-12)
3. Ionization Through Earth Satellites, L. Triskova, p. 27-36 refs (See N64-11620 03-12)

Nagata, T., "Polar Geomagnetic Disturbances," Planetary and Space Science, Vol. 11, Dec. 1963.

Critical review of the results of recent geomagnetic disturbance observaations in both northern and southern high latitudes. Various theories on these phenomena are presented.

Namikawa, T., Okuzawa, T., and Kitamura, T., "On the Propagation of Weak Hydromagnetic Shock Waves in the Exosphere and the Sudden Commencement of Geomagnetic Storm. I - Fast Shock," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 1, 1963.

Investigation of the propagation of weak hydromagnetic shock discontinuities, of fast made, in the dipole magnetic field. The results obtained are applied to the weak shock propagation in a model exosphere.

Namikawa, T., Kitamura, T., and Okuzawa, T., "On the Propagation of Weak Hydromagnetic Shock Waves in the Exosphere and the Sudden Commencement of Geomagnetic Storm. III - Transverse Shock," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 1, 1963.

Investigation of the propagation of weak hydromagnetic shock discontinuity of transverse mode. The results obtained are applied to the propagation of a weak transverse shock wave in a model exosphere.

Neher, N. V., and Anderson, H. R., "Cosmic-Ray Intensity at Thule, Greeland, during 1962 and 1963 and a Comparison with Data from Mariner 2," Journal of Geophysical Research, Vol. 69, 5 (March 1, 1964).

A cosmic-ray albedo effect of 21% at the top of the atmosphere is deduced. Not entirely convincing.

III,
F. MAGNETIC FIELDS (CONT.)

Nerurkar, N., and Webber, W. R., "Observations of Primary Cosmic-Ray Variations Using Ion Chamber and Geiger Counters," Journal of Geophysical Research, Vol. 69, 5 (March 1, 1964).

Cosmic-ray intensity is uniquely related to neutron monitor rate at high latitudes and at the equator. The spectrl dependence of Forbush decreases appears to be identical to that of long-term modulation, with the greatest change occurring in primary particles of low rigidity.

Ness, N. F., Scearce, C. S., and Seek, J. B., "Initial Results of the Imp 1 Magnetic Field Experiment," Journal of Geophysical Research, Vol. 69, 17 (Sept. 1, 1964).

The interplanetary magnetic field varies between 4 and 7γ and is extremely stable over a few hours time, although its direction does change. The average direction of the field is slightly below the ecliptic plane and approximtely along the streaming angle predicted for steady state solar wind. However, the interplanetary field appears to have a filamentary structure with null surfaces between filaments and in the overall field structure. A collisionless magnet hydrodynamic shock wave at 13.4 Re was detected. The magnetopause at stagnation was at 10.25 Re. High magnetic turbulence exists between the shock wave and the magnetopause. A magnetohydrodynamic wake behind the moon extending at least 150 moon radii into space was also detected. A very significant article.

Newkirk, L. L., and Walt, M., "Longitudinal Drift Velocity of Geomagnetically Trapped Particles," Journal of Geophysical Research, Vol. 69, 9 (May 1, 1964).

Angular drift velocities of order $2.5 \cdot 10^{-18}$ radians/sec for L = 1.25, vary with longitude, being as much as 30% greater in the region of magnetic anomalies.

Newman, P., "Optical, Electromagnetic and Satellite Observations of High Altitude Detonations," AGARD Advan. in Upper Atmosphere Res., 1963.

Nikol'skii, A. P., "Characteristics of the Diurnal Distribution of Irregular Magnetic Disturbances Between the Geomagnetic and The Geographic Poles in the Arctic," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963. (Translation).

Analysis of data obtained from drifting stations located between the north geomagnetic and north geographic poles on the diurnal distribution of irregular magnetic disturbances.

Nikol'skii, A. P., "The Geographical Distribution of Magnetic Disturbances, Radio Wave Absorption and Radar Echoes from Auroras in the High Latitudes," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963 (Translation).

Results of analysis of cosmic radio noise and auroral radar echo data for Bjørnøya, Norway, and magnetic disturbance data for Cape Chelyuskin, USSR.

III,
F. MAGNETIC FIELDS (CONT.)

Nikol'skii, A. P., and Nikolaev, I. V., "The Reality of the Diurnal Periodicity of Magnetic Activity," Akademiia Nauk SSSR, Geomagnetizm i Aeronomiia, Vol. 3, Nov-Dec 1963. (In Russian).

Nikol'skii, A. P., and Ol', A. I., "Comments on the Article 'Certain Problems of Magnetic Activity. I.,' by V. M. Mishin and I. A. Zhulina," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963. (Translation)

Critical examination of the method used by Mishin and co-authors in statistical investigations of magnetic disturbance, especially in the study of the diurnal variation of magnetic activity.

Nikol'skiy, A. P., "The Application of the Basic Conclusions of Stormer's Theory for the Explanation of Some Laws of Magnetic Disturbances at High Altitudes," Transl. into English from Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No. 1, 1964.

The distribution of irregular magnetic disturbances during 24-hr periods is investigated using the data of various observations conducted over a period of 145 months (1950-60) on drifting stations and at the Tikhaya, Chelyuskin, and Uelen stations.

Nishida, A., and Cahill, L. J. Jr., "Sudden Impulses in the Magnetosphere Observed by Explorer 12," Journal of Geophysical Research, Vol. 69, No. 11, (June 1, 1964).

Sudden ground impulses are propagated through the magnetosphere at close of the hydromagnetic wave speed. A negative impulse expands the magnetosphere. Changes in the solar wind are the probable cause.

Nishida, A., and Cahill, L. J., Jr., "Sudden Impulses in the Magnetosphere Observed by Explorer 12," Journal of Geophysical Research, Vol. 69, June 1, 1964. (Contract NASw-155; NSF Grant No. GP 797).

Morphological study of sudden changes in the geomagnetic field which takes place almost simultaneously all over the world. A distinction from other flux variations detected by the magnetometer is that the pulse is not followed by a magnetic storm.

Nishida, A., and Young, J. H., "Explorer XII Observations of Magnetic Sudden Impulses in the Earth's Magnetosphere," (1963) (NASA Contract NASw-155; NSF Grant GP-797) (NASA CR-53231)

The successful operation of the flux-gate magnetometer on board Explorer XII made possible a correlational study of geomagnetic field observation of ground-based magnetometers with the satellite observations at geocentric altitudes ranging from about 3 to 13 earth radii.

Nishida, A., and Cahill, L. J., Jr., "Observations of Sudden Impulses in the Magnetosphere Obtained from Explorer XII Data," (1963) (NASA Contract NASw-155; NSF Grant GP-797) (NASA CR-53611; UNH-64-2).

Explorer XII magnetic records show that a positive sudden impulse on the

ground is accompanied by an increase in the field strength within the magnetosphere, and, hence, by a compression of the magnetosphere.

Nishida, A., "Ionospheric Screening Effect and Storm Sudden Commencement," Journal of Geophysical Research, Vol. 69, May 1, 1964 (Grants ONR(00)3116; NSF No. GP-797).

In former estimates of the ionospheric screening effect, a magnetic potential field or an electromagnetic wave has been employed to represent the disturbance field in the neutral atmosphere. When this result ia applied to a suddent commencement of the magnetic storm, it is found that a deformation of the magnetosphere by the viscous force of the corpuscular stream may be responsible for the preceding reverse change of a sudden commencement.

Noerdlinger, P. D., "Wave Generation Near the Outer Boundary of the Magnetosphere," Journal of Geophysical Research, Vol. 69, No. 3 (Feb. 1, 1964).

Plasma instabilities are investigated in the region between the magnetosphere and the solar wind (considering a shock).

Obayashi, T., "Interaction of Solar Plasma Streams with the Outer Geomagnetic Field," Journal of Geophysical Research, Vol. 69, No. 5 (March 1, 1964).

The standing shock layer and the geomagnetic cavity (magnetosphere) are analyzed and discussed. The observed shock is consistent with Mach 3-4. Estimated values for a typical quiescent solar plasma stream are 400 - 600 km/sec, 5 particle/cm^3, and 10γ.

Ogilvie, K. W., and Bryant, D. A., "Solar Proton Spectrums in the Events of November 12 and 15, 1960," Journal of Geophysical Research, Vol. 69, No. 3 (Feb. 1, 1964).

Solar proton spectrums are discussed for two solar flares.

Osborne, F. J. F., Shkarofsky, I. P., and Gore, J. V., "Laboratory Simulation of the Solar Wind Magnetosphere Interaction," Canadian Journal of Physics, Vol. 41, Nov. 1963.

Description of magnetic and visual observations on a laboratory experiment designed to simulate the interface of the cavity formed by a solar wind compressing the Earth's magnetic field.

Osborne, F. J. F., Bachynski, M. P., and Gore, J. V., "Laboratory Measurements of Plasma Trapping Within the Magnetosphere," Applied Physics Letters, Vol. 5, August 15, 1964 (Contract No. PD 69-300003).

Measurements of visible regions of plasma trapped within the deformed magnetospheric cavity. It is noted that the physical location of the trapped plasma is in the region of the peak perturbation, suggesting an association of the luminosity of the regions to the peak magnetic field perturbation.

Osipov, N. K., "The Outer Part of the Earth's Main Magnetic Field," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963 (Translation).

Discussion of the problem of the outer part of the main geomagnetic field, based on the results of an analysis of the Earth's main magnetic field for the period 1932-1958. It is shown that the outer part of the magnetic field delineated for the analysis is real. The hypothesis of the radiation belts as possible sources of the outer field is also discussed.

Osipov, N. K., "The Energy Spectrum of the Inner Part of the Constant Geomagnetic Field in the Epochs 1955 and 1958," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963. (Translation).

Examination of the relationship between spherical harmonics of various orders and the energy density spectra of the inner part of the geomagnetic field at various levels relative to the surface of the Earth.

Osipov, N. K., "Secular Variations of the Energy Spectrum of the Inner Part of the Earth's Main Magnetic Field," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963. (Translation).

Presentation of the results of an analysis of the energy density of harmonics of the nth order in the inner part of the Earth's main magnetic field conducted over seven epochs from 1932 to 1958.

Osipov, N. K., "The Nonpotential Part of the Earth's Main Magnetic Field," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963 (Translation).

Analysis of the problem of the nonpotential part of the main geomagnetic field, using the expansion coefficients for spherical functions of the N part of the field previously obtained.

Papagiannis, M. D., and Huguenin, G. R., Ionospheric Focusing in the Presence of the Earth's Magnetic Field, Technical Report No. 5, October 1963 (Contract AF 19(604)-6120 (ARCRL-63-945; AD-431004).

A new technique has been developed for application to problems of radio wave propagation in magnetoionic media. This method is based on a mathematical formulation of Poeverlein's graphical solution.

Parker, E. N., "The Scattering of Charged Particles by Magnetic Irregularities," Journal of Geophysical Research, Vol. 69, May 1, 1964 (Grant No. NsG 96-60.)

Integration of the equations of motion of a charged particle through an irregularity in a large-scale magnetic field. The scattering of the particle is shown to diminish as the cyclotron radius of the particle becomes either large or small compared to the scale of the irregularity and to have a maximum when the radius is comparable to the scale.

III,
F. MAGNETIC FIELDS (CONT.)

Parker, E. N. and Dessler, A. J., "Discussion of Paper by E. J. Stegelmann and C. H. Von Kenschitzki, 'On the Interpretation of the Suddent Commencement of Geomagnetic Storms,'" Journal of Geophysical Research, Vol. 69, Sep. 1 1964 (Grant No. AF AFOSR-521-64.)

Demonstration that, no matter how sharp the onset of the enhanced solar wind in space, the compression of the field in the vicinity of the Earth cannot reach its full value in less than about 1-2 x 10^2 sec, thus accounting for much of the observed sudden commencement rise times of geomagnetic storms.

Patel, V. L. and Cahill, L. J., Jr., Evidence of Hydromagnetic Waves in the Earth's Magnetosphere and of Their Propagation to the Earth's Surface, 1963 (Contract NASw-155) (NASA-CR-58130)

The first evidence of elliptically polarized hydromagnetic waves in the ground records of the earth's magnetic field at College, Alaska, was communicated by Sugiura (1961).

Paulikeas, G. A., and Freden, Stanley C., "Precipitation of Energetic Electrons Into the Atmosphere," Journal of Geophysical Research, Vol. 69, No. 7 (April 1, 1964).

Electrons are lost from the radiation belts in narrow ranges near L = 1.2 and 2 as well as in the L = 3 to 8 region. Precipitating fluxes are typically $10^3/cm^2$sec near L = 2 with B = 0.35 gauss and E $>$ 0.9 Mev, and a typical energy spectrum of E^{-3} up to 1.7 Mev. These fluxes have no connection with the Starfish nuclear explosion. A significant paper.

Parker, E. N., "The Scattering of Charged Particles by Magnetic Irregularities," Journal of Geophysical Research, Vol. 69, 9 (May 1, 1964).

The scattering is maximum when the cyclotron radius of the particle is of comparable scale to the magnetic irregularity.

Parker, E. N., "Dynamical Properties of Stellar Coronas and Stellar Winds. III. The Dynamics of Coronal Streamers," Astrophysical Journal, Vol. 139, 2 (Feb. 15, 1964).

The solar corona may consist of thin radial filaments and streamers, confined by the magnetic field along whose lines of force they lie. There would be little effect on the solar wind velocity, and not much on mean wind density. Some instability disordering is to be expected at distances of order 1 a.u. and beyond.

III,
F. MAGNETIC FIELDS (CONT.)

Petschek, H. E., "Magnetic Field Annihilation," presented at the Solar Flare Symp., Goddard Space Flight Center, Greenbelt, Md., Oct 28-30, 1963 (Contract Nonr-2524(00)) (AMP-123; AD-425751)

Sweet's mechanism for the rate of annihilation of magnetic field at the boundary between two regions of plasma containing oppositely directed field lines is re-examined.

Piddington, J. H., "Recurrent Geomagnetic Storms, Solar M-Regions and The Solar Wind," Planetary and Space Science, Vol. 11, 12, Feb. 1964.

Pisacane, V. L., "Particle Motion in the Equatorial Plane," AIAA Journal, Vol. 2, August 1964 (Contract NOw 62-0604-c.)

Theoretical analysis of the motion of bound particles in the equatorial plane of a concentric gravitational and dipole magnetic field.

Pochtarev, V. I., "Regional Secular Geomagnetic Variations in the USSR," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).

Presentation of a schematic chart of regional anomalies in the secular variation of the vertical component of the geomagnetic field in the USSR.

Pochtarev, V. I. "The Western Drift of the Geomagnetic Field," Geomagnetizm i Aeronomiia, Vol. 4, Mar-Apr 1964 (In Russian).

Pletnev, V. D., "Density and Intensity Distribution of Charged Particles in a Stationary Geomagnetic Field, without Considering Particle Interaction," Transl. into English from Kosmich. Issled (Moscow), Vol. 1, No. 3, Nov-Dec. 1963.

The asymptotic method of solving the Boltzmann equation for a low-density ionized gas in a strong stationary magnetic field is applied to evaluate the density and intensity distribution of charged particles in the radiation belts of the earth.

Pochoda, P. and Schwarzschiled, M., "Variation of the Gravitational Constant and the Evolution of the Sun," Astrophysical Journal, Vol. 139, 2 (Feb. 15, 1964).

An interesting speculative work resulting in no firm conclusions, except perhaps that no strong variation of the gravitational constant is indicated.

Price, A. T. and Wilkins, G. A., "New Methods for the Analysis of Geomagnetic Fields and Their Application to the Sq Field of 1932-3," Royal Society (London), Philosophical Transactions, Series A, Vol. 256, Dec. 12, 1963.

Presentation of methods for interpolating and analyzing magnetic fields observed over the Earth's surface, and application of these methods to study the quiet-day magnetic daily variations (Sq) during the sunspot minimum 1932-3.

III.
F. MAGNETIC FIELDS (CONT.)

Prikner, K., "Shortening of Periods of Electromagnetic Pulsations and Two Periods in Main Phase of Geomagnetic Storm," Studia Geophysica et Geodaetica, Vol. 7, No. 3, 1963.

Analysis of the structure of the main phase in a magnetic storm, based on the relationship between the microstructure and the macroscopic variation of intensity components in the geomagnetic field.

Pudovkin, I. M., "The Spatial Structure of the Geomagnetic Field and Some Problems of Investigation of the Earth's Inner Structure," Geomagnetizm i Aeronomiia, Vol. 4, Mar-Apr 1964 (In Russian).

Pudovkin, I. M., "The Three-Dimensional Structure of the Geomagnetic Field and Some Problems Involved in the Study of the Internal Structure of the Earth," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Pudovkin, I. M. and Kolesova, V. I., "Zero Isoline of the ΔT Vertical Gradient and Its Use in the Interpretation of Magnetic Anomalies," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Zelwer, Ruben, Geomagnetic Bays - A Review, technical report, 3 Dec. 1963 (Contract Nonr-222(89).

The causes of geomagnetic bays are discussed from several points of view, including their classification, their frequency of occurrence, their frequency of variation, their order of appearance, their recurrence, and other characteristics. Previous research in this area is selected and summarized to gain an overall picture of a phenomenon as yet little known.

Raspopov, O. M., and Ianovskii, B. M., "Vertical Gradient of the Geomagnetic Z Component over the Northwest Wing of the East Asian Anomaly," Academy of Sciences, USSR, Bulletin, Geophysics Series, Apr. 1964 (Translation).

Raspopov, O. M., and Ianovskii, B. M., "The Field of the Vertical Gradient of the Z-Component of the Geomagnetic Field Above the North-Western Limb of the East-Asian Anomaly," Akademiia Nauk SSSR. Izvestiia, Serliia Geofizicheskaia, Apr 1964, (In Russian).

Rastogi, R. G. and Sanatani, S., "Longitudinal Effect in the Equatorial F2-Region of The Ionosphere," Journal of Atmospheric and Terrestrial Physics, Vol. 25, Dec. 1963.

Discussion of the longitudinal differences in the daily variation of f_0F_2 at the equatorial stations having magnetic dip similar to that of Rastogi. Diagrams showing daily variations of f_0F_2 at four equatorial stations, and variations of dip equator with geographic latitude, are presented.

III,
F. MAGNETIC FIELDS (CONT.)

Ray, E. C., "On the Motion of Charged Particles in the Geomagnetic Field," Annals of Physics, Vol. 24, Oct. 1963.
Construction of an approximate first integral of the equations of motion of a charged particle in a static magnetic field.

Ray, E. C., Cosmic-Ray Cutoffs at High Latitude," Journal of Geophysical Research, Vol. 69, 9 (May 1, 1964).
Cutoffs are lower than would be calculated for a pure dipole field. This difficulty can be reconciled by a turbulent component everywhere beyond a certain distance from the center of the earth.

Rourke, G. F., "Magnetic Quiet Day Relationships," Nature, Vol. 202, May 30, 1964. (NSF Contract No. C-255.)
Comparison of locally selected quiet days at 13 Antarctic stations during the IGY with internationally selected days.

Rycroft, M. J. and Wormell, T. W., "The Natural E.L.F. Electromagnetic Noise in the Band 2-40 C/S; Apparatus and Some Preliminary Results," AGARD, Propagation of Radio Waves at Frequencies Below 300 Kc/s, 1964.
A program of observations on radio noise in the frequency range from 2 to 40 cps is discussed. The experimental arrangements are considered in some detail, particular attention being paid to the devices for rejecting the unwanted manmade disturbances that are prominent at an ordinary site.

Salpeter, E. E. and Trieman, S. B., "Backscatter of Electromagnetic Radiation from a Turbulent Plasma, Journal of Geophysical Research, Vol. 69, 5 (March 1, 1964).

Schilling, G. F., "Forbidden Regions for the Formation of Clouds in a Planetary Atmosphere," Journal of Geophysical Research, Vol. 69, 17 (Sept. 1, 1964).
Shows that where atmospheric temperature exceeds melting-sublimation temperature of cloud-forming substance, clouds will not form.

Sears, R. L., "Helium Content and Neutrino Fluxes in Solar Models," Astrophysical Journal, Vol. 140, 2 (Aug. 15, 1964).
A preferred solar model of 71% hydrogen, 27% helium, and 2.0% heavier dements is derived. A neutrino flux at earth orbit of $6.7 \cdot 10^{10}/cm^2$ is predicted, and varies by less than a factor of 2 for an assortment of solar models. Various assumptions include a solar mass of $1.989 \cdot 10^{30}$ kg, age of $4.5 \cdot 10^9$ years, luminosity of $3.90 \cdot 10^{26}$ watts, diameter of $1.388 \cdot 10^6$ km, and properties in the center of $15.7 \cdot 10^6$ °K, 158 gm/cm^3 with 36% hydrogen.

III,
F. MAGNETIC FIELDS

Shabanskii, V. P., "On the First Phase of Magnetic Storm," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Investigation of the changes in the Earth's magnetic field caused by disturbances originating from the Sun. The changes in the solar wind parameters and the form of the magnetosphere due to a shock wave propagating from the Sun are discussed.

Shabanskii, V. P., "Hydromagnetic and Thermodynamic Characteristics of Magnetic Storms," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th Florence, Italy, May 8-20, 1964, Paper.

Discussion of the hydrodynamic and thermodynamic considerations associated with changes in the Earth's magnetic field. A magnetic storm on the Earth is attributed to a corpuscular flux originating from the Sun which is an intensification of the solar wind.

Shapiro, I. I., Jones, H. M., and Perkins, C. W., "Orbital Properties of the West Ford Dipole Belt," IEEE Proceedings, Vol. 52, May 1964.

Presentation of the main features of a theoretical analysis of the collective motion in space of the individual West Ford dipoles. Theoretical analysis indicates that the former possibility is more likely, but it is felt that experimental verification will be very difficult since the dipoles will probably not be detectable during re-entry.

Sheeley, N. R., Jr., "Polar Faculae During the Sunspot Cycle," Astrophysical Journal, Vol. 140, Aug. 15, 1964.

Presentation of results of measurements of North and South polar faculae, the numbers of which have been counted for the period 1935-1963. It is noted that the comparison between the numbers of polar faculae and measurements of the polar magnetic field since 1952 suggests that the past observations of polar faculae can be used to extend measurements of polar magnetic field prior to 1952.

Shevnin, A. D., "Analytical Representation of the Earth's Magnetic Field in an Orbital System of Coordinates," Kosmicheskie Issledovaniia, Vol. 2, May-June, 1964. (In Russian.)

Shevnin, A. D., "The Magnetic Field of the Ring Current," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963 (Translation).

Presentation of a general solution to the problem of the magnetic field of a toroidal current of constant density. Formulas for the computation of the magnetic field are given in toroidal and cylindrical systems of coordinates.

III,
F. MAGNETIC FIELDS (CONT.)

Siebert, M., "Geomagnetic Pulsations with Latitude-Dependent Periods and Their Relation to the Structure of the Magnetosphere," Planetary and Space Science, Vol. 12, Feb. 1964.
Presentation of a model to explain the results of an evaluation of geomagnetic pulsations recorded simultaneously at two German observatories, according to which there is a systematic increase in the period of pc and pse-type H-components with increasing geomagnetic latitude, while the D-components hardly differs with latitude.

Sigov, I. S., and Tverskoi, B. A., "Structure of the Boundary Layer Between a Magnetic Field and a Plasma Stream," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).
Study of the boundary layer between a plasma stream and a magnetic field. The conditions under which charge separation and the electrostatic field can be neglected are presented, and it is shown that the thermal scatter of ion velocities leads to the formation of a thin layer of high particle concentration at the boundary of the plasma with the magnetic field.

Singer, S. F., "Forces and Torques Due to Coulomb Interaction with the Magnetosphere," Torques and Attitude Sensing in Earth Satellites, edited by S. F. Singer.
Analysis of the Coulomb forces and torques produced by interactions between an electrostatically charged satellite or space vehicle and the ions and electrons of the ionized gas through which it is moving.

Simonow, G. V., "Geomagnetic Time," Geophysical Journal, Vol. 8, Dec. 1963.
Derivation of exact formulas for computing geomagnetic time and geomagnetic noon and midnight referred to a centered dipole representation of the geomagnetic field.

Slee, O. B., "A Search for Radio Emission from Uranus at 11.3 Cm," Astrophysical Journal, Vol. 140, 2 (Aug. 15, 1964).
Uranus emits no non-thermal radiation component similar to Jupiter.

Smith, E. J., Sonnett, C. P., and Dungey, J. W., "Satellite Observations of the Geomagnetic Field During Magnetic Storms," Journal of Geophysical Research, Vol. 69, 13 (July 1, 1964).
During geomagnetic storms the geomagnetic field remains essentially dipolar, but is strongly perturbed out to distances of 8 earth radii. Measurements were from Explorer 6 (apogee at 8 earth radii).

Sonett, C. P., "The Distant Geomagnetic Field. V - Long-Period Oscillations," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963.
Discussion of long-period magnetic oscillations ($\geq$ 100 sec) seen on the Pioneer I flight. The indication is that these oscillations are comparable in scale to the magnetosphere and are primarily radial, that is, are contained in the geomagnetic meridian planes.

III,
F. MAGNETIC FIELDS (CONT.)

Sonett, C. P., "The Distant Geomagnetic Field. 5. Long-Period Oscillations," Repr. from J. Geophys. Res., Vol. 68, No. 24, 15 Dec. 1963.

Long-period magnetic oscillations ($\geq$ 100 seconds) seen on the Pioneer 1 flight are discussed. The indication is that these oscillations are comparable in scale to the magnetosphere and are primarily radial, that is, they are contained in geomagnetic meridian planes.

Smith, E. J., Sonett, C. P., and Dungey, J. W., "Satellite Observations of the Geomagnetic Field During Magnetic Storms," Repr. from J. Geophys. Res. Vol. 69, 13, 1 July 1964.

Explorer 6 satellite data and surface magnetograms are used to study the gradual and sudden commencement geomagnetic storms of August 16-18, 1959.

Smith, H. W., "Some Observations of Type Pc 1 Geomagnetic Micropulsations," Journal of Geophysical Research, Vol. 69, May 1, 1964. (Contracts Nonr 375(14); AF 19(605-8513).

Definition of the general characteristics of Earth currents and geomagnetic micropulsations in the Pc 1 band (0.2- to 5-sec period), based on observations made at three sites by the University of Texas.

Spreiter, J. R. and Summers, A. L., Effect of Uniform External Pressure and Oblique Incidence of the Solar Wind on the Terminal Shape of the Geomagnetic Field, Dec. 1963 (NASA-TR-R-181).

Approximate solutions and numerical results are given for the coordinates of the boundary separating the geomagnetic field from the interplanetary plasma for a $\pm 35^{\circ}$ range of angles between the direction of the incident stream and the geomagnetic equatorial plane for a model that assumes the plasma pressure exerted on the boundary to be composed of two components.

Spreiter, J. R. and Jones, W. P., "On the Effect of a Weak Interplanetary Magnetic Field on the Interaction Between the Solar Wind and the Geomagnetic Field," Repr. from J. Geophys. Res., Vol. 68, No. 12, 15 June 1963.

Recent developments have indicated the possibility that the presence of a weak interplanetary magnetic field may lead to the formation of a collision-free shock wave upstream from the boundary of the geomagnetic field, and to a transition region characterized by an irregular magnetic field in the intervening space.

Spreiter, J. R., and Alksne, A. Y., The Effect of a Ring Current on the Boundary of the Geomagnetic Field in a Steady Solar Wind, Dec. 1963 (NASA-TR-R-177).

Approximate solutions are given for the shape of the boundary separating a steady neutral stream of ionized solar corpuscles from the combined magnetic fields of a three-dimensional dipole and an equatorial ring current.

III,
F. MAGNETIC FIELDS (CONT.)

Stegelmann, E. J. and von Kenschitzki, C. H., "On the Interpretation of the Sudden Commencement of Geomagnetic Storms," Journal of Geophysical Research, Vol. 69, Jan 1, 1964. (Contract NASw-256).

Calculation of the geometric attenuation of hydromagnetic waves originating from discrete point sources, assuming the applicability of geometrical optics methods for the propagation of hydromagnetic waves. The waves are assumed to be generated by point sources located at a distance of 6 Earth radii from the center of the Earth.

Stepanian, A. A., "Some Properties of Anisotropy During the Forbush Effect," Geomagnetism and Aeronomy, Vol. 2, No. 3, 1962 (Translation).

Analysis of the properties of anisotropy for 14 steep drops in cosmic-ray intensity during magnetic storms with a sudden commencement, on the basis of observations by a number of stations during the International Geophysical Year.

Stinchcomb, T. G., "Time and Longitudinal Drift Integrals for Particle Motions in the Earth's Magnetic and Gravitational Fields," Journal of Geophysical Research, Vol. 69, May 1, 1964. Research supported by the Defense Atomic Support Agency.

Study of the effects of the gravitational field on the time and longitudinal drift integrals for particles moving slowly along a geomagnetic field line.

Stone, E. C., The Local Time Dependence of the Non-Stormer Cut-Off for 1.5 MeV Protons in the Quiet Geomagnetic Field, (Ph.D. Thesis) Feb. 1964 (NASA Grant NsG-179-61; Contract AF 49(638)-1008; AF AFOSR Grant-62-23)

Two solid-state detector telescopes, vertically and horizontally oriented, were launched into a polar orbit during a time of low geomagnetic activity.

Stone, E. C., "A Measurement of the Primary Proton Flux from 10 to 130 Million Electron Volts," Journal of Geophysical Research, Vol. 69, 19 (Oct. 1, 1964).

Limited data from a polar-orbiting satellite is consistent with earlier data but indicates an energy-dependence flatter than E^{-2}.

Stone, E. C., "Local Time Dependence of Non-Stromer Cutoff for 1.5 Mev Protons in Quiet Geomagnetic Field," Journal of Geophysical Research, Vol. 69, 17 (Sept. 1, 1964).

A small number of 1.5 Mev protons individually interact with the geomagnetic field at all latitudes above a characteristic cutoff latitude. The observed cutoff was 65° - 67° as compared with the theoretical Stormer cutoff of 76° (equivalent dipole latitude). Current theories are somewhat inadequate.

III,
F. MAGNETIC FIELDS (CONT.)

Suguiura, M., "Geomagnetic Disturbances," Repr. from Trans. Amer. Geophys. Union, Vol. 44, No. 2, June 1963 (NASA RP-47).
A review is given of research activities concerning geomagnetic disturbances from 1960-1963. The advancement in this field during this time period is attributed to the recognition of the importance of the magnetosphere in the interpretation of geomagnetic disturbances.

Sugiura, M., "Oscillation of the Geomagnetic Field Lines and Associated Magnetic Perturbations at Conjugate Points," Journal of Geophysical Research, Vol. 69, April 1, 1964 (NSF Grant No. G-14734; Contract No. AF 19(604)-7988.
Application of an idealized elastic string model to the study of the symmetry relations in the magnetic perturbation at a pair of conjugate points due to oscillation of the lines of force of the geomagnetic field.

Stone, R. G., Alexander, J. K., and Erickson, W. C., "Low-Level Decameter Emissions from Jupiter," Astrophysical Journal, Vol. 140, (July 1, 1964).
Observations at 26.3 Mc/sec show a large amount of weak activity with flux densities between 10^{-23} and 10^{-22} W/m^{2}cps, and a secondary strong-activity flux greater than $7 \cdot 10^{-22}$ W/m^2 cps. The region from 330° to 70° longitude appears devoid of activity.

Sugiura, M., and Wilson, C. R., "Oscillation of the Geomagnetic Field Lines and Associated Magnetic Perturbations at Conjugate Points," Journal of Geophysical Research, Vol. 69, 7 (April 1, 1964).
Geomagnetic field oscillations are discussed.

Swift, D. and Hessler, V. P., "A Comparison of Telluric Current and Magnetic Field Observations in the Arctic Ocean," Journal of Geophysical Research, Vol. 69, May 1, 1964 (Contracts AF 19(628)-2779; Nonr 3010(01); Nonr 1381(01).
Simultaneous observations of the H and D components of the magnetic field and of two components of telluric current were made on Arctic drifting station Charlie during the winter of 1959-1960 and on station Arlis 1 in early 1961.

Talwar, S. P., "Hydromagnetic Stability of the Magnetospheric Boundary," Repr. from J. Geophys. Res., Vol. 69, No. 13, 1 July 1964 (NASA-RP-297).
The problem of the stability of the interface between the solar wind and the magnetosphere is investigated by means of hydromagnetic equations. An explicit criterion of instability is written for the special case in which both the solar plasma and the magnetospheric medium are supposed to be of the same density and carry a uniform magnetic field in the direction of streaming.

III,
F. MAGNETIC FIELDS

Talwar, S. P., "Hydromagnetic Stability of the Magnetospheric Boundary," Journal of Geophysical Research, Vol. 69, 13 (July 1, 1964).

From hydromagnetic equations it is deduced that even under quiet solar conditions the magnetosphere boundary is likely to be unstable towards the tail.

Tamankin, P., "Effects of Neutrons from High-Altitude Detonations," Journal of Geophysical Research, Vol. 69, 13 (July 1, 1964).

For nuclear detonations above 30 km neutron decay is the dominant source of high-energy trapped proton fluxes and can be the major source of trapped electron fluxes.

Tamao, T., "A Hydromagnetic Interpretation of Geomagnetic SSC*," Report of Ionosphere and Space Research in Japan, Vol. 18, No. 1, 1964.

Tauer, J., "On Methods Used for Determining the Effect of a Solar Eclipse on The Geomagnetic Field," Studia Geophysica et Geodaetica, Vol. 8, No. 1, 1964.

Summary description of five most widely used methods for determining the effect of solar eclipse on the geomagnetic field, covering the comparative method, harmonic analysis method, difference curve method, method of adjusting mean hourly values of diurnal variation, and component vector method. Conditions under which these methods can be used and the degree of their accuracy are described.

Tauer, J., "A Hydromagnetic Model of the Solar Eclipse Effect on the Diurnal Variation of the Geomagnetic Field," Studia Geophysica et Geodaetica, Vol. 8, No. 3, 1964.

Tepley, L., "Low-Latitude Observations of Fine-Structured Hydromagnetic Emissions," Journal of Geophysical Research, Vol. 69, June 1, 1964 (Contracts AF 19(604)-5906; AF 19(628)-462).

Description and interpretation of regular micropulsations (0.02-7 cps) recorded by induction magnetometers located at four widely spaced Pacific Ocean stations.

Tepley, L. and Amundsen, K. D., "Notes on Sub-ELF Emissions Observed During Magnetic Storms," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964 (Contracts AF 19(604)-5906 AF 19(628)-462.

Presentation of recently observed properties of a type of fine-structured sub-ELF emission frequently observed during magnetic storms.

III,
F. MAGNETIC FIELDS (CONT.)

Tepley, L., Wentworth, R. C., and Amundsen, K. D., Sub ELF Geomagnetic Fluctuations. Volume I: Frequency-Time Characteristics of Hydromagnetic Emissions, Final Report, 8-08-64-1 (Contract AF 19(628)-462) (AD-437332).

Results are presented of recent measurements of hydromagnetic emissions at four Pacific Ocean stations widely separated in both latitude and longitude. The signals were observed simultaneously at the four locations.

Tamao, T., "Absorption of Short Period Hydromagnetic Waves by The Phase Mixing Process in a Model V_3-Belt," Report of Ionosphere and Space Research in Japan, Vol. 17, No. 1, 1963.

Determination of the characteristics of inward energy transmission of short-period hydromagnetic waves in the outer exosphere, using data obtained from satellites.

Troitskaia, V. A., "Classification of Rapid Variations of the Geomagnetic Field and Earth Currents," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964. (In Russian).

Troitskaya, V. A., "Rapid Pulsations of the Earth's Electromagnetic Field and Processes in the Upper Atmosphere," 8 April 1964, Transl . into English from Vestn. Akad. Nauk, SSSR (Moscow), No. 1, 1964.

The International Geophysical Year and the years that followed were a period of brisk development of work on short-period pulsations. Information on short-period pulsations was found to be quite necessary for practical work involved in the study of the structure of the earth's crust and exploration of minerals.

Van Allen, J. A., and Lin, W. C., "The Edge of the Polar Plateau for Galactic Cosmic Rays and Their Charged Albedo," Journal of Geophysical Research, Vol. 69, 3 (Feb. 1, 1964).

The edge of both polar plateaus is at about L = 2.9 and does not vary significantly.

Van'ian, L. L., "Build-Up of an Electromagnetic Field in an Anisotropic Layer," Academy of Sciences USSR, Bulletin, Geophysics Series, Oct. 1963 (Translation).

Van'ian, L. L., "Formation of a Magnetic Field in an Anisotropic Layer," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, Oct. 1963 (In Russian).

III,
F. MAGNETIC FIELDS (CONT.)

Vestine, E. H., Note on Low-Level Geomagnetic Ring-Current Effects, June 1963, (NASA Contract NAS4-21(05)) (NASA CR-56010; RM-3674-NASA).
Various measurements of the intensity of radiation within the inner Van Allen belt have indicated little possibility that the equatorial magnetic field of the belt should exceed one-half gamma.

Vestine, E. H. and Kern, J. W., "Geomagnetism and the Ionosphere," Prepared for Proc. of Conf. on Artificial Satellites, Blacksburg, Va., 12-16 Aug. 1963 (NASA Contract NASr-21(05)) (NASA CR-52904; P-2801).
The geometry of the magnetosphere and the dynamics of energetic particles and plasma trapped within it are discussed in relation to some problems of geomagnetism.

Vinogradov, P. A., "Solar-Day Variations of the Electrotelluric Field," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, April 1964. (In Russian).

Vinogradov, P. A., "P_t Pulsations in the Earth's Electromagnetic Field," Geomagnetizm i Aeronomiia, Vol. 4, Mar-Apr 1964 (In Russian).

Vints, B. D. and Privalova, L. A., "Correction of the Chart of Normal Geomagnetic Field Intensity T of the 1950 Epoch for the USSR (East of the Yenisey River)," Geomagnetism and Aeronomy, Vol. 2, No. 3, 1962 (Translation).
Description of the method of processing aeromagnetic and ground survey data used for the correction of the chart of normal geomagnetic field intensity T of the 1950 epoch in Russia.

Walt, M., Crane, G. E., and MacDonald, W. M., "Analysis of Atmospheric Loss Rates for Geomagnetically Trapped Electrons," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Edited by P. Muller. (DOD-Navy-supported research). Interscience Publishers, 1964.
Comparison of the theoretical results with the measured time-dependence of trapped electrons injected by high-altitude nuclear explosions, to evalute the loss mechanisms and to investigate quantitatively the role of atmospheric scattering.

Walt, M., "The Effects of Atmospheric Collisions on Geomagnetically Trapped Electrons," Journal of Geophysical Research, Vol. 69, 19 (Oct. 1, 1964).
After the high altitude nuclear explosion of July 9, 1962, measurements of Van Allen electron fluxes were made. Removal of electrons with magnetic shell parameter $L < 1.25$ appears to have been largely by atmospheric scattering. But for $L > 1.25$ some other mechanism appears to have been dominant.

III,
F. MAGNETIC FIELDS (CONT.)

Walters, G. K., "Effect of Oblique Interplanetary Magnetic Field on Shape and Behavior of the Magnetosphere," Journal of Geophysical Research, Vol. 69, 9 (May 1, 1964).

Calculations are made of the angular deflection of the solar wind (and hence of the magnetopause), as it traverses the standing hydromagnetic shock, due to the interplanetary magnetic field. The earth's orbital velocity also contributes to deflection (about 5°). The total deflection angle is probably 10° to 25°. Changes in the interplanetary magnetic field may account for Explorer 10's numerous encounters with the magnetospheric boundary.

Ward, S. H. and Fournier, H. G., Coherency of Geoelectromagnetic Signals, (Contract Nonr-222(89)) (AD-428953), 6 Nov. 1963

By theory and observation it is possible to demonstrate that the coherency between orthogonal electric and magnetic time series used in magnetotelluric sounding is a function of (1) the direction of the measuring axes, (2) the anisotropy ratio, (3) the coherency between the orthogonal H components, (4) the relative magnitudes of the orthogonal H components, and (5) the frequency.

Wentworth, R. C., "Enhancement of Hydromagnetic Emissions After Geomagnetic Storms," Journal of Geophysical Research, Vol. 69, June 1, 1964 (Contracts AF 19(604)-7989; AF 19(604)-5906; AF 19(628)-462).

Statistical examination of California records of hydromagnetic emissions for the period 1960-1963. No correlation is found between these signals and geomagnetic indices K_p, but the emissions tend to avoid quiet days and occur most frequently in the week following a geomagnetic storm.

Wentworth, R. C., "Evidence for Maximum Production of Hydromagnetic Emissions Above the Afternoon Hemisphere of the Earth. I - Extrapolation to the Base of the Exosphere," Journal of Geophysical Research, Vol. 69, July 1, 1964

Presentation of an empirical formula giving attenuation as a function of F2 peak ion density and hydromagnetic-wave frequency. The formula is applied to a 9-month data sample of hydromagnetic emissions (quasi-sinusoidal oscillations of the Earth's magnetic field in the frequency interval around 1 cps). Under the hypothesis that these signals are attenuated as they propagate downward through the ionosphere as hydromagnetic waves, the amplitude and frequency spectrum above the ionosphere at middle latitudes is deduced.

Wentworth, R. C., Sub ELF Geomagnetic Fluctuations. Volume II: Statistical Studies of Hydromagnetic Emissions, final report, (Contract AF 19(628)-462) (Rept. 8-08-64-1, Vol. II: AD-437330) (26 Dec. 1963).

An empirical formula giving attenuation as a function of F2 peak ion density and hydromagnetic wave frequency was applied to a 9-month data sample of hydromagnetic emissions (quasi-sinusoidal oscillations of the earth's magnetic field in the frequency interval around 1 cps). Under the

hypothesis that these signals are attenuated as they propagate downward through the ionosphere as hydromagnetic waves, the amplitude and frequency spectrum above the ionosphere at middle latitudes was deduced.

Wescott, E. M. and Mather, K. B., An Investigation of Solar Induced Phenomena at Magnetically Conjugate Points, final report, Part I, Contract AF 19(628)-2779) (UAG-R146; AFCRL-64-274; AD-602296), May 1964.

The results of a study of solar-induced geophysical phenomena at pairs of stations linked by a magnetic-field line have established that magnetic variations (except S_q), telluric currents, ionospheric absorption, visual auroras, very-low-frequency and extra-low-frequency emissions, and auroral X-rays occur in similar manners in conjugate areas - similar in time, form, and amplitude.

Wescott, E. M. and Mather, K. B., An Investigation of Solar Induced Phenomena at Magnetically Conjugate Points, Part 2 (Chapters IV-IX), final report, Contract AF 19(628)-2779) (UAG-R146, Pt. 2; AFCRL-64-274; Pt 2; AD-602297)

The results of a comprehensive study of solar induced geophysical phenomena at pairs of magnetically conjugate stations are presented. Magnetic variations (except Sq), telluric currents, ionospheric absorption, visual auroras, VLF and ELF emissions, and auroral X-rays occur in a similar manner in conjugate areas - in time, form, and amplitude.

Williams, D. J. and Bostrom, C. O., "Albedo Neutrons in Space, Journal of Geophysical Research, Vol. 69, 3 (Feb. 1, 1964).

Albedo neutron data from the Navy's satellite 1961$\alpha\eta 2$ are presented. Results from several investigators are tabulated and compared with theories of Hess, et al, and Lingenfelter. Little semblance of correlation is present.

Winch, D. E. and Slaucitajs, L., "Quiet Solar Daily Magnetic Variations at Toolangi, Victoria," Australian Journal of Physics, Vol. 17, June 1964.

Review of an analysis of the quiet-day solar daily variations (Sq) for all magnetic characteristics recorded at Toolangi, Victoria, from 1949-1958. The seasonal sets of values were subjected to classical harmonic analysis, and the times of occurrence of extrema and the percentage contributions of each harmonic to each extremum were found. Graphs of S_q in X, Y, and Z are given.

III,
F. MAGNETIC FIELDS (CONT.)

Yinn-Nien, H., "Postsunset Rise of f_0F_2 and Geomagnetic Activity," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964.

Investigation of the relations between the postsunset rise of f_0F_2 and h'F and geomagnetic activity. During the maximum epoch of the present sunspot cycle 19, owing to its unusually high solar activity, some anomalies in the postsunset rise of f_0F_2 at subtropical belts and the postsunset rise of h'F in the equatorial zone have been observed.

Zhigalov, L. N., "Some Peculiarities of Variations in the Vertical Component of the Magnetic Field of the Earth in the Arctic Ocean," Geomagnetic Disturbances, Dec. 1963.

The material of geomagnetic observations of the North Pole-6 drifting station has been considered together with the material of the USSR high latitudinal Arctic geomagnetic observatories. It is detected that, far from the auroral zone, the character of geomagnetic field disturbances is well correlated with the ocean depth.

No author, "Results of Observations of the Terrestrial Magnetic Field in 1963 - Geophysical Center, Dourbes," Institut Royal Météorologique de Belgique, Publications, Série A, No. 46, 1964 (In French and Flemish).

No author, "Telluric Bays and Disturbances," Transl. into English from Geol. i. Geofiz., Akad. Nauk SSSR, Sibirsk Otd. (Novosibirsk), No. 12, Dec. 1963. (JPRS-24049: OTS-64-21993)

Results are presented that support the close connection between the activities of the geomagnetic and telluric fields; the regularities of the daily, seasonal and cyclical changes in magnetic activity, established earlier for the middle latitudes, were also observed in the changes in the telluric field. It has been shown that both components of the electromagnetic field of the earth are subordinate to common statistical regularities.

No author, "Report on Gravimetric Work - Antarctic. I.," International Geophysical Year, Annals, Vol. 31, pt. 1, 1964 (In French).

No author, "Synoptic Charts of Magnetic Disturbance in the Arctic," Geomagnetic Disturbances, Dec. 1963 (Translation).

Based on the material of the Soviet high-latitudinal observatories and drifting stations, synoptical charts of magnetic disturbances ($r\chi_H$) have been made for 1957-1958.

III,
F. MAGNETIC FIELDS (CONT.)

No author, "Long-Period Gigantic Geomagnetic Field Pulsations," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).

Study of a special type of gigantic pulsation (Pgl) found in the magnetograms of polar observatories. The main characteristics of Pgl are their regular form, high amplitude, and long period.

No author, "Soviet Research on the Earth's Magnetic Field," Transl. into English of four articles from Uch. Zap. Liningr. Gos. Univ., Ser. Fiz. i Geol. Nauk Voprosy Geofiz., No. 13(303), 1962).

Contents:

1. Measurement of the Components of the Earth's Magnetic Field by the Proton Resonance Method, V. D. Lomanyy, A. G. Prokof'yev, and B. M. Yanovskiy.
2. The Use of Natural Electromagnetic Pulsations for Investigation of the Earth's Upper Layers, M. N. Berdichevskiy, B. Y. Bryunelli, A. Y. Lantsov, and O. M. Raspopov.
3. Construction of Magneto-Telluric Sounding Curves from Records of Short-Period Pulsations of the Earth's Natural Electromagnetic Field, A. A. Kovtun.
4. The Influence of the Earth-Air Discontinuity on the Electric Field of a Polarized Sphere, G. A. Tarasov.

III. INTERPLANETARY SPACE

G. IONOSPHERE

Aikin, A.C., Kane, J. A., and Troim, J., "An Interpretation of a Rocket Measurement of Electron Density in the Lower Ionosphere," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4 - 10, 1963, Proceedings, by Muller, P.

Presentation of midlatitude rocket measurements of the electron density at altitudes between 65 and 85 km. The included interpretation of the profile indicates that the region between 70 and 85 km is ionized by the action of Lyman alpha radiation on nitric oxide rather than by 2- to 8-A X-rays. Possible explanations are given for a minimum found in the electron density distribution in the vicinity of the mesopause.

Al'pert, Y. L., Dobryakova, F. F., Chudesenko, E. F., and Shapiro, B. S., "The Determination of Electron Density in the Outer Regions of the Ionosphere from Observations of Radio Signals Received From the First Artificial Earth Satellite," Advance in Physical Science, Vol. 65, No. 1-4, May - Aug. 1958 1964.

A method of obtaining information on the properties of the ionosphere by analyzing the radio observations from satellites is presented. The method is based on timing the satellite's "radio-rising" and "radio-setting," and can be used to determine the electron density distribution in regions above the ionospheric maximum. Preliminary results obtained by processing the observed data are presented.

Al'pert, Y. L., "Results of Ionospheric Studies Conducted by Coherent Radio Waves Radiated from Satellites," Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. (In Russian).

Anastassiades, M., Ilias, D., and Caroumbalos, C., "Ionospheric Absorption and Solar Activity in the Middle Latitudes," Advance in Upper Atmosphere Research, 1964.

Systematic measurements of ionospheric absorption with a riometer allowed the evaluation of the contributions of the F-region and D-region, respectively, and also an additional regional contribution to the total absorption. From these records, the rising velocity of the source of an outburst in the coronal medium could be determined.

Anufrieva, T. A., "Altitude Variation of the Maximum Electron Concentration in The F2 Region," Geomagnetizm i Aeronomiia, Vol. 4, (In Russian).

Aono, A., Tsukamoto, K., and Ichinose, M., IGC Data of Ionospheric Drifts at Yamagawa In Japan, Science Council of Japan, Tokyo, March 1963.

IGC Ionospheric drift measurement has been made at Yamagawa Station (Lat. 31° 12.5'N, Long. 130° 37.7'E) in Japan, using the closely spaced receivers fading method.

Aono, Y., Hirao, K., and Miyazaki, S., Profiles of Electron Temperature, Electron Density and Ion Density Observed with Kappa Rockets, International Symposium on Space Technology and Science, Tokyo, Japan, August 27 - 31, 1962, 4th, Proceedings, Edited by Nomura, T.

Presentation of the results of ionospheric measurements by means of the sounding rockets K-8-7 to K-8-10 (seventh and tenth of the Kappa-8 series).

Argence, E., "The Ionospheric Faraday Effect. I - General Study of Faraday Rotation," Zeitschrift fur angewandte Mathematik und Physik, Vol. 14., (In French) Sept. 1963.

Arendt, P. R., and Papayonaou, A., Conversion of Topside Ionograms to Exponential Electron-Density Profiles, Army Signal Research & Development Lab., Fort Monmouth, N.J. (1964)

Ionograms obtained from the Alouette Satellite suggest that above the F_2-layer the electron-density profile is an exponential or quasi-exponential function. This concept of electron distribution is used in reducing the ionograms to true-height profiles. The reduction yields the distribution as well as the altitude variation of the exponential function.

Arnold, H. R., "Comments on a Paper 'Collisional Detachment and The Formation of an Ionospheric'," by Pierce, E.T., Journal of Research, Section D - Radio Science, Vol. 68D, Feb. 1964.

Extension of and addition to the Pierce calculation of approximation of ion molecule collision rate. The calculations of ion concentrations can be used to obtain Pierce's C term.

Avan, L., and Gaillard, G., "Application of the Ionographic Method for the Study of the Presence of α Emissions in Natural Atmosphere," Academie des Sciences (Paris), Comptes Rendus, Vol. 258, Apr. 27, 1964. (In French).

Baker, D. C., and Gledhill, J. A., The F-2 Region of the Ionosphere Over Sanae, Antarctica, Cospar, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964.

Discussion and analysis of data gathered. The behavior of f^o_{F2} at the South African National Antarctic Expedition base is shown to be anomalous in the summer months, in that it reaches its maximum value at about 06 hr UT and its minimum at about 18 hr UT. A harmonic analysis of the data has been made and is presented in tabular form.

Balarama Rao, P., and Ramachandra Rao, B., "Height Variation of Drift and Anisotropy of the Ionospheric Irregularities," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Feb. 1964.

Study of the variation of drift and anisotropy characteristics of ionospheric irregularities with true height, using the "correlation function method."

Balser, M., and Wagner, C. A., "Thunderstorm Excitation of the Earth-Ionosphere Cavity," Agard Propagation of Radio Waves at Frequencies Below 300 kc/s 1964.

Early results of a program to study the spectrum of ELF radio noise in the band 5 to 30 cps were obtained by simulated filtering on a digital computer.

Bauer, S. J., and Jackson, J. E., "Alouette Mid-Latitude Topside Studies," I.G. Bulletin, Jan. 1964.

Review of the Alouette topside-sounder satellite studies conducted at the Goddard Space Flight Center. Data analysis techniques and the degree of accuracy of the soundings from Alouette were investigated.

Bauer, S. J., Blumle, L. J., Donley, J. L., Fitzenreiter, R.J., and Jackson, J. E., "Simultaneous Rocket and Satellite Measurements of the Topside Ionosphere," Journal of Geophysical Research, Vol. 69, Jan. 1, 1964.

Comparison of the electron density profiles obtained by the topside sounder of the Alouette satellite (1962 Beta Alpha 1) with similar data obtained with an Argo D-4 rocket launched from Wallops Island, Va., July 2, 1963, to intersect the Alouette orbit.

Bauer, S. J., and Blumle, L. J., "Mean Diurnal Variation of the Topside Ionosphere at Mid-Latitudes," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964.

Presentation of the mean diurnal behavior of the mid-latitude topside ionosphere for the 3-month period from Oct. through Dec. 1962. There is also the suggestion of latitude gradients in the electron temperature and mean ionic mass.

G. IONOSPHERE (cont.)

Bauer, S. J. and Jackson, J. E., A Small Multi-Purpose Rocket Payload for Ionospheric Studies, NASA-TN-D-2323 , June 1964.

A miniaturized version of the two-frequency cw-propagation experiment was developed for ionospheric measurements using small sounding rockets. If ranging errors during the propulsion phase can be overcome, the complete rocket trajectory can be calculated with an accuracy of 1% of the maximum altitude from the Doppler data at a single receiving site.

Barbier, D., "Comparison of Photometric and Ionospheric Observations of the F-Layer (Comparaison D'Observations Photometriques Et Ionospheriques De La Couche F)." Academie des Sciences (Paris), Comptes Rendus, Vol. 257, no. 15, Oct. 7, 1963. In French.

Barth, C. A., "Rocket Measurement of the Nitric Oxide Dayglow," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper, NAS7-100.

Description of the most prominent features of dayglow spectral scans: the Γ bands of nitric oxide.

Bates, D. R., "Chemical Reactions Contributing to the Nightglow," Faraday Society, General Discussion on Chemical Reactions in the Atmosphere, Edinburgh, Scotland, Apr. 2, 3, 1964, Paper 3164.

Brief survey of recent work on chemical reactions contributing to nightglow. The view is expressed that, in spite of the difficulty in interpreting certain laboratory measurements, the Chapman and the Barth mechanisms should continue to be regarded as possible sources of λ 5577, and that the three-body recombination of oxygen atoms should continue to be regarded as a possible source of the Herzberg and Atmospheric bands. It is noted that the position regarding the D-doublet of sodium remains undecided.

Barrington, R. L., and Thrane, E. V., "Electron Density Profiles in the Quiet D-Region Derived from Observations of Cross Modulation," Agard Propagation of Radio Waves at Frequencies Below 300 kc/s 1964.

Observations of pulsed cross modulation were made during quiet days in the spring, summer, and fall of 1960. A brief description of the experimental method is given.

Belrose, J. S., and Burke, M. J., "Study of the Lower Ionosphere Using Partial Reflection. I - Experimental Technique and Method of Analysis," Journal of Geophysical Research, Vol. 69, July 1, 1964.

Study of electron density and electron collision frequency in the lower ionosphere, using recordings of the amplitude of weak echoes partially reflected from ionization irregularities in the height range 50 - 100 km. The presented method of analysis is essentially similar to that developed by Gardner and Pawsey, except that the generalized magneto-ionic formulas, which take into account the energy dependence of the collision cross section, are employed.

Belrose, J.S., "Present Knowledge of the Lowest Ionosphere," AGARD Propagation of Radio Waves at Frequencies Below 300 kc/s, (1964), Pergamon Press & Macmillan Co.

Deductions about the physical parameters of the ionospheric D-region have usually been made indirectly by studying its effects on waves that have traversed it, reflected in layers above (MF and HF absorption measurements), or by studying waves returned from within it on a few isolated frequencies (IF and VLF propagation experiments). The current state of knowledge concerning the D-region is summarized.

Belrose, J. S., and Hewitt, L. W., "Variation of Collision Frequency in the Lowest Ionosphere with Solar Activity," Nature, Vol. 202, Apr. 18, 1964.

Presentation of data concerning the collisions between electrons and neutral molecules in the D-region of the ionosphere, which suggest a correlation between collision frequency and solar activity.

Belugin, V. F., "Monthly Forecasts of the F_2 Layer's Maximum Usable Frequency," Tr. Inst. Zemnogo Magnetizma, Ionosferi i Rasprostraneniya Radiovoln(Moscow), no. 19(29), 1961. Translation into English May 17, 1963.

Two forms of presentation of the maximum usable frequency (MUF) forecasts of the F2 layer are presented, along with the method for preparation of forecasts in the preferred form.

Ben'kova, N. P., and Vasil'ev, K. N., "The E-Layer at Low Latitudes According to Investigations on the Schooner Zarya," (Geomagnetizm i Aeronomiia, Vol. 3, no. 1, 1963) Geomagnetism and Aeronomy, Vol 3, no. 1, 1963. (Translation)

Study of the latitudinal distribution of f_0E at all hours of the day in various low latitude locations. A formula for the diurnal variation of f_0E is obtained.

Besprozvannaia, A. S., "The Relationship Between Disturbance of the F2 Layer and Planetary Magnetic Activity," (Geomagnetizm i Aeronomiia, Vol. 3, no. 2, 1963) Geomagnetism and Aeronomy, Vol. 3, no. 2, 1963. (Translation)

Presentation of the results of an analysis of the relationship between the disturbances of the F2 layer and magnetic activity, based on data for 30 stations located to the north of 55° geomagnetic latitude during the period from April through September 1958.

Besprozvannaya, A. S., On the Estimation of the F2 Layer Disturbance in the High Latitudes, Feb. 26, 1963. (Translation)

The possibility of an estimate of the F2-layer disturbance in the high latitudes by the method of the magnitude of deviation of critical frequencies, taking into account the peculiarities of the high latitudinal ionosphere, is considered.

Besprozvannaia, A. S. "Spatial Variability of Disturbance of the F2 Layer," (Geomagnetizm i Aeronomiia, Vol. 3, no. 2, Geomagnetism and Aeronomy, Vol. 3, no. 2, 1963. (Translation)

Study of the spatial variability of distrubances in the F2 layer in the high latitudes, using f_0F2 values for all days from April through September 1958, regardless of the level of magnetic activity. On the basis of an analysis of the relationship between the Δf_0F2 values of longitudinally widely separated stations in a relatively narrow zone of latitudes, it is shown that there is a sharply developed diurnal dependence of the degree of correlation.

Beynon, W. J. G., and Jones, E. S. O., "Collision Frequency in the Ionosphere and Solar Activity," Nature, Vol. 203, Sept. 12, 1964.

Discussion of evidence for a variation in collision frequency with solar activity in the ionosphere obtained at an altitude of about 110 km.

Bibl, K., "A Note Regarding Fluctuation of Ionization in the F2 Layer," Advan. in Upper Atmosphere Res. Pergamon Press, 1963.

Considerations regarding the dynamical properties of the F-2 ionization are essential for the understanding of the relation between the ionospheric storms and the normal variations of the F-2 ionization with the time of day, season, solar cycle, and geographic and geomagnetic latitude.

Boenkova, N. M., "The Latitudinal and Seasonal Distribution of Maximum and Minimum Diurnal Values of f_0F2 (O Shirotnom I Sezonnom Raspredelenii Maksimal'nykh I Minimal'Nykh Sutochnykh Znachenii f_0F2)." Geomagnetizm i Aeronomiia, Vol. 4, No. 1, 1964. In Russian.

Bondarenko, L. N., "Spectropolarimetry of the Twilight Sky at the Zenith (Spektropolyarimetriya Sumerochnogo Neba V Zenite)." Astron. Zh. (USSR), V.41, no. 2, 1964. (Translation) 8 Jul. 1964. (NAS5-2078)

As the sun sets below the horizon, light is scattered by higher and higher atmosphere layers. Observation data on sky light polarization at the zenith were obtained at different moments of twilight, in the morning and evening.

Bourdeau, R. E., and Donley, J. L., Explorer VIII Satellite Measurements in the Upper Ionosphere, NASA-TN-D-2150, Jun. 1964.

This is an extensive report on upper ionospheric ion composition, electron temperature, and spacecraft plasma interaction, all measured by Explorer VIII. The measured orientation sensitivity of three types of current flowing between the satellite and the ionosphere is described.

Blamont, J. E., and Chanin Lory, M. L., "Temperature Measurements in the Ionosphere from 100 to 400 KM Between 1960 and 1964," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper.

Presentation of data, in the form of diagrams, on neutral gas temperature measurements in the ionosphere from 100 to 400 km between 1960 and 1964, using the absorption technique.

Braginskiy, S. I., "Structure of the F-Layer and Reasons for Convection in the Earth's Core," July 16, 1963, Doklady Akad. Nauk SSSR, v. 149, no. 6 Apr. 21, 1963. (Translation)

A hypothesis on the structure of the F layer at the boundry of the earth's inner core is given, and the nature of convection in the earth's core is discussed. Studies of the Jeffries effect (velocity drop in the F layer) and the Gutenberg effect (wave dispersion in the transient layer) are utilized in forming the hypothesis of the structure of the F layer.

Calvert, W., and Schmid, C. W., "Sprend-F Observations by the Alouette Topside Sounder Satellite," J. Geophys. Res., v. 69, no. 9, 1 May 1964. NASA

Ionograms recorded by the Alouette topside sounder satellite exhibit a variety of spred-F echo configurations. Spread F appeared on 54% of the topside ionograms; the three types exhibit markedly different patterns of occurrence in geomagnetic latitude and local time.

Chapman, F. W., and Jones, D. L., "Earth-Ionosphere Cavity Resonances and Effective Ionospheric Parameters," Propagation of Radio Waves at Frequencies Below 300 kc/s, Pergamon Press and Mc Millan Co., 1964.

The cavity resonator region of the natural electromagnetic noise spectrum has been observed since June 1961 by means of an integrating spectrometer that sweeps the frequency range 4 to 40 cps in a period of one hour.

Chapman, F. W., and Jones, D. G. C., "The Influence of the Ionosphere on the Polarization of V.L.F. and E.L.F. Radio Waves," Propagation of Radio Waves at Frequencies Below 300 kc/s, Pergamon Press and Mc Millian Co., 1964.

Measurements of the polarization of atmospheric waveforms have been made in the frequency range 500 cps to 12 kcps, for propagation distances between 300 and 3,000 km.

Chasovitin, Iu. K., and Solchatova, L. Ia., "The Dependence of Characteristics of the E_s Layer on the Sensitivity of Receiving Apparatus," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 5, 1963. (Translation)

Consideration of the influence of the technical parameters of the receiving equipment on the observed characteristics of the sporadic E Layer.

Collinge, J., and Haynie, W., Measurement of 15-Micron Horizon Radiance From a Satellite, (AF 04(695)-160), 1 Mar. 1963.

An orbital test program was conducted providing radiometric measurement of the sky-CO_2 horizon profile. The horizon profile was measured by detectors responding to radiation from spectral bandwidths of about 1.0, 2.0, and 3.0 μ centered near 15 μ.

Conway, D. C., "Ion Clusters in the Ionosphere," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Analytical study of the possibility that O_4^+ ion clusters might exist below 100 km in the ionosphere. These clusters would be present for conditions where the equilibrium (O_4^+/O_2^+) ratio for the reaction $O_2^+ + O_2 = O_4^+$ is greater than unity. Mechanisms for the formation and for the dissociation of O_4^+ are examined, based on available data, and methods by which future measurements could be used to determine the existence of ion clusters are noted.

G. IONOSPHERE (cont.)

du Castel, F., Faynot, J. M., and Vila, P., "Influences of Particles on Some Ionospheric Irregularities," I - Ducted Echoes Observed by Topside Sounding, II - Travelling Disturbances Observed in the Bottom and Topside of the Ionosphere, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper. In French.

Clemesha, B. R., Kent, G. S., Koster, J. R., and Wright, R. W., Equatorial Study of Irregularities in the Ionosphere, Final Report, 1960 - 1963, (AF 61(052)-421) Aug. 1963.

Contents:

1. Clemesha, B. R., and Wright, R. W. H., "Field Strength Measurements of the Transmissions from the Thule and Fairbanks Backscatter Sounders."
2. Clemesha, B. R., and Wright, R. W. H., "Group-Delay Measurements on the 16,570 Mc/s. Pulsed Transmissions From Freiburg."
3. Kent, G. S., and Koster, J. R., "An Investigation of Irregularities in the Night-Time Equatorial F Region."
4. Clemesha, B. R., and Wright, R. W. H., "The Scattering of Radio Waves From the Ionosphere."
5. Clemesha, B. R., "The Elongation of Irregularities in the Equatorial Ionosphere."
6. Koster, J. R., "Some Measurements of the Sunset Fading Effect."
7. Clemesha, B. R., "An Investigation of the Irregularities in the Ionosphere Associated with Equatorial Type Spread-F."

Clemesha, B. R., "An Investigation of the Irregularities in the F Region Associated with Equatorial Type Spread-F," Equatorial Study of Irregularities in the Ionosphere, Ghana University(Legon), August 1963.

The results are given of an investigation of spread-F irregularities, using a backscatter radar operating on a frequency of 18 mc.

Clemesha, B. R., "An Investigation of the Irregularities in the F-Region Associated with Equatorial Type Spread-F," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Jan. 1964.

Presentation of the results of an investigation of spread-F irregularities, using a backscatter radar operating on a frequency of 18 Mc/s.

Conley, T. D., and Blood, D., Sunrise Effects on East-West Ionospheric Propagation Paths, (AFCRL-64-346; AD-601686), May 1964.

The extent of propagation afforded by the ionosphere is analyzed during the sunrise period on long east-west paths. During this period the propagation conditions are examined as functions of distance along the path and of time. The propagation losses are attributed primarily to absorption in the lower ionosphere and the ground when multiple E-layer modes occur at the eastern end of the paths.

Crouse, P. E., Methods for Obtaining Electron Density Profiles From Capactive Ionospheric Rocket Probes Scientific Report No. 208, (NASA-CR-58605; AFCRL-64-529), 15 May 1964.

Two rockets were fired in which the nose-cone was insulated and the resistive and capacitive components of the admittance of two frequencies were measured between this insulated portion of the rocket and the main rocket body.

Cutolo, M., "On Some New Properties of the Lower Ionosphere," Agard Propagation of Radio Waves at Frequencies Below 300 kc/s, Pergamon Press, 1964.

The main nonlinear effects discovered in the ionosphere (Luxembourg-Gargov effect, self-modulation, gyrointeraction,etc.) are dealt with.

Danilkin, N. P., and Zhuchenko, S. A., "Computer Calculation of Nz-Profiles of the Ionosphere Taking into Account Both Components of a Split Signal (Raschet Nz-Profilei Ionosfery S Uchetom Obeikh Komponent Magnitorasshcheplennogo Signala Na Evm)," Geomagnetizm I Aeronomiia, Vol. 4, Mar. - April 1964. In Russian.

Danilkin, N. P., "Ionization of the F-Region of Ionosphere Above Moscow During The Solar Eclipse of 1964 (Ionizatsiia Oblasti F Ionosfrey Nad Moskvoi Vo Vremia Solnechnogo Zatmeniia 1961 Goda)," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964. In Russian.

Danilov, A. D., and Yatsenko, C. P., "Experimental Investigation of the Constants of Ionospheric Ion Exchange Processes," Cosmic Res., v.2, no. 2, 8 June 1964.

A description is given of the first experiment in the rate of basic ion exchange in the ionosphere by means of an "air-discharge" device and a radiofrequency mass spectrometer, both of which were installed on a geophysical rocket.

Danilov, A. D., and Ivanov-Kholodnyi, G. S., "Experimental Data on the Magnitude of Energy Sources in the Ionosphere," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 5, 1963. Translation.

Calculations of the energy balance in the Earth's upper atmosphere from various experimental data. It is concluded that the most reliable data on the magnitude of energy sources in the ionosphere indicate a value of 3 - 10 ergs/cm^2 sec. A number of problems concerning the energy source and the energy balance in the Earth's upper atmosphere are discussed.

Danilov, A. D., "Some Questions Connected with Recombination and Ionization Processes in the Earth's Atmosphere," (Iskusstvennye Sputniki Zemli, No. 15, 1963), Planetary and Space Science, Vol. 11, Nov. 1963. Translation.

Danilov, A. D., and Iatsenko, S. P., "Experimental Investigation of the Constants of Ion-Exchange Processes in the Ionosphere (Eksperiment Po Issledovaniiu Konstant Ionno-Obmennykh Protsessov V Ionosfere)," Kosmicheskie Issledovaniia, Vol. 2, Mar. - Apr. 1964. In Russian.

Danilov, A. D., and Yatsenko, S. P., "Experiment Concerned with the Investigation of Constants of Ion-Exchange Processes in the Ionosphere (Eksperiment Po Issledovaniyu Konstant Ionno-Obmennykh Protsessov V Ionosfere)," Kosmich. Issled., v. 2., no. 2., 1964. (Contract NAS5-2078)

This is a description of the first experiment for the study of the rate of basic ion-exchange processes in the ionosphere with the aid of the device "Vypusk vozdukha" of "Air Release" and of a radiofrequency mass spectrometer, installed in a geophysical rocket.

Davidson, D., and Gallant, R. M., Investigation of Ionospheric Oblique Sounder Data, Scientific Report No. 1, (Contract AF 19(628)-3267), 2 Apr. 1964.

During October and November 1962, simultaneous vertical HF ionospheric soundings were taken at Midway, Johnston, and Palmyra Islands. This report uses the observed vertical soundings to predict oblique propagation, using four methods, for the Midway-Palmyra path (3000 km).

Davies, F. T., "Alouette Topside Ionosphere Studies," IG Bulletin, No. 79, Jan. 1964.

Review of the Alouette topside sounder satellite studies conducted at the Canadian Defence Research Telecommunications Establishment.

G. IONOSPHERE (cont.)

Dessler, A. J., The Dissipation of Hydromagnetic Wave Energy in the Ionosphere, April, 1964.

The basic concepts of ionospheric heating by hydromagnetic waves are reviewed. The theoretical aspects are well understood and were treated at length in the literature.

Dubrovskii, V. G., and Kramarenko, S. A., "Some Additional Comments on the Diurnal and Geographic Distribution of Ionospheric and Magnetic-Ionospheric Disturbance," (Geomagnetizm i Aeronomiia, Vol. 3., no. 2, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 2, 1963. Translation.

Discussion of the results of a study of the diurnal, seasonal, and latitude distributions of disturbances in the F2 layer of the ionosphere in order to determine the influence of geomagnetic activity on the diurnal distribution of disturbed hours in the F2 layer.

Dueño, B. , Ionospheric Propagation Studies, Final Report, (Contract AF 19(604)-8342), 1 June. 1964.

Conditions of minimum time delay focusing, for spherical earth geometry, are obtained, assuming on ionosphere with a parabolic distribution of electron density.

Duncan, R. A., "Luni-Solar Variations in the Ionsphere," Australian Journal of Physics, Vol. 17, Mar. 1964.

Examination of Martyn's luni-solar analyses of $h^{max}F_2$ and f_0F_2 at Huancayo, Peru, and Canberra, Australia. Not all the coefficients are felt to be significant. Significant variations are attributed to electric currents in the E region setting up polarization which is conducted along the geomagnetic field lines to the F region. The E region near the magnetic equator appears to fail abruptly as a dynamo at sunset, while the E region above Canberra remains active until midnight.

Dobrovol'skiy, S. P., "The Nature of Noctilucent Clouds," Noctilucent Clouds and Cosmic Dust on Earth, 10 June 1964.

Two hypotheses are considered: the condensation theory and the meteor theory. Although the author favors the condensation theory, he does not affirm that noctilucent clouds consist exclusively of the products of cosmic water.

Evans, J. V., "Ionospheric Temperatures During the Launch of NASA Rocket 8.14 on July 2, 1963," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964.

Presentation of the results of radar measurements made during the time of the flight of the NASA rocket 8.14 from Wallops Island at 0921 EST on July 2, 1963.

G. IONOSPHERE (cont.)

Ellis, G. R. A., "The F_2 Component of Cosmic Radio Noise Absorption," Australian Journal of Physics, Vol. 16, Sept. 1963.

Calculations of the attenuation of cosmic radio waves expected in the F region. The amount of attenuation is generally less than 0.2 db, providing the wave frequence is greater than twice the critical penetration frequency for wave frequencies less than 10 Mc.

Fastie, W. G., Grosswhite, H. M., and Heath, D. F., Rocket Spectrophotometer Airglow Measurements in the Far Ultraviolet, (NASA-TN-D-2362), Jul. 1964.

Aerobee rockets carried far-ultraviolet spectrophotometers to an altitude of about 210 km. The experimental data obtained from these flights are presented.

Fastie, W. G., and Crosswhite, H. M., Far U. V. Dayglow Measurements: Atomic Oxygen, Jun. 1964.

An experiment designed to obtain information about the radiative transfer process in atomic oxygen is discussed. The instrumentation used in the experiment are described, and data from two flights are presented in graphic form.

Fatkullin, M. N., "The Heating of the Ionosphere by Current Systems," (Geomagnetizm i Aeronomiia, Vol. 3, no. 4, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 4., 1963. Translation.

Discussion of ionospheric heating with the comment that, according to estimates made, the role of regular current systems in the heating of the upper atmosphere is apparently insignificant.

Fatkullin, M. N., "Estimation of the Vertical Distribution of S_q-Current Densities (Otsenka Vertikal'nogo Raspredeleniia Plotnosti S_q-Tokov)", Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. In Russian.

Faynot, J., "Observation of Itinerant Disturbances in the Lower and Upper Ionosphere (Sur L'Observation De Perturbations Itinerantes Dans L'ionosphere Inferieure Et Superieure)," C. R. Acad. Sci. Ionosphere, V. 258, no. 23, (Contract NAS5-2078), 8 Jun. 1964.

Mechanisms that might explain itinerant disturbances observed in the lower and upper ionosphere are discussed.

Fejer, J., "Incoherent Scattering As a New Technique in Ionospheric Investigations," Agard Advan. in Upper Atmosphere Res., 1963.

Theories of incoherent scattering are discussed, and the present state of the incoherent scattering theory is described. Experimental observations of this type of incoherent scattering (back-scattering) are compatible with this theory and provide some useful, though not very accurate, information on electron densities and temperatures in the ionosphere, both below and above the peak of the F-2 region.

Fejer, J., "Theories of the Ionospheric F Region," A Review, Agard Advan. in Upper Atmosphere Res., 1963.

Various theories of the ionospheric F-region are reviewed. These theories deal mainly with the three different causes of movements of ionization in this region, as follows: (1) diffusion that attempts to establish a hydrostatic equilibrium in the ionized components of the earth's atmosphere in the presence of the earth's gravitational field; (2) the existence of electric fields acting in combination with the earth's magnetic field; and (3) the existence of a wind (a motion of the neutral particles) within the F-region.

Fitzpatrick, J. A., and Pantoja S, J., "Unusual Fishbone Echoes Observed on Ionograms Having a Virtual Height of 1500 Kilometers," Journal of Geophysical Research, Vol. 69, Mar. 1, 1964.

Brief description of the modifications made on the C-4 ionosonde in operation at Instituto Geofisico de los Andes Colombianos, Universidad Javeriana, so that virtual heights up to 1500 kilometers could be recorded; previously recordings were made to a maximum virtual height of 1000 kilometers.

Fitzenreiter, R. J., and Blumie, L. J., "Analysis of Topside Sounder Records," Journal Geophysical Research, Vol. 69, no. 3, (NASA RP-169), Feb. 1964.

A discussion is presented of methods for interpreting the data obtained by the Alouette, including an outline of a technique for reducing the topside sounder satellite data to electron density distributions with height. The most useful feature for plan for the collection of hydrometeorological information and the technical reorganization of the service are discussed.

Foderaro, A., "Another Possible Explanation of Sudden Atmospheric Ionization in Regions Shadowed from High-Altitude Nuclear Burst," Journal of Geophysical Research, Vol. 69, Contract No. Nonr 3851-(00), Aug. 1, 1964.

Description of a neutron transport mechanism for explaining the sudden changes in VLF propagation characteristics, presumably due to increased D-layer ionization, which commence less than one second after a high-altitude nuclear burst.

Frihagen, J., "Study of Fine-Scale Ionospheric Structure by Satellite Techniques," Radio Astronomical and Satellite Studies of the Atmosphere, Contract No. AF 61(051)-344, 1963.

Discussion of satellite scintillations observed at Kjeller, Norway (60°N, 11°E), and Tromso, Norway (70°N, 19°E), on 20 Mc and 108 Mc. It is shown that the horizontal extent of the ionospheric region giving rise to scintillation is normally of the order of several hundred kilometers. The height of the region is almost always 300 - 500 km. The structure of the pattern over the ground is highly elongated.

Fuks, N. A., "Steady-State Distribution of Aerosol-Particle Charges in a Bipolar-ionized Atmosphere (O Statsionarnom Raspredelenii Zariadov Aerozol'Nykh Chastits V Bipoliarno Ionizirovannol Atmosfere)," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, Apr. 1964. In Russian.

Gachechiladze, R. G., and Khocholaya, G. M., "The State of Ionosphere at Middle Latitudes During Magnetic Storms Associated With an Anomalous Absorption at the Polar Cap (Sostoianie Ionosfery V Srednikh Shirotakh Vo Vremia Magnitnykh Bur', Sviazannykh S Anomal'nym Pogloshcheniem V Poliarnoi Shapke)," Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. In Russian.

Gagnon, R. J., An Approximate Method for Computing Difraction Patterns Caused by Ionospheric Irregularities, Boeing Scientific Research Labs., Aug. 1963.

A method, suitable for investigation of ionospheric phenomena, is derived for computing the amplitude and phase characteristics of an electromagnetic wave after it has been perturbed by a phase distorting screen.

Garriott, O. K., and de Mendonca, F., "A Comparison of Methods Used For Obtaining Electron Content From Satellite Observations," Journal Geophysical Research, Vol. 68, no. 17, 1 Sep. 1963.

Measurements of the effects of the ionosphere on the polarization and the Doppler shift of radio transmissions from earth satellites permit the electron content of the ionosphere to be calculated.

Gershman, B. N. "Appearance of Ionospheric Inhomogeneities in the F-Layer," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5, 1963), Geomagnetism and Aeronomy, Vol, 3, no. 5, 1963. Translation.

Proposal of a mechanism for the formation of ionospheric discontinuities. The mechanism is associated with the instability of the drift motions of charged particles in the F-layer.

Getmantsev, G. G., and Denisov, N. G., Results From the Investigations of the Ionosphere by the Methods of Impulse Sounding and Artificial Satellites, 1963.

This report contains a review of investigations carried out at Gorki and Moscow Universities from 1960 to 1963. These complex investigations made use of radio astronomy, impulse sounding, and artificial satellites.

Gillett, F. C., Huch, W. F., Ney, E. P., and Cooper, G., "Photographic Observations of the Airglow Layer," Journal Geophysical Research, Vol. 69, no. 13, NASA, 1 Jul. 1964.

The night airglow photographs taken by Gordon Cooper during his orbital flight of May 15 and 16, 1963, are discussed.

Goldberg, R. A., Kendall, P. C., and Schmerling, E. R., "Geomagnetic Control of the Electron Density in the F Region of the Ionosphere," Journal Geophysical Research, Vol. 69, no. 3, (NASA-RP-263), 1 Feb. 1964.

The solution of a problem recently treated by Goldberg and Schmerling is written in a simple closed form. The problem concerns a possible explanation of the geomagnetic anomaly in terms of diffusion along the magnetic lines of force for a special model of the F_2-layer at the magnetic equator.

Gdalevich, G. L., "Measurement of the Electrostatic Field Strength at the Surface of a Rocket Flying Throught the Ionosphere (Izmereniye Napryaz-Hennosti Elektrostaticheskogo Polya U Poverkhnosti Rakety Vo Vremya Yeye Poleta V Ionosfere)", Iskusstv. Sputniki Zemli, (NASA-TT-F8527), Oct. 1963. Translation.

This article examines conditions at the surface of a rocket in the ionosphere in relation to electrostatic field measurements, describes the equipment used for these measurements on three vertically launched Soviet geophysical rockets, and reports and discusses the results of these experiments.

Goldberg, R. A., Kendall, P. C., and Schmerling, E. R., "Geomagnetic Control of the Electron Density in the F Region of the Ionosphere," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.

Presentation of a closed-form analytic solution to a problem treated by Goldberg and Schmerling. The problem concerns a possible explanation of the geomagnetic anomaly in terms of diffusion along the magnetic lines of force for a special model of the F_2 layer at the magnetic equator.

Golomb, D., Rosenberg, N. W., Wright, J. W., and Barnes, R. A., "Formation of an Electron Depleted Region in the Ionosphere by Chemical Releases," Cospar, International Space Science Symposium, 4th, Warsaw, Poland, June 3 - 11, 1963, Paper.

Goncharova, E. E., "The Sporadic E-Layer at High Latitudes During Magnetic Disturbances (Sporadicheskii Sloi E V Vysokikh Shirotakh Vo Vremia Magnitnykh Vozmushchenii)," Geomagnetizm i Aeronomiia, Vol. 4, no. 1, 1964. In Russian.

Gossard, E. E., and Paulson, M. R., Electron Density Profile in the Ionosphere D-Region. Construction of a Model Accounting for Certain Characteristics of the Large, Nighttime, Phase and Amplitude Fluctuations of VLF Signals in Arizona During Summer, (NEL 1178; AD-422949), 23 Aug. 1963.

The objective was to develop a capability for predicting the phase and amplitude of VLF radio signals, specifically, to devise a model or mechanism to explain why the ionospheric D-region exhibits more irregular fluctuations at night than during the day.

Grigor'iev, G. I., and Dokuchaiev, V. P., "The Influence of Diurnal Variation of the Electric Conductivity of the Ionosphere on the Spectrum of S_q Variations," (Geomagnetizm i Aeronomiia, Vol. 3, no. 2, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 2, 1963. Translation.

Study of the effect of changes, with time, in electric conductivity of the ionospheric dynamo region on the spectrum of quiet diurnal variations of the Earth's magnetic field. It is shown that this influence is considerable. The spectra of geomagnetic variations for constant electric conductivity, which changes with time, do not coincide.

Grigor'ev, G. I., "The Effect of Electron-Ion Collisions on the Diffusion of Electron Concentration Inhomogeneities in the Ionosphere (Vliianie Soudarenii Elektronov S Ionami Na Diffuziiu Neodnorodnostei Elektronnoi Kontsentratsii V Ionosfere)," Geomagnetizm i Aeronomiia, Vol. 4, no. 1, 1964. In Russian.

Gringauz, K. I., Gorozhanki, B. N., Shyutte, N. M., and Gdalevich, G. L., "Altitude Distribution of Charged Particles in Ionosphere and Transitional Region Between Oxygen and Helium Ionic Layers by Data From Experiments with Ion Traps on Satellite "Kosmos-2"," Dokl. Akad. Nauk SSSR, V. 151, no. 3, 1963. Translation.

Experiments conducted with ion traps on cosmos-2 attest that previous observations of charged particles in the ionosphere and between oxygen and helium ionic layers have been correct. However, peculiarities that were noted of the external ionosphere are inherent only in the period closest to the maximum of solar activity, and change with time.

Gringaux, K. I., "Some Results of Experiments in the Ionosphere and Interplanetary Space Made in 1961 - 1962 on Geophysical Rockets of the USSR Academy of Sciences, The Cosmos 2 Satellite and the Mars 1 Space Probe," Intern. Sci. Radio Union 1963.

This report reviews the following experiments: (1) the determination of electron concentration from measurements of radio-wave dispersion and of the Faraday effect by means of geophysical rockets; (2) the direct detection of an electric field in the ionosphere by means of an electrostatic fluxmeter mounted on rocket; (3) measurements of the structure of the ionosphere from the time of maximum solar activity, according to probe measurements on Cosmos II; and (4) plasma measurements by means of charged particle traps on the Mars I space probe.

Gringauz, K. I., Gorozhankin, B. N., Shutte, N. M., and Gdalevich, G. L., "Changes of the Distribution of Charged Particle Density With Height and of the Ionic Composition of the Outer Ionosphere Since the Solar Activity Maximum According to Data Collected by Ion Traps on the Cosmos 2 Satellite," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4 - 10, 1963, Proceedings.

Discussion of the results obtained in 1962 with the Cosmos-2 satellite. It is concluded that the changes in the structure and ionic composition of the ionosphere seem to be connected with the decrease of solar activity.

Gush, H. P., and Buijs, H. L., "The Near Infrared Spectrum of the Night Airglow Observed from High Altitude," Canadian Journal of Physics, Vol. 42, June 1964.

Presentation of a complete spectrum of the airglow between 1.2 and 2.5 μ obtained with a Michelson interferometer carried to an elevation of 90,000 ft by a balloon. The complete $\Delta v = 2$ sequence of rotation-vibration OH bands has been observed at a resolution sufficient to resolve the rotational structure. The (0,0) band of the electronic transition $^1\Delta_g - {}^3\Sigma^-_g$ of oxygen at 1.27 μ has been observed in the night-sky spectrum for the first time. Its brightness is comparable with that of the (4, 2) OH band at 1.6 μ.

Hagfors, T., and Landmark, B., "The Angular Law of Scattering in VHF Ionospheric Forward Propagation," Agard Advan. in Upper Atmosphere Res.,1963.

A theory is presented whereby it is possible to separate the two main signal components in an ionospheric forward scatter signal, through the study of the angular power law at the receiver.

Hanson, W. B., McKibbin, D. D., and Sharp, G. W., "Some Ionospheric Measurements with Satellite-Borne Ion Traps," Journal of Geophysical Research, Vol. 69, July 1, 1964.

Presentation of results obtained with ion traps of plane geometry which were flown in polar-orbiting oriented satellites, one in Oct. 1961 and one in Apr. 1962. Several results from these flights are at variance with present understanding of the ionosphere.

Harnischmacher, E., Research on Ionospheric Structure and Motion, (AF 61(052)-81), 15 Nov. 1963.

Individual fadings observed with six antennas are reduced for different combinations of three of them. The differences between dirft vectors so found are statistically analyzed.

Hasigawa, S., Omiya, N., Nishikori, K., Ikeda, M., and Suzuki, K., "Observation of the Ionosphere and Absorption of Medium Frequency Waves During the Solar Eclipse in Hokkaido on July 20, 1963," Radio Research Laboratories, Journal, Vol. 11, May 1964.

Description of vertical incidence ionospheric sounding and absorption measurements of broadcast frequency, made at several stations during the total eclipse on July 20, 1963.

Heckman, H. H., and Nakano, G. H., Direct Observations of Mirroring Protons in the South Atlantic Anomaly, (Contract W-7405-ENG-48), 15 May 1964.

Nuclear track emulsions recovered from oriented polar-orbiting satellites are being used to carry out a systematic study of the high-energy geomagnetically trapped protons (E > 58 Mev) in the region of the South Atlantic anomaly.

Heikkiia, W. J., and Matthews, D. L., "Direct Observations of Low-Energy Electrons in the Disturbed Ionospheric E-Region," Nature, Vol. 202, May 23, 1964.

Results of observations of auroral absorption by the Black Brant II rockets launched in 1963 at Churchill, Manitoba. The absorption events, usually lasting from a few minutes to about an hour, are considered caused by the injection into the ionosphere of electrons of energy less than 100 kev.

Helliwell, R. A., "Whistlers," Propagation and Instabilities in Plasmas; Proceedings of the Seventh Lockheed Symposium on Magnetohydrodynamics, Palo Alto, Calif., Dec. 14, 15, 1962.

General discussion of the nature of ionospheric whistlers. Dispersive effects in whistler-mode propagation are analyzed, and the directions of wave normals and ray paths are discussed. Also considered are coupling between ionosphere and Earth-ionosphere waveguides, and absorption of energy from the whistler mode as it passes through the ionosphere. Man-made whistler-mode signals are briefly considered.

Herman, J. R., Antarctic Research and Data Analysis. Atmospheric Radio Noise at Byrd Station, Antarctica. Scientific Report 9, (Contract NSF-C255), March 1958 - Dec. 1959. 27 Dec. 1963.

Since no thunderstorms occur at Byrd, the atmospheric noise is received only by ionospheric propagation modes from distant sources, such as the major active centers in Central Africa, the East Indies, and Central and South America.

Hibberd, F. H., A Study of the Ionosphere at Mid Latitudes Based on Total Electron Content, Scientific Report, Jul. 1961 - Jun. 1962, (NASA-CR-56935; SR-213), 10 Jul. 1964.

This report describes a study of the total electron content of the ionosphere, derived from satellite doppler measurements, for July 1961 through June 1962. By combining the electron content with simultaneous values of the maximum electron density and true height data obtained from a nearby ionosonde, scale heights and temperatures were obtained. The variations of the electron content and other ionospheric parameters with time of day, season, solar radio flux, and magnetic disturbance were investigated.

Hines, C. O., Correction to "Internal Atmospheric Gravity Waves at Ionospheric Heights," Canadian Journal of Physics, Vol, 42, July 1964.

Hines, C. O., "The Formation of Midlatitude Sporadic E Layers," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Review of the results of Rosenberg et al, on the simultaneous detection of sporadic E layers and wind shears at heights of 95 - 110 km compared to Whitehead's conclusions. It is pointed out that a reinterpretation of the data is required as a consequence of a correction to Whitehead's analysis.

Hirao, K., Wakai, N., Sawada, K., Hikosaka, T., Yano, K., and Maeda, K., Some Evidences of the Particle Effects on the Ionosphere at the Middle Latitude," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper.

Discussion of evidence of particle effects on the ionosphere at middle latitudes. The electron temperatures in the ionosphere is high at the high latitude region in quiet condition. It becomes much higher than usual in the low latitude region and in the period of disturbance.

Hirao, K., and Muraoka, T., "Results From the Joint Japanese - US Rockets Probes," International Symposium on Space Technology and Science, Tokyo, Japan, August 27 - 31, 1962, 4th Proceedings, 1963.

Description of a cooperative experiment of rocket measurements of the ionosphere. It is concluded that the observed electron density profile agrees well with that of ionograms, and its detail profile provides suggestions for the interpretation of complicated ionograms.

Holmes, J. C., Johnson, C. Y., and Yound, J. M., "Ionospheric Chemistry," COSPAR Meeting in Florence, May 1964.

Day and night observations were made of the positive ion composition of the ionosphere between 120 and 230 km. Certain chemical reactions were found to be consistent with the experimental observations.

Holt, O., "Multistation Riometer Observations of Sudden Ionospheric Disturbances," Radio Astronomical and Satellite Studies of the Atmosphere, (Contract No. AF 61(052)-526), 1963.

Study of the absorption of cosmic radio noise during sudden ionospheric disturbances, using riometers at several locations. The absorption is compared with quantities describing the simultaneous solar flare, and some correlation with the flare importance and the central meridian distance of the flare is found.

Hughes, J. V., "Sky Brightness as a Function of Altitude," Applied Optics, Vol. 3, Oct. 1964.

Review of experimental evidence. The brightness equation from Rayleigh's theory of scattering is presented.

Huguenin, G. R., Investigation of the Outer Ionosphere by Observations of Extraterrestrial Low-Frequency Noise in Space Vehicles, Final Report, (Contract AF 19(604)-6120), Mar. 1964.

A total of 41 radiometers for 15 separate rocket probes and satellites were instrumented. The large amount of original work conducted in ionospheric focusing and Z-mode propagation provides a potential tool for obtaining highly directive observations with modest satellite payloads.

Hultqvist, B., "Studies of Ionospheric Absorption of Radio Waves by the Cosmic Noise Method," Radio Astronomical and Satellite Studies of the Atmosphere, (Contract No. AF 61(514)-1314 and AF 61(052)-601), 1963.

Discussion of a method for evaluating the ionospheric attenuation of radio waves, by measuring cosmic noise power, and determining from its amplitied, the absorption of the radio waves passing through the ionosphere, taking into account the sidereal time variation of power on undisturbed days.

Ignatov, V. S., "Disturbance of the Ionosphere at the Geomagnetic Poles," Geomagnetism and Aeronomy, Vol. 2, no. 3, 1963. Translation.

Investigation of certain parameters of the disturbed ionosphere at the geomagnetic poles. The diurnal and seasonal variations of the given characteristics at Vostok station in the region of the sough geomagnetic pole are determined, and the results are compared with ionospheric data from Thule, located in the region of the north geomagnetic pole.

Iudovich, L. A., "Cyclic Variations in the Anomalous Ionization of the F2-Layer (Tsiklicheskie Izmeneniia Anomol'noi Ionizatsii Sloia F2)," Geomagnetizm i Aeronomiia, Vol. 4, Mar. - Apr. 1964. In Russian.

Ivanov-Kholodni, G. S., "On the Interpretation of the Seasonal Variations of Electron Density in the F_2 Region of the Ionosphere," Space Research IV; International Space Science Symposium, 4th Warsaw, Poland, June 4 - 10, 1963, Proceedings, 1964.

Presentation of an explanation of the seasonal variations of the electron density in the F_2 region of the ionosphere. These variations have been observed by ionospheric sounding stations, and they are characterized by the "anomalous" increase of daily n_eF_2 in winter, especially during the maximum of the solar activity. Conclusions following from this approach to the anomalous seasonal variations of n_e are presented.

Ivanov-Kholodnyi, G. S., "Investigation of the Electron Concentration in the Lower Ionosphere (D-Region) (Issledovanie Elektronnoi Kontsentratsii V Nizhnei Chasti Ionosfery (Oblast' D) Obzor)," Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. In Russian.

Ivanov-Kholodnyi, G. S., "Intensity of Short-Wave Solar Radiation and the Rate of Ionization and Recombination Processes in the Ionosphere," Geomagnetism and Aeronomy, Vol. 2, no. 3, 1962. Translation.

Review of problems associated with the interpretation of new data obtained by rockets and artificial Earth satellites. The examination of the data obtained from the measurements of ion composition and corpuscular radiation in the ionosphere shows that the present concepts about recombination and ionization rates in the ionosphere are incorrect.

Jacobs, K. G., and Rawer, K. "Electron Density Measurements in the Ionosphere Over the Sahara With A Variable Frequency Impedance Probe," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper, (Contract No. AF 61(052)-290).

Brief discussion of electron-density measurements, made on May 1, 1963, with a Veronique rocket flown over Hammaguir (Sahara), using variable frequency sweeping over a large frequency range. Three rocket packages were developed which differed in frequency ranges of the oscillators. The frequency variations were obtained by magnetization of the ferrite core supporting inductance of the oscillating circuit. Results are discussed as a function of height, emphasizing phenomena appearing above 150 km.

Jarrett, A. H., Hoey, M. J., and Paffrath, L., "Observations of the 6300 Å Oi Emission of the Nightglow With A Pressure Scanning Fabry-Perot Interferometer," Planetary and Space Science, Vol. 12, June 1964.

Presentation of the results of observations of the nightglow 6300 Å OI emission made at l'Observatoire de Haute Provence with a 7-cm clear aperture pressure-scanning Fabrey-Perot interferometer. Profiles of the 6300 nightglow emission yielded temperatures ranging from 500 to 1700°K for the pre-dawn and post-twilight periods.

Jun, Li, "The Application of Correlation Analysis Methods to the Study of Ionospheric Irregularities," (Acta Geophysica Sinica, Vol. 11, no. 2, 1962) Scientia Sinica, Vol. 13, Jan 1964. Translation.

Comparison of several methods of correlation analysis used to study small-scale irregularities in the ionosphere. The computational labor involved in the Phillips and Spencer correlation method is noted, as are several deficiencies inherent in this method.

Kanellakos, D. P., "Origin and Location of Ionospheric Perturbations Affecting The Instantaneous Frequency and Azimuthal Angle of Arrival of HF Waves," Radio Astronomical and Satellite Studies of the Atmosphere, (Contract No. Nonr-225(33), John Wiley and Sons Inc., 1963.

Presentation of a new technique for studying the effects on the ionosphere of electromagnetic and corpuscular radiation emitted during solar flares and a few geomagnetic storms. From the variations of these characteristics as a function of time, frequency, and radio path length, the location and type of perturbation in the ionosphere are deduced.

Kantor, G., The Whistler-Hydromagnetic Extension of Magneto-Ionic Theory, (AFCRL-63-929; AD-430051), Dec. 1963.

The whistler-hydromagnetic extension of magnetoionic theory is studied in detail, and includes derivations of exact and approximate expressions for the phase refractive index; computation of numerical values, considering protons; plots of standard curves, as well as refractive index surfaces; and plots of error curves for the approximations.

Karyagina, Z. V., "The Hydroxyl Emission in the Airglow Spectrum From Observations in Alma-Ata," Aurorae and Airglow, NASA, May 1964.

According to the observations in Alma-Ata, the absolute intensities and rotational temperatures of OH bands (6.1 and 9.3) are determined. The relation between the intensity of OH bands and the rotational temperature for $T \leq 250°K$ has not been detected.

Kato, S., "Movement of Ionized Irregularities in the Upper Atmosphere," Planetary and Space Science, Vol. 12, Jan. 1964.

Study of the movements of ionized irregularities taking into account the motion along the external magnetic field. Unlike two-dimensional weak irregularities, three-dimensional irregularities cannot preserve their shapes. The velocity of plane weak irregularities is calculated under a number of ionospheric conditions.

Kazimirovskii, E. S., "Horizontal Drift of Ionization Inhomogeneities in the Upper Ionosphere," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5), Geomagnetism and Aeronomy, Vol. 3, no. 5, 1963. Translation.

Results of an analysis of measurements of the horizontal drift of ionization discontinuities in the F-region of the ionosphere at 28 stations during the IGY. It is shown that there is a single system of movements, and the main parameters of this system are computed.

Kazimirovskii, E. S., "The Latitude Variation of Midday Directions of the Horizontal Drift in the Lower Ionosphere," (Geomagnetizm i Aeronomiia, Vol. 3, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 3, 1963. Translation.

Evaluation of data from 15 Northern Hemisphere stations during the IGY-IGC period to establish that the midday direction of drift changes linearly with geomagnetic latitude in the summer months.

Kendall, P. C., and Windle, D. W., "Combined Effects of Drift and Diffusion is the F2 Region," Nature, Vol. 203, July 18, 1964.

Examination of the problem of a self-maintained equilibrium layer in the absence of electron production and loss. The latitude distribution of f_0F_2 characteristically exhibits an anomalous equatorial through (Appelton anomaly). The equilibrium diffusion-drift equation may then be transformed into an equation in one variable and integrated under suitable boundary conditions. The solution to the equilibrium diffusion equation is graphically compared with Croom's measured results.

Kerblai, T. S., "Critical Frequencies Reflected From the Thin E_s Layer in the Case of Incidence at an Angle (Predel'nye Chastoty, Otrazhaiushchieisia Ot Tonkogo Sloia E_s Pri Naklonnom Padenii)," Geomagnetizm i Aeronomiia, Vol. 4, no. 1, 1964. In Russian.

Kerblai, T. S., and Volshinova, Z. V., "Estimate of Surface Inclinations of Equal Electron Concentrations in the Ionosphere by the Data on Ionization Distribution With Height," Geomagnetizm i Aeronomiya, Vol. 4, no. 1, Contract NAS5-2078, 1964. Translation.

Data on surface inclinations of equal electron concentrations are discussed. Especially considered are the inclinations due to different altitudes of equal electron concentrations h_{N_c} at various latitudes of different illuminance (because of latitude distribution of h_{N_c}. The conclusion had been derived that h_m, y_m converted into h_{N_c} maps may be used for estimating the effect of inclination during the propagation of shortwaves.

Knox, F. B., "A Contribution to the Theory of the Production of Field-Aligned Ionisation Irregularities, in the Equatorial Electrojet," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Feb. 1964.

Development of a theory which shows that in the presence of crossed electric and magnetic fields fluctuations of ionization density may increase in amplitude where gradients of mean ionization density or electric field exist.

G. IONOSPHERE (cont.)

Kokourov, V. D., "The Phenomenon of Scattered Reflections as an Experimental Basis for Studying the Nonhomogeneous Structure of the Ionosphere (Lavlenie Rasseiannykh Otrazhenii Kak Eksperimental'Naia Osnova Izucheniia Neodnorodnoi Struktury Ionosfery)," Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. In Russian.

Kokurin, Ju. L., "Results of a Radioastronomical Investigation of Heterogeneous Structure of the Ionosphere," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4 - 10, 1963, Proceedings, Ed. by Muller, P., Interscience Publishers, (1964).

Discussion of the measurements of the irregular ionospheric refraction of radio waves of $\lambda = 4$ m in the interval of the zenith angles from 70° to 90°. The possible connection between the appearance of the wavy heterogeneities and solar activity is noted.

Krasil'nikov, D. D., "On the Origin of Large Ionization Bursts Observed Under Dense Materials Near Sea Level," Cosmic Rays, NASA, Jul. 1964.

The results of an evaluation of the contribution of μ-meson showers to the observed burst frequency near sea level are given. This estimate is based upon a detailed examination of transition effects, and it yields conclusions as to the spin and magnetic moment of the μ-meason.

Krassovskii, V. I., Truttse, Iu. L., and Shefov, N. N., "Night Ionosphere Maintaining Mechanism," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper.

Review of several studies of the night ionosphere and a presentation of some data on corpuscular ionization obtained by Cosmos Satellites. The possibility and corpuscular ionization takes place in zones of high latitude and sporadically at low latitudes during the night is also considered.

Iavrova, E. V., "Three-Dimensional Distribution of Ionospheric Disturbances in the F_2-Layer (Prostranstvennoe Raspredelenie Ionosfernykh Vozmushchenii V Sole F_2)," Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. In Russian.

III,

G. IONOSPHERE (cont.)

Liemohn, H. B., and Scarf, F. L., Whistler Determination of Electron Energy and Density Distributions in the Magnetosphere, Boeing Scientific Research, 1963.

Fifty-seven nose whistlers recorded at 5 stations were employed to test the validity of model magnetospheric electron distributions and two theories for the upper cutoff frequency of the whistler signal.

Likhachev, A. I., "Dependence of F_2-Layer Ionization on the Influx of Solar Energy into the Atmosphere," Geomagnetism and Aeronomy, Vol. 2, no. 3, 1962. Translation.

Examination of the relationship between the state of ionization of the F_2-layer, the zenith angle of the Sun, and the influx of solar energy into the Earth's atmosphere, on the basis of observations at Tomsk and other ionospheric stations during and prior to the International Geophysical Year. It is shown that this phenomenon affects the correlation between the state of ionization of the F_2-layer and solar activity.

Link, F., Neuzil, L., and Zacharov, I., "The Importance of High Diffusion During Twilight (Sur L'Importance De La Diffusion Elevee Pendant Le Crepuscule)," Studia Geophysica et Geodaetica, Vol. 8, no. 3, 1964. In French.

Lyarkhova, L. N., "A Short-Range Prediction of the State of the Ionosphere," Trans. of the Acad. of Sci. of the USSR, Ints. of Earth's Magnetism, the Ionosphere, and Radio Wave Propagation, Air Force Systems Command, 14 Feb. 1963.

An examination of the space-time variability of the critical frequencies of the F-2 layer during disturbances showed that the layer does not vary more on quiet days then on stormy days, except for during large storms. This was the basis of compilation of a forecast by extrapolation several hours in advance, and is more accurate than a forecast using the average characteristics.

Maeda, K., Obayashi, T., and Kimura, I., "Rocket Observation of the Ionosphere by Using The VLF Doppler Technique," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8 - 20, 1964, Paper.

Investigation of ionospheric electron density using the radio Doppler technique, carried out in a Japanese rocket L-2-2, launched December 11, 1963, from the Kagoshima Space Center. The difference between ascent and descent frequencies is attributed to a latitude difference of approximately 400 km between the ascent and descent observing points.

III,

G. IONOSPHERE (cont.)

Mariani, F., "Evidence for the Effect of Corpuscular Radiation on the Ionosphere," Journal Atmospheric Science, Vol. 20, no. 6, NASA RP-144 6 Nov. 1963.

The correlation of maximum electron density in the F region at noon, with solar activity, is investigated for both long-term and month-to-month variations, in data for 1937 to 1957 from all existing observations. The energy of the ionizing particles is in the range of Kev. Quantitative evidence is given that Van Allen Belts could be an important, or possibly the main, source.

Mariani, F., "Pitch-Angle Distribution of the Photoelectrons and Origin of the Geomagnetic Anomaly in the F_2 Layer," Journal of Geophysical Research, Vol. 69, no. 3, NASA-RP-213, 1 Feb. 1964.

A major anomaly of the F region is the equatorial or geomagnetic anomaly, which consists of the pronounced minimum of f_oF_2 on the geomagnetic equator and two maximums near 20° north and south latitude, at meridian hours and in the afternoon, in every season.

Masonson, M., Schmidt, A., and Weber, S., Microwave Radio Relay. Ionospheric Transmission Models, Task 5 Final Report, 28 Mar. - 30 Sep. 1963, (Contract DA-36-039-SC-87240), Radio Corp. of America, 30 Sept. 1963.

This report covers the following: (1) Rayleigh fading and normal noise; (2) development of power spectra and correlation functions required to describe a fading carrier in a noise background; (3) actual error-rate analysis; (4) specular component, multipath overlap, and minimum-error combiners; and (5) experimental data on the stability of carrier phase over a high frequency circuit.

Maynard, L. A., and McAlpine, J. L., "Total Electron Content Measurements During the July 20, 1963, Solar Eclipse," Canadian Journal of Physics, Vol. 42, Sept. 1964.

Results of measurements of the Faraday rotation of returned radar echoes from the Moon, recorded at Prince Albert, Sakatchewan (53°13'N, 105°56'W).

III,

G. IONOSPHERE (cont.)

McClure, J. P., "The Height of Scintillation-Producing Ionospheric Irregularities in Temperate Latitudes," Journal of Geophysical Research, Vol. 69, July 1, 1964.

Discussion of measurements of the heights of ionospheric irregularities responsible for radio satellite scintillation. These measurements were made directly by using spaced receivers on 130 passages of Transit 4A.

McClure, J. P., and Swenson, Jr., G. W., Beacon Satellite Studies of Small Scale Ionospheric Inhomogeneities, NASA-CR-56481, May 1964.

The height of the irregularities responsible for scintillation was measured by the cross-correlation method for 130 satellite passages. A concise expression was obtained for the cross-correlation as a function of the thickness and average height of a uniform slab of irregularities, the size of the irregularities, and the receiver spacing.

Meinel, A. B., and Meinel, C. P., "Low-Latitude Noctilucent Cloud of 2 November 1963," Science, Vol. 143, Jan. 3, 1964.

Measurement of the filamentary noctilucent cloud of 2 November 1963. The height of the cloud was 56 km. Subsequent measurement of the points along the cloud yielded heights, range, and velocity of the cloud.

Mendonça, F. de, "Ionospheric Studies With the Differential Doppler Technique," (Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of the Atmosphere, Corfu, Greece, June 1962), Radio Astronomical and Satellite Studies of the Atmosphere, Wiley and Sons (1963).

Review of ionospheric measurements in which the differential Doppler technique is utilized. Comments are also made about the method of combining the differential Doppler with the Faraday rotation measurements to establish a necessary constant of integration in the measurements made with satellites.

Mendonça, F. de, Ionospheric Electron Content Measurements in Regions of Low Magnetic Dip Angles and Through the Brazilian Magnetic Anomaly, May 1964.

Differential Doppler measurements made with harmonically related frequencies transmitted from satellites are utilized for calculation of the latitudinal and diurnal variations of the total electron content of the ionosphere.

III,

G. IONOSPHERE (cont.)

Merrill, R. G., Lawrence, R. S., and Roper, N. J., "Synoptic Variations and Vertical Profiles of Large-Scale Ionospheric Irregularities," Journal of Geophysical Research, Vol. 68, no. 19, Oct. 1, 1963.

Analysis of Faraday rotation records obtained from observations of satellite $1958\delta_2$ during 18 months revealed that those irregularities that average 300 km in spatial extent occur mostly at night but show no seasonal variations, unexpectedly decrease in amplitude with increasing magnetic activity while showing no trend in spatial extent, and show negligible variation with satellite height and elevation angle.

Millman, G. H., "Ionospheric Investigations By Radar Reflections From Echo I," (Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of the Atmosphere, Corfu, Greece, June 1962), Radio Astronomical and Satellite Studies of the Atmosphere, NATO, Contract No. AF 30(602)-224, Wiley and Sons, 1963.

Consideration and comparison of two methods for evaluating the integrated electron density in the ionosphere from the amplitude of radar pulses reflected off the surface of a spherical satellite.

Miner, R. J., Observations of Ionospheric Behavior During the Solar Eclipse of 20 July 1963 at Bedford, Massachusetts, AFCRL-64-24; AD-432045, Jan. 1964.

Observations of the ionosphere during the July 20, 1963, solar eclipse at Bedford, Massachusetts, are presented. A series of optical photographs of the sun in eclipse, taken at ground level, are presented.

Minnis, C. M., "Annual Variations in E-Layer Ionization," Nature, Vol. 202, Apr. 11, 1964.

Brief note on the functional relation between the critical frequency of the E-layer index by several authors are compared.

Mitiakov, N. A., and Mitiakova, E. E., "A Method for Investigation of the Ionosphere by the Ground Reception of Radio Signals from Artificial Earth Satellites," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 5, 1963. Translation.

Method for measuring the electron concentration in the ionosphere by recording the phase shift of coherent frequency signals - i.e., harmonics derived from an internal reference signal, emanating from an artificial satellite. Examples are given of the computation of ionospheric parameters for two radio contacts in the Crimea with the satellite Cosmos 1 (1962 Theta 1).

III,

G. IONOSPHERE (cont.)

Mityakova, E. E., "Measurement of Electron Concentration in the Ionosphere by Observations of the Faraday Effect of Signals From Earth's Artificial Datellites (Izmereniye Elektronnoy Kontsetratssi V Ionosfere Po Nablyudeniyam Effekta Faradeya Radiosignalov Isz)," Geomagnetizm i Aeronomiya, Vol. 4, no. 4, (Contract NAS5-3760), 1964. Translation.

A method is worked out for analyzing the Faraday fadings of signals from satellites in a vertical column of unitary cross section. Calculation formulas and their limits of applicability are obtained. The results of processing of amplitude registrations of signals from Cosmos-1, Cosmos-2, and Explorer-VII are presented.

Mitra, A. P., "Recombination Processes in the Ionosphere," Agard Advan. in Upper Atmosphere Res., Pergamon Press, 1963.

The various loss processes operating in the ionosphere and contributing to the effective recombination coefficient are surveyed.

Moorcroft, D. R., "On The Determination of Temperature and Ionic Composition by Electron Backscattering From the Ionosphere and Magnetosphere," Journal of Geophysical Research, Vol. 69, Contract No. AF 19(604)-7436, Mar. 1, 1964.

Observations of the scattering of electromagnetic waves from thermal fluctuations in the electron density of the ionosphere and magnetosphere have previously been used to investigate ion and electron temperatures and the electron density.

Morozov., V. M., "The Primary Scattering of Light in Twilight (O Pervichnom Rasseianii Sveta V Sumerki)," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, May 1964. In Russian.

Morozov, V. M., "Spectral Composition of the Variable Emission Component in the Continuous Spectrum of the Night Sky (O Spektral'nom Sostave Peremennoy Sostavlyayushchey Izlucheniya V Nepreryvnom Spektre Nochnogo Neba)," Astron. Zh. (USSR), Vol. 41, no. 2, (Contract NAS5-2078), 1964. Translation.

Various data on the night sky emission in the continuous spectrum are briefly summarized. Data on large variations of the spectral composition of the continuum are not corroborated, and the possible variations lie within small limits.

III,

G. IONOSPHERE (cont.)

Mullen, J. P., Daniels, G., and Allen, R., Investigating Ionospheric Ducting With The Orbis Beacon, (AFCRL-64-29: AD-430420), Jan 1964.

An experiment is described that uses a satellite-borne, two-frequency HF beacon to perform a synoptic investigation of ionospheric ducting. The expected ducting modes are described qualitatively and quantitatively using the AFCRL ray-tracing computers. System calculations, based upon estimated ionospheric parameters, are contained in the Appendix.

Muzzio, J. L. R., Computation of Group Velocities in the Ionosphere, (LAFE-10), Mar. 1964.

Simple mathematical formulas for the calculation of group velocity, group path, and attenuation of electromagnetic waves in the ionosphere were developed by Millington (1938). The Milligton expressions are adapted for the calculation of the group velocity of ordinary and extraordinary rays. The computations were performed on an IBM-1620 data-processing system.

Rao, G. L. N. and Rao, B. R., "World Wide Study to Apparent Horizontal Movements in F2-Region of the Ionosphere," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Feb. 1964.

Analysis of the results of a study of latitude variation of apparent horizontal movements in the F2-region of the ionosphere, using data procured from the World Data Center for 1958. Conclusions relate horizontal movements to latitude and time.

Nelms, G. L., "Ionspheric Results From the Topside Sounder Satellite Alouette," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4 - 10, 1963, Proceedings, Interscience Publishers, 1964.

Presentation of results obtained with the artificial Earth satellite, Alouette, which contains an ionospheric sounder consisting of a pulse transmitter and receiver sweeping in frequence from 0.5 to 11.5 Mc. Some of the types of records obtained from the satellite are presented, and analyses are summarized.

Nestorov, G., and Samardzhiev, D., "The Appearance of a Daily E-Layer and the Absorption in the D-Region of the Ionosphere at Sunrise (Poiavlenie Dnevnogo Sloia E I Pogloshchenie V Oblasti D Ionosfery Pri Voskhode Solntsa)," Geomagnetizm i Aeronomiia, Vol. 4, Mar. - Apr. 1964. In Russian.

III,

G. IONOSPHERE (cont.)

Nestorov, G., Taubenheim, J., "Investigation of the E Layer of the Ionosphere at the Time of the Solar Eclipse of 15 February 1961," (Geomagnetizm i Aeronomiia, Vol. 3, no. 2, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 2, 1963. Translation.

Estimation of the critical frequencies f_0E of the normal E layer, measured at Sofia and Nessebar, Bulgaria, at the time of the total eclipse of February 15, 1961.

Nicalet, M., and Swider, Jr., W., The Ionospheric Conditions, (Contract AF 19(604)-4563; Contract DASA-WEB-07010; NSF), 10 Sep. 1963.

A general analysis of ionospheric conditions has been made in the light of possible ionic reactions occurring in the upper atmosphere.

Noxon, J. F., "A Study of the 6300 Å Oxygen Line in the Day Airglow," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Analysis of measurements from the ground of the oxygen red line at 6300 Å in the day airglow, for the period June 1962 - Dec. 1963. It is suggested that a significant contribution to these fluctuations may arise from the excitation of oxygen atoms by relatively high-temperature electrons in the F region of the ionosphere.

Obezgel'diev, O., and Kozsunova, L. P., "Study of Drift in the E-Region of the Ionosphere (Issledovanie Dreifa V E Oblasti Ionosfery)," Akademiia Nauk Turkmenskoi SSR, Izvestiia, no. 2, 1964. In Russian.

O'Brien, B. J., Allum, R., and Goldwire, H. C., Rocket-Borne Measurement of Mid-Latitude Airglow and Particle Precipitation, (Contract NASr-209), 1964.

A simultaneous measurement of midlatitude night airglow and particle fluxes was made with a Nike-Apache rocket fired from Wallops Island, Virgina, near midnight and new moon. The results, therefore, prove that less than approximately 3% of midlatitude 5,577 A night airglow can be termed a permanent aurora.

Odintsova, I. N., "Effects of Solar Flares in the E and D Layers of the Ionosphere," (Geomagnetizm i Aeronomiia, Vol. 3, no. 4, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 4, 1963. Translation.

Discussion of the effects of chromospheric flares of importance 2 and 3 at the time of their occurrence during the IGY period, on the basis of data from the world network of vertical sounding ionospheric stations.

G. IONOSPHERE (cont.)

Ovezgel'dyev, O., and Korsunova, L. P., "The Sporadic E-Layer of the Ionosphere and Diurnal Variations of the Earth's Geomagnetic Field (Sporadicheskii Sloi E Ionosfery I Sutochnye Variatsii Magnitnogo Polia Zemli)," Geomagnetizm i Aeronomiia, Vol. 4, Mar. - Apr. 1964. In Russian

Ovezgel'dyev, O., and Vasil'eva, E. K., "A Theory of E_s Formation at Mid-Latitudes (OB Odnoi Theorii Obrazovaniia E_s V Srednikh Shirotakh)," Geomagnetizm i Aeronomiia, Vol. 4, Mar. - Apr. 1964. In Russian.

Ovezgel'dyev, O., and Lezhneva, A., "Relation Between the E_s and F Regions of the Ionosphere (Sviaz' E_s c F Oblast' Iu Ionosfery)," Akademiia Nauk Turkmenskoi SSR, Izvestiia, Seriia Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk, no. 3, 1964. In Russian.

Ovezgel'dyyev, O., and Korsunova, L. P., "The Sporadic E-Layer of the Ionosphere and the Daily Variations of the Earth's Mangetic Field (Sporadicheskiy Sloy E Ionosfery I Sutochnyye Variatssi Magnitnogo Polya Zemli)," Geomagnetizm i Aeronomiya, Vol. 4, no. 2, (Contract NAS5-2078), 28 May 1964.

The processing of data pertinent to the sporadic E-layer and the daily variations of the earth's magnetic field is discussed. The processed data were obtained in Ashkhabad for the period May - August, 1962. A preliminary conclusion is that the emergence, at any time of the day, of the intense sporadic E-layer does not exert any basically significant effect on the daily variations of the earth's magnetic field.

Parshin, I. A., "The Absolute Photometry of the Twilight Sky and Noctilucent Clouds," The Study of Noctilucent Clouds, Air Force Systems Command, 30 Oct. 1962.

Photometric observations of the twilight sky and noctilucent clouds were made in the summer of 1959, by using a reflector having an objective diameter of 54 mm and a focal length of 550 mm.

Pavlova, T. D., "The Apparent Frequency of the Appearance of Noctilucent Clouds According to Observations by the Stations of the Hydrometeorological Service Network in 1957 and 1958," The Study of Noctilucent Clouds, Air Force Systems Command, 30 Oct. 1962.

A study is made of the apparent frequency of the appearance of noctilucent clouds in the Northern Hemisphere during the summer and in a latitude zone north of 45°N. The results of the observations of noctilucent clouds indicate their presence or absence, their brightness, and an estimate of their general coverage.

III,

G. IONOSPHERE (cont.)

Piddington, J. H., "Ionospheric and Magnetospheric Anomalies and Disturbances," Planetary and Space Science, Vol. 12, June 1964.

Study of some features of anomalies and disturbances in terms of motions of ionization between the ionosphere and the magnetosphere, together with circulatory motions in the latter. The magnetosphere contains much more ionization than the F-region and interchange must occur.

Piddington, J. H., "Irregularities in the Upper Ionosphere," Planetary and Space Science, Vol. 12, Feb. 1964.

Discussion of the origin of the irregularities observed in the electron density distribution in the F-region of the ionosphere.

Pierce, E. T., and Arnold, H. R., Sudden Ionospheric Disturbances and the Propagation of Very-Low-Frequency Radio Waves. Part 1: Phenomenology and Relevant Ionospheric Theory Final Report, (Contract AF 49(638)-1081; ARPA Order 159-61, Amend. 7), Jul. 1963.

Accomplishments cited include: (1) A survey was made of the changes in VLF radio noise accompanying a solar flare and its association with sudden ionospheric disturbances (SID). (2) A detailed examination was made of the formative processes of the lower ionosphere. (3) A model of the solar X-ray flux during a flare was derived, and its ionizing effects were examined. (4) The ionization produced by an X-ray burst from a nuclear explosion in space was deduced.

Pierce, E. T., "Collisional Detachment and the Formation of an Ionosperic C Region," Journal of Research, Section D - Radio Propagation, Vol. 67D, Sept. - Oct. 1963.

Derivation of a simple expression for the collisional detachment coefficient for a molecule impinging on an O_3^- ion in the ionosphere. Comments are made on the conflict, in considering stratospheric ionization, between the concepts of ionospheric physics and those of atmospheric electricity.

Polk, C., "Some Recent Magnetic Field Measurements in the Earth-Ionosphere Resonance Region," Agard Propagation of Radio Waves at Frequencies Below 300 kc/s Pergamon Press and Mac Millan Co., 1964.

Amplitude vs time records of 2-min duration of north-south and east-west magnetic field variations in the 5 to 20 cps frequency range, and 24-hr records of 7.5 to 10 cps magnetic fields, which were obtained over a period of several months, are analyzed.

III,

G. IONOSPHERE (cont.)

Poppoff, I. G., and Whitten, R. C., Ionization and De-Ionization in the Lower Ionosphere Final Report, (Contract AF 19(604)-8355; ARPA Order-6-61), Geophysics, 31 Mar. 1963.

A body of information pertaining to ionization and de-ionization in the lower ionosphere was compiled from various sources.

Popov, N. P., "Vertically Moving Ionospheric Disturbances Observed at Irkutsk," (Geomagnetizm i Aeronomiia, Vol. 3, no. 3, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 3, 1963. Translation.

Observations indicate the following: (1) vertically moving disturbances are at a maximum in daytime; (2) they are most common in the winter months; (3) they cause brief appearances of the E_s layer at heights of 100 km-160 km; and (4) in winter vertically moving disturbances in the F layer cause stratification interpreted as the formation of the F_1 layer.

Potapova, N. I., and Shapiro, B. S., "N(h) - Profiles of the Ionosphere Over Moscow During the Magnetic-Ionospheric Disturbances of November 1960," (Geomagnetizm i Aeronomiia, Vol. 3, no. 1, 1963), Geomagnetism and Aeronomy, Vol, 3, no. 1, 1963. Translation.

Discussion of a comparison made between changes in the vertical section parameters of the ionosphere over Moscow during the magnetic-ionospheric disturbances of November 1960 and July 1959. The general nature of variations in the height distribution of ionization at middle latitudes during intense magnetic-ionospheric disturbances with sudden outbursts remains approximately the same in winter and summer.

Poliakov, V. M., "Determination of the Electron Recombination Rate in the F_2-Layer from the Diurnal Ionization Variation," (Geomagnetizm i Aeronomiia, Vol. 3, no. 5, 1963), Geomagnetism and Aeronomy, Vol. 3, no. 5, 1963. Translation.

Determination of the form of the ionization function and the values of the ionization-recombination parameters of the F_2-layer of the ionosphere at middle latitudes from the diurnal ionization variation over Irkutsk for the period from 1948 to 1960.

III,

G. IONOSPHERE (cont.)

Poularikas, A. D., and McCutcheon, M., 'mpedance Frequency Characteristics of the Ionosphere at High Frequencies," AIAA Student Journal, Vol. 2, May 1964.

Extension of Gambirosio's work on the electrical behavior of an ideal plasma, and application of the results to the ionosphere. Some quantitative results of the ionospheric impedance are given.

Pozigun, V. L., "Calculation of the Coefficient of Ionospheric Opacity (O Vychislenii Koeffitsienta Mutnosti Ionosfery)," Geomagnetizm i Aeronomiia, Vol. 4, May - June 1964. In Russian.

III,

G. IONOSPHERE (CONT.)

Quinn, T.P., Scientific Report on Recombination and Transport in the Nighttime F Region of the Ionosphere, (Grant NsG-134-61) (NASA-CR-56827;SR-212),1 July 1964.

A method by which the recombination coefficient for the nighttime F may be determined, and an extension of the method that allows a determination of the drift and diffusion velocities is presented.

Rangaswamy, S., and Kapasi, K.B., "A Study of Equatorial Spread-F," Journal of Atmospheric and Terrestrial Physics, Vol. 25, Dec. 1963.

Analysis of data from seven stations ranging in magnetic dip from 0° to 44°N to study nighttime and seasonal variations of spread-F through nearly half a solar cycle. A significant lunar variation is observed in the occurrence of equatorial spread-F which suggests that electrodynamic drift plays a major role in the occurrence of equatorial spread-F.

Rao, A.S., and Rao, B.R., "Horizontal Drifts in the E-Region at Waltair," Journal of Atmospheric and Terrestrial Physics, Vol. 26, March 1964.

Presentation of the results obtained at Waltair on the measurement of ionospheric drifts for the E-region over a period of 2 years by spaced receiver technique.

Rao, C.S.R., "Sporadic-E and the Equatorial Electrojet," Journal of Atmospheric and Terrestrial Physics, Vol. 26, March 1964.

An analysis of characteristics of sporadic-E at Indian and American equatorial stations has been made for quiet and disturbed days during the year 1958.

Rastogi, R.G., "Lunar Tides in the Equatorial Electrojet and in the Ionosphere Over the Magnetic Equator," Nature, Vol. 200, Dec. 14, 1963.

Brief review of analyses of midday values of f_0F_2 measured at Huancayo over the years 1938 to 46 plus 1951 to 60, in order to study further the relations between the lunar tidal effects in f_0F_2 and in the electrojet. The results of the analyses are compared to those of Bartels and Johnston. It is found that there is a remarkable similarity in the seasonal variations of the lunar tidal effects in the f_0F_2 and the range of the horizontal magentic intensity.

Ratcliffe, J.A., "The Ionospheric F-Region and Space Research - A Critical Review," Space Research IV, Ed. by Muller, P., Amsterdam, North-Holland Publishing Co., N.Y., Interscience Publishers, 1964.

Presentation of the most probable theory for the "normal" ionization in the F region. Doubtful points in the theory are considered, and the "abnormal" behavior of the F region is discussed, including possible explanations of these phenomena. "Space" experiments are suggested aimed at solving some of the problems involved in the "normal" ionization theory as well as in the points of "abnormal" behavior.

G. IONOSPHERE (CONT.)

Rawer, K., "F2 Layer Ionization," AGARD Advan. in Upper Atmosphere Res., 1963.
At low latitudes there exists some connection between the influences responsible for the typical anomalies and storm effects. From recent real height research, it seems that rapid vertical plasma transport occurs even during rather small magnetic disturbances - the so-called bays. This would occur with an east-to-west electric field - as yet unexplained.

Reid, G.C., "Polar Cap Absorption," AGARD Advan. in Upper Atmosphere Res., 1963.
The hypothesis that polar cap absorption (PCA) is caused by the great increase in the ionization of the lower ionosphere produced by an influx of particles of solar origin has gained general acceptance. Attempts to explain the long duration of the proton flux, evidenced by the slow decay of PCA, in terms of the storage somewhere in the solar system of large numbers of protons, initially accelerated at the time of the flare, involve radial- and tongue-shaped magnetic fields of solar origin.

Renau, J., and Flood, W.A., Project Flayer III: A Study of Spread-F Echoes from the Ionosphere, Final Report, (Contract AF 19(628)-351) (CAL RA-1684-P-1; AD-430349)
Techniques for measuring the cone angle of arrival of radio waves, experimental equipment used in the study, and experimental results obtained are discussed.

Rishbeth, H., and Garriott, O.K., "Relationship Between Simultaneous Geomagentic and Ionospheric Oscillations," Journal of Research, Section D- Radio Science, Vol. 68D, March 1964.
Discussion of possible interpretations of correlated oscillations of the geomagnetic field and the height of the ionospheric F region, with periods of 1/2 to 30 minutes, in terms of the ionospheric "dynamo-motor" theory and in terms of hydromagnetic waves.

Roberts, W.T., Proposed Solution to the Geomagnetic Anomalies in the Ionosphere, (NASA TM X-53003), 24 September 1963.
In order to determine the driving and controlling mechanisms that predominate in the ionosphere, a series of contour maps were drawn from IGY data taken at stations lying approximately along the 75th meridian. Furthermore, if the atmosphere tends to expand and contract diurnally, ions and electrons may be deflected into regions at times that could account for the nocturnal increase in electron density north and south of the geomagnetic equator.

Robinson, N., "The Electrical State of the Atmosphere. I - The Ionization State of the Atmosphere as a Function of the Meteorological Elements and of Various Sources of Ions," Israel Journal of Technology, Vol. 2, No. 1, 1964.

Study of the dependence of meteorological factors, radiation from the Earth and radioactive fallout in the atmosphere after nuclear tests, on the electrical state of the lower atmosphere - particularly positive ions per unit of volume N^+, negative ions per unit of volume N^-, and their relation N^+/N^-.

Roger, R.S., "Some Ionospheric Measurements Using the Faraday Effect in Satellite Transmissions at 108 Mc," Radio Astronomical and Satellite Studies of the Atmosphere, Ed. by Aarons, J., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers Div., John Wiley and Sons, Inc., 1963.

Calculation of the Faraday effect in the 108 Mc transmissions of Vanguard I (1958 Beta 2) made during several observation periods from 1959-1960. The results of three observation periods are given.

Rosenberg, N.W., "Ionospheric Temperatures Obtained from Photography of Shock Waves," Journal of Geophysical Research, Vol. 69, June 1, 1964.

Optical detection of the pulse from the detonation of an RDX grenade at 108-km altitude. The overpressure in the shock wave increase the brightness of a chemiluminous trail of trimethyl aluminum + triethyl aluminum deposited just before the explosion.

Rothwell, P., "Electron Density Distribution in the Topside Ionosphere at Medium and High Magnetic Latitudes and During Magnetic Disturbances," Space Research IV, Ed. by Muller, P., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964

Presentation of the results of a further analysis of the electron-density data from Ariel 1. It is shown that at medium latitudes ionization was enhanced at intersections of the satellite orbit with the $L \approx 1.8$ magnetic shell throughout the period of April 27 - July 12, 1962.

Rydbeck, O.E.H., and Askne, J., Whistler Mode - Ionized Stream Interactions, Part 1, (Contract AF 61(052)-451) (Res. Rept. 18; AFCRL-64-80; AD-436810)

The transformation of a fast cyclotron wave to a backward whistler mode is probably a phenomenon in the exosphere. A number of graphs are presented, applicable also to plasma amplifier theory.

Schmelovskii, K.H., Klinker, P., and Knut, R., "Electron Concentration in the Outer Ionosphere According to Observations of Sputnik III." Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).

Analysis of the radio signal attenuation, produced by the Faraday effect, of 20 Mc transmission from Sputnik III (1958 Delta 2) for the purpose of measuring the electron concentration in the upper ionosphere. A model of electron concentration is developed and tested for reliability by statistical methods.

III,

G. IONOSPHERE (CONT.)

Serafimov, K., and Nestorov, G., "A Method for Determining the Electron Density Profile in the D-Region of the Ionosphere," Geomagnetizm i Aeronomiia (Moscow), Vol. 3, No. 6, 1963 (Contract AF 19(604)-8505) (E-T-R-64-24; AD-602127), (Translation)

On the basis of results measuring nondeviative absorption L'_D in the D-region with moderately high frequencies, the distribution law for electron density can be determined as a function of altitude.

Serafimov, K.B., "The Intermediary E- F-Region of Ionosphere During the Complete Solar Eclipse of February 15, 1961," Geomagnetizm i Aeronomiia, Vol. 4, No. 1, 1964 (In Russian).

Shapiro, B.S., "Compliation of Predictions of the Geometric Parameters and the h'f Frequency-Height Curves of the Ionosphere," Trans. of the Acad. of Sci. of the USSR, Inst. of Earth's Magnetism, the Ionosphere, and Radio Wave Propagation, 14 Feb. 1963.

The calculation and analysis of the geometric parameters of the ionosphere and the method of predicting the true and virtual heights (h') are discussed. To determine the geometric parameters of the ionosphere and calculate h', approximate methods and formulas for a parabolic layer were used.

Shapiro, B.S., and Vinnikova, T.L., "The Programming of Computations of Ionospheric True Heights on Electronic Computers," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963. (Translation).

Presentation of formulas and operator schemes for a program developed for the computation and processing of the vertical distribution of ionization with height in the inosphere below the maximum of the F2 layer, using digital computers. The program presented is specifically designed for the BESM-2 digital computer.

Sharonov, V.V., "Photometric and Colorimetric Observations of Noctilucent Clouds During the Summer of 1959," The Study of Noctilucent Clouds, 30 Oct. 1962.

This investigation of photometric and colorimetric observations of noctilucent clouds during the summer of 1959 covers the following: single-time relative photometry; relative photometry at various times; standard photometry at various stations; and absolute photometric determinations.

Sharp, G.W., Hanson, W.B., and McKibbin, D.D., "Some Ionospheric Measurements with Satellite-Borne Ion Traps," Space Research IV, Ed. by Mulier, P., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964.

Presentation of data obtained with two ion traps with plane geometry, flown in polar-orbiting oriented satellites, one in Oct. 1961, and the other in April 1962. The possibility is considered that the satellite might have affected the immediate ionospheric environment in such a way as to invalidate some of the measurements.

Shcheglov, P.V., "Concentration to the Ecliptic of Night Sky Emmission in the Line H α and its Radial Velocities," Astronom. Zh. (Moscow), Vol. 41, No. 2, 1964, (Contract NAS5-2078) (NASA-TT-F-8919; ST-AA-10165). (Translation).

New observations of the nightglow emission in H_α are described in this paper. Its strong concentration to the sun and to the ecliptic is observed. These observations fit the model of a cloub in the ecliptic plane, with an increasing density at night and decreasing in daytime. The interaction of emission and absorption lines in the course of such observations is discussed.

Shearman, E.D.R., "Sounding the Ionosphere by Incoherent Scatter at Very High Frequencies," Institution of Electrical Engineers, Journal, Vol. 9, Oct. 1963.

General discussion of the development of incoherent-scatter radar, based on the ideas of Rayleigh and Thomson, in relation to its application to ionospheric studies. It is noted that the completely unexpected spectral results stimulated a great deal of useful theoretical work which has revealed the potentialities of the technique, especially for measurements of electron and ion temperatures, identification of ions, and magentic-field orientation and intensity out to the limits of the Earth's atmosphere.

Shimazaki, T., "Nighttime Variations of F-Region Electron Density Profiles at Puerto Rico," Journal of Geophysical Research, Vol. 69, July 1, 1964.

Investigation of the origin of the time-dependent variations of nighttime F-region electron density profiles. Assuming a model atmosphere, the set of parameters that best satisfies the continuity equation over a wide range of height in the F region is determined from observational data for midnight in March 1959.

Shirmamedov, M.,"Synchronous Observations of Anomalous Values of the Coefficent of Reflection from the F_2-Region of the Ionosphere Using Scattered Receiving Antennas," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Skaperdas, D., and Knoebel, H., Theoretical and Experimental Investigations of Electron Density and Collision Frequency in the Lower (D and E) Regions of the Ionosphere by Research Rocket Radio Transmissions During the IQSY Using Differential Absorption, Faraday Rotation and Mass Spectrometry, (Grant NsG-504) (NASA-CR-56939; SASR-2) 10 June 1964.

A rocket was fired as part of a series of experiments conducted under a synoptic IQSY program. The purpose of this experiment was to measure the differential absorption and Faraday rotation for the determination of electron collision frequency in the D-region. This report describes the system used to make these measurements and presents the data obtained from them.

G. IONOSPHERE (CONT.)

Smiley, R.F., Magnetohydrodynamic Wave Propagation and Boundary Value Problems in the Lower Ionosphere, Report No. 12 (Eighth Quarterly Letter Report) (1 Jan.-29Feb. 1964) (Contract DA-36-039-SC-89117; ARPA Order 163) (ARA-T-9197-12; AD-432131)

Progress reported includes: (1) Numerical results were obtained, by means of the IBM-7090 digital-computer program, for both incident modified Alfven (ordinary) waves and incident Alfven (extraordinary) waves. (2) A significant theoretical conclusion concerning the prediction of geomagentic micropulsation effects of high-altitude nuclear detonations has been reached.

Somayajulu, Y.V., "Some Features of the F-Region Electron-Density and Height Variations in the Equatorial Regions," Journal of Geophysical Research, Vol. 69, April 1, 1964. Contract No. AF 19(604-4563; NSF Grant No. G-18983.

Presentation of the average quiet day variations in NmF and h (.9NmF) for the equatorial stations Talara and Huancayo, derived from the true-height profiles for the 5 international quiet days for each of the IGY months. It is concluded that, in the equatorial regions, the ionospheric electrostatic fields play a dominant part in causing the equatorial "anomalies,"

Somayajulu, Y.V. Tyagi, T.M., and Bhatnagar, V.P., Upper F-Region Profiles During Low Solar Activity Derived from Observations on Faraday Fading of Satellite Transmissions, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Derivation of the upper F-region profiles using the total electron flux measured at Delhi and Faraday fading of the Cosmos (1962 Upsilon) transmissions during July-October 1962. One of the consequences is that the ratio of the electron contents above and below peak for low solar activity are higher than for high solar activity, in agreement with the results of the authors reported earlier.

Spizzichino, A., and Taieb, C.,"Contribution to the Study of Sporadic E-Layer Movements, Ann. Geophys. Vol. 20, No. 2, 1964 (Translation) (Contract NAS5-3760) (NASA-TT-F-8951; ST-Al-10198), 2 September 1964.

An ionospheric sounder made it possible to study systematically the vertical displacements of sporadic E-layers. A general downward movement of E_s-layers accompanies the increase in electron density. An interpretation of results is given in the light of recent theories that have been advanced for E_s.

Sprenger, K., and Kushnerevskii, V., "Some Properties of Inhomogeneities in the Lower Ionosphere According to Long-Wave Observations," Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963 (Translation).

Comparison of the results of observations of drifts in the lower ionosphere (90-100 km) at a frequency of 245 kc obtained by the method of equal fadings and complete correlation analysis. It is found that the directions of drift agree well with each other.

G. IONOSPHERE (CONT.)

Stefant, R., "Application of an Induction Magnetometer to the Detection of Resonance Frequencies of the Earth-Ionosphere," Annales de Geophysique, Vol. 19, July-Sept. 1963 (In French, with summaries in English and Russian).

Stone, M.L., Bird, L.E., and Balser, M., "A Faraday Rotation Measurement on the Ionospheric Perturbation Produced by a Burning Rocket," Journal of Geophysical Research, Vol. 69, March 1, 1964.

Description of measurements of the angle of rotation of linearly polarized waves radiated from missiles launched at Cape Kennedy performed at a site in Yankeetown, Florida. Results consistently indicated a deficiency in the electron density along the path in the F region, generally by about an order of magnitude.

Storey, L.R.O., Renard, C., and Driancourt, G., The Aerobee Experiment at Wallops Island in October 1963. Programme "FR-1", Part 1 C: Text, (Tech. Rept. 372-TC) Feb. 1964.

One Aerobee objective was the trial of methods for measuring local electron density in the ionosphere from observations of the properties of the VLF wave field. Since the wave-admittance method could not be tested properly due to uncertainty in the behavior of the electric antennas, electron-density profiles were determined by the joint measurement of the Doppler effect and the direction of propagation.

Storey, L.R.O., "Whistler Propagation," AGARD Advan. in Upper Atmosphere Res. 1963,

This paper summarizes the present situation in research on the propagation of whistlers. It is intended mainly as a guide to the published literature.

Sukhorukova, E.V., "Space-Time Distribution of the Sporadic E_S-Layer at High Latitudes," Geomagnetism and Aeronomy, Vol. 3, No. 5, 1963 (Translation)

Examination of the simultaneous appearance of the E_S layer over two groups of high-latitude stations. One group of stations is located in the Eastern Hemisphere and the other in the Western. The probability for the simultaneous appearance is greater, the closer the stations are to each other along the geomagnetic latitude. Sporadic layers appear most frequently simultaneously over an area of approximately 300,000 - 400,000 km^2. There is a relationship between large limiting E_S frequencies and the increase of H to 200-300 γ.

Sullivan, H.M., and Hunten, D.M., "Lithium, Sodium, and Potassium in the Twilight Airglow," Canadian Journal of Physics, Vol. 42, May 1964, (Contract No. AF 19(604)-7265; No. AF 19(628)-2829)).

Application of a birefringent filter photometer to measure the weaker twilight emissions due to free lithium and potassium atoms, the twilight sodium emission having been monitored simultaneously with an interference wedge photometer.

Tixier, M., "Occurrence of Ionospheric Diffusion in Two Magnetically Conjugate Points - Its Correlation with the Reception of Radioactive Whistling," Academie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 1, Jan. 6, 1964 (In French).

Tříska, P., "Influence of Ionospheric Wind on Structure of Electron Density in Lower Ionosphere," Studia Geophysica et Geodaetica, Vol. 7, No. 3.

Derivation, based on the equations of motion for a partly ionized gas in the lower ionosphere, of expressions describing the density variation of charged particles, caused by their vertical displacement due to the effect of the geomagnetic field on a horizontally moving plasma, taking into account the collisions between electrons and neutral particles.

Tsedilina, E.E., and Kharybina, A.A., "Investigation of the Irregular Structure of the Ionosphere According to Radioobservations on Cosmos-1, Cosmos-2, and Cosmos-11 in Coherent Frequencies," Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No. 3, 1964 (Translation) (Contract NAS5-3760) (NASA-TT-F-8945; ST RWP-10191)

A spectrum W (ρ) of the dimensions of irregular ionosphere formations was obtained from measurements of the doppler shift of radiowave frequencies, emitted by satellites in coherent frequencies of 20.005 and 90.0225 mc/s.

Ulwick, J.C., Pfister, W., and McInerney, R.E., Direct Satellite Probe Measurements of Ionospheric Irregularities, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Itlay, May 8-20, 1964, Paper.

Review of measurements made with a standing wave inpedance probe flown on polar orbiting satellite through the F_2 layer. It is found that there are irregularities superimposed on the gross features of the ionosphere.

Vassy, E., "Determination of the Total Electron Concentration of the Ionosphere with the Aid of Artificial Satellites," Space Research IV, Ed. by Muller, P., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964 (In French). Contract No. AF 61(514)-1141.

Vitolnieks, R., "Relation Between the Occurrence of Noctilucent Clouds and the E_s-Layer," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Voronin, A.L., "Polarization Phenomena in the Magnetoactive Ionosphere," Geomagnetizm i Aeronomiia, Vol. 4, May-June 1964 (In Russian).

Wagner, K.U., "Investigation of the State of the Lower Ionosphere During Sunrise," Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No. 1, 1964 (Contract NAS5-2078) (NASA-TT-F-8695; ST-AT-10-132) 8 May 1964.

During the time between sunrise at the altitude of 100 km and sunrise at the ground, the lower ionosphere is not in the state of equilibrium. An attempt was made to calculate the electron density inside the unsteady ionosphere.

Wallace, L., and Nidey, R.A., "Measurement of the Daytime Airglow in the Visual Region," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.

Description of data obtained by means of a 50-cm focal-length Ebert-Fastie spectrometer with an Ascop 543-A photomultiplier mounted in an Aerobee 150 rocket equipped with an attitude control system which kept the spectrometer pointing within 90° of the zenith. The spectrometer has revealed five emission features in the day airglow spectrum in the interval from 150 to 192 km.

Wakai, N., and Sawada, K., "Nocturnal Variation of the Ionospheric E Region in a Temperature Latitude with Geomagnetic Disturbances," Radio Research Laboratories, Journal, Vol. 11, Jan. 1964.

Discussion of variations of the night E-layer in temperate latitudes with geomagnetic activity and the absorption of HF waves due to the increase of electron density in this region. Night ionograms obtained at four Japanese ionospheric stations are used in the analysis. Reflections from the night E-layer, which appears at a height of about 150 km, correlate with the geomagnetic activity.

Warwick, C.S., "The Sudden Ionospheric Disturbance," Radio Astronomical and Satellite Studies of the Atmosphere, Ed. by Aarons, J., Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers Div., John Wiley and Sons, Inc., 1963.

Review of studies of sudden ionospheric disturbances, emphasizing the influence on their study of direct measurements of ionizing radiation from rockets and satellites. Individual cases of sudden ionospheric disturbance are found to show a great diversity of form of development that is only generally described by classification schemes. Different ionospheric models are noted, and various observational data are presented.

Warwick, J.W., "Radio-Star Scintillations from Ionospheric Waves," Journal of Research, Section D- Radio Science, Vol. 68D, Feb. 1964.

Study of radio-star scintillations arising from irregularities in the electron density of the ionosphere, and interpretation of scintillations, some 10% of the total, which show interesting patterns of motion and duration.

Watkins, C.D., and Sutcliffe, H.K., "Research at R.R.E. III - Some Radar Observations of Electrons in the Ionosphere," British Communications and Electronics, Vol. 10, Nov. 1963.

Description of an incoherent backscatter technique for studying the ionosphere using radar. The theory of the method is outlined, and the radar equation in incoherent backscatter is examined. Experimental investigations of the ionospheric electron density and distribution are briefly discussed, and some proposed experiments are noted.

Weisbrod, S., Ferraro, A.J., and Lee, H.S., "Investigation of Phase Interaction as a Means of Studying the Lower Ionosphere," Journal of Geophysical Research, Vol. 69, June 1, 1964, NSF Grant No. GP-846; Contract No. AF 19(628)-4014.

New technique for studying the lower ionosphere (60-90 km) by observation of minute changes (order of 10^{-4} radian) in the phase of ionospherically reflected echoes subject to rapid amplitude fading and phas tumbling.

Wentworth, R.C.,"Evidence for Maximum Production of Hydromagnetic Emissions Above the Afternoon Hemisphere of the Earth. II - Analysis of Statistical Studies," Journal of Geophysical Research, Vol. 69, July 1, 1964. Contracts No. AF 19(604)-7989; No. AF 19(604)-5906; No. AF19(628)-462.

Investigation using previous results, concerning attenuation as a function of F_2 peak ion density and hydromagentic-wave frequency to correct a number of studies of times of occurrence of hydromagnetic emissions at middle and upper latitudes.

Whitten, R.C., and Poppoff, I.G., "Ion Kinetics in the Lower Ionosphere," Journal of Atmospheric Sciences, Vol. 21, March 1964, Contract No. AF 19(604)-8355.

Discussion of positive and negative ionic processes which contribute to the control of electron density in the lower ionosphere. Particular attention is given to the recombination of free electrons with positive ions, the recombination of negative ions with positive ions, and to charge transfer and ion-atom interchange.

Whitten, R.C., and Popoff, I.G., Reaction Rates Determined from Ionospheric Observations Faraday Society, General Discussion on Chemical Reactions in the Atmospher, Edinburgh, Scotland, April 2, 3, 1964, Paper 3168, Contracts No. AF 19(601)-199A; No. AF 19(604)-835

Computation of relaxation parameters by means of some recent D- and E-region measurements. Solar flare X-ray data obtained during the Naval Research Laboratory Sun Flare II program, together with an 18-Mc sudden cosmic-noise absorption record, are used to compute an effective dissociative recombination coefficient corresponding to an altitude of approximately 80 km.

Wichersham, A.F., Jr., "Analysis of Large-Scale Traveling Ionosphere Disturbances," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.

Presentation of an acoustic-gravity wave interpretation of Chan and Villard's observations of large-scale traveling ionospheric disturbances.

Willmore, A.P., "Ionospheric Heating in the F-Region," Royal Society (London), Proceedings, Series A, Vol. 281, Aug. 25, 1964.

Analysis of measurements made aboard Ariel I toward a calculation of the ionospheri energy input required to maintain the electron temperature above the ion temperature. The results are found to be consistent with the energy input due to photoionization in the daytime, provided that allowance is made for the effects of the escaping flux of photoelectrons spiralling upward along the geomagnetic field lines which impart energy to the ionosphere by electron-electron interaction.

III,

G. IONOSPHERE (CONT).

Willmore, A.P., "Energy Sources for the Ionospheric Electrons," Nature, Vol. 202, April 4, 1964.

Analysis of an extensive number of measurements of electron temperature and density to study the energy source required to produce the observed temperature distribution. Use is made of Dalgarno's energy transfer rates, calculated from the electron gas to the ion gas and from the ion gas to the neutral gas, after appropriate modification to allow for the presence of ionized helium.

Winkelman, R.E., and Dyce, R.B., "Solar-Flare Enhancements of Ionization at F-Region Heights," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964, Contract No. AF 49(638)-989.

Examination of vertical-phase path measurements of pulsed radio waves reflected from the ionosphere at 5953 and 6110 kc, and an oblique Loran A 1850-kc path, during known solar flares. It is stated that the ionization generated by these several solar flares was located predominantly in the F region.

Wright, J.W., "Ionosonde Studies of Some Chemical Releases in the Ionosphere," Journal of Research, Section D- Radio Science, Vol. 68D, Feb. 1964.

Discussion of ionosonde observations obtained during release of chemicals by rocket detonations in the ionosphere. An important adjunct of the experiments was the determination of the ambient electron distribution, N (h), into which the chemicals were released.

Yamada, K., and Ogata, T., "Geomagnetic Latitudinal Dependence on the F2 Layer by Observations on Board Ship," Radio Research Laboratories, Journal, Vol. 11, May 1964.

Presentation of the results of ionospheric observations performed on board the Kagoshima-maru during its voyage for observation of the solar eclipse.

Yonezawa, T., Maintenance of Ionization in the Night-Time F2 Region, COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964.

An attempt is made to explain the nighttime behavior of the F2 layer, in particular, the maintenance of ionization during the night, on the assumption that the electrons diffuse themselves slowly downwards into the F2 region from outside along geomagnetic lines of force.

Yubovich, L.A.,"Spatial Distribution of Anomalous Ionization in the F2 Layer at High Latitudes," Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No.3, 1964, Contract NAS5-3760, NASA-TT-F-8947; ST-A1-10193, (Translation).

The spatial distribution of anomalous ionization in the F2 layer of the shadowed ionosphere is considered at stations of the Northern and Southern Hemispheres, as well as the influence of the anomalous ionization on f_0F2, conditioned by the ultraviolet radiation of the sun.

G. IONOSPHERE (CONT.)

Zipf, E.C., and Fastle, W.G., An Observation of the (0.0) Negative Band of N_2^+ in the Dayglow, (NASA Grant NsG-193-62) (NASA TN D-2249), April 1964.

The observations discussed represent results of the blue (3914 A) photometer experiment obtained May 7, 1963, from an Aerobee Hi rocket launching at Wallops Island, Virgina. Density data and photo ionization rates and loss frequencies for N_2^+ are tabulated for altitudes from approximately 140 to 220 km.

Zevakina, R.A., "Space-Time Distribution of an Ionospheric Disturbance at High Latitudes of the Northern and Southern Hemispheres After Large Chromospheric Flares," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).

Study of the anomalous absorption that takes place at high latitudes after large chromospheric flares that are accompanied by type IV radio burst, and an examination based on synoptic charts of the changes in the E_s and F_2 regions at the time of the September 12-15 and 20-26, 1957 disturbances.

Zevakina, R.A., "On the Seasonal Variation of the Spatial Distribution of Ionospheric Disturbances at High Latitudes of the Northern and Southern Hemispheres," Geomagnetizm i Aeronomiia, Vol. 4, No. 1, 1964 (In Russian)

No author, "Catologue of Disturbances in Ionosphere, Geomagnetic Field, Field Intensity of Radio Wave, Cosmic Ray Solar Phenomena and Other Related Phenomena," Report of Ionosphere and Space Research in Japan, Vol. 18, No. 1, 1964.

Collection of data from various Japanese geophysical stations for the period April 30 - May 4, 1963. The tables include information on solar flares, solar radio emission, whistlers and VLF emissions, atmospheric radio noise, and data on the state of the ionosphere.

III. INTERPLANETARY SPACE

H. EARTH ATMOSPHERE

Almond, R., Farmer, S. F. G., and Frith, R., "Rocket Soundings of the Upper Atmosphere," Nature, Vol. 202, May 9, 1964.

Presentation of results of measurements of temperature and winds made at heights up to 60 km during the first World Geophysical Interval of the IQSY, using the new meteorological rocket Skua, launched in the Outer Hebrides.

Al'pert, I. L., Belianskii, V. B., and Mitiakov, N. A., "Radio Investigations of the Structure of the Ionosphere by Means of the 'Cosmos' Satellites Using Coherent Frequencies (Preliminary Results," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963 (Translation).

Discussion of a preliminary analysis of measurements of the difference in Doppler shift of the frequencies of coherent radio waves emitted from Cosmos I (1962 Theta 1) and II (1962 Iota 1) of 20.005 Mc and 90.0225 Mc.

Anderson, A. D. and Francis W. E., A Semi-Theoretical Model for Atmospheric Properties from 90 to 10,000 KM, May 1964 (Contract DA-49-146-XZ-204).

A semitheoretical model of the upper atmosphere was constructed to allow the calculation of the primary atmospheric properties from 90- to 10,000-km altitude as a function of local time and solar activity. The calculations are based upon an empirical density profile from a density model as the initial input.

Angerami, J. J. and Thomas, J. O., The Distribution of Ions and Electrons in the Earth's Exosphere, Technical Report No. 4, Dec. 1963 (NASA Grant NsG-30-60; AF AFOSR Grant 62-370).

The factors governing the distribution of electrons and ions in the earth's exosphere are discussed. The theory takes into account the effect of the electric field that arises from charge separation, the centrifugal force arising from the rotation of the earth, and the effect of the earth's gravitational field.

Antonov, R. A., Smorodin, Iu. A., and Tulinova, Z. I., "Altitude Variation of Vertical Extensive Air Showers in the Upper Part of the Atmosphere," Soviet Physics-JETP, Vol. 18, May 1964 (Translation).

Experimental investigation of particle fluxes and spectra in vertical extensive showers in the upper atmosphere. Density spectra for the showers are analyzed. The altitude dependence of showers with $\sim 10^6$ particles is derived, and indicates a high degree of energy dissipation in the interactions of those particles with particles having energies of $\sim 10^{15}$ ev which initiate the showers.

Argence, E., Eyfrig, R., Hess, H. A., Paul, A., and Rawer K., "Equivalent Thickness of the Outer Ionosphere Obtained by Evaluation of Faraday Records," Planetary and Space Science, Vol. II, Dec. 1963. Bundesministerium für Wirtschaft Grant No. J 4569.

Calculation of the Faraday-effect for instantaneous ionospheric models, the data of which are derived from the results of vertical soundings, in order to improve present techniques for evaluating such data.

III,
H. EARTH ATMOSPHERE (CONT.)

Arthur, W. and Beiser, A., Methods of Promoting the Removal of Free Electrons from an Ionized and Dissociated Atmosphere, June 1963 (Contract AF 19(268)-255; DASA MIPR 554-61).

This study included an analysis of the relevant atomic and ionic processes (with special regard to the dependence of these processes upon electrical energy) and quantitative assessment of the various possible means for removal of free electrons from such an atmosphere, including estimates of time scales, efficiencies, and power requirements.

Babaian, Kh. P., Grigorov, N. L., Mamidzhanian, E. A., and Shestoperov, V. Ia., "Vertical Distribution of High-Energy Nucleons in the Atmosphere," Akademija Nauk Armianskoi SSR, Koklady, Vol. 38, No. 2, 1964 (In Russian).

Bandeen, W. R., Conrath, B. J., and Hanel, R. A., "Experimental Confirmation from the Tiros VII Meteorological Satellite of the Theoretically Calculated Radiance of the Earth Within the 15-Micron Band of Carbon Dioxide," J. Atmospheric Sci., Vol. 20, No. 6, Nov. 1963 (NASA RP-163).

Barbier, D., Possibility of Detecting High Energy Particles in the Upper Atmosphere by Observations of the Night Airglow, Transl. into English of a Paper Presented at the COSPAR Meeting, Florence, May 1964 (NASA-TT-F-9031).

The excitation of high latitude auroras (i.e., classical auroras whose prime cause is the existence of high energy particles in the upper atmosphere) is studied.

Barry, G., "Ray Tracings of Acoustic Waves in the Upper Atmosphere," Journal of Atmospheric and Terrestrial Physics, Vol. 25, Nov. 1963 (Contract No. Nonr 225(33); ARPA Order No. 196-62.

Description of the use of an analog computer to trace acoustic-wave ray paths to altitudes in excess of 300 km.

Bauer, S. J., "Some Implications of a Direct Measurement of the Hydrogen and Helium Ion Distribution in the Upper Atmosphere," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.

Evaluation of results obtained from measurements of ion composition in the altitude region from 300 to 940 km.

Bennett, E. W., Energy Deposition in the Atmosphere by Delayed Gammas from Fission, 24 Apr. 1964 (Contract W-7405-ENG-36).

Calculated source functions are provided for the determination of energy deposition in the atmosphere by delayed gammas from fission of U^{235} and U^{238}.

III,
H. EARTH ATMOSPHERE (CONT.)

Berezin, V. M. and Shafrin, Yu. A., "Computing the Vertical Distribution of Atmospheric Ozone," Transl. into English from Geomagnetizm i Aeronomiya (USSR), Vol. 4, No. 1, Jun. 1964 (NASA-TT-F-9015).

On the basis of the mean vertical distribution of ozone over Arosa, the effect of vertical currents and turbulence on ozone distribution is estimated by using numerical analysis of the continuity equation. Preliminary information is obtained on the interrelationship of these factors in combination with the photochemical equilibrium factor.

Berg, M. A. and Shefov, N. N., "OH Emission and the Atmospheric Band λ 8,645 Å of the O_2 Molecule," Aurorae and Airglow, May 1964 (see N64-21876 15-12).

According to the observations in Zvenigorod, there is a dependence between the intensity of the (0.1) O_2 λ 8,645 Å band and the rotational temperatures of O_2 and OH. This dependence is similar to the one observed in Yakutsk for the hydroxyl radiation. There is also a dependence for the emission of the OH molecules, which confirms earlier results.

Berkner, L. V. and Marshall, L. C., "The History of Oxygenic Concentration in the Earth's Atmosphere," Faraday Society, General Discussion on Chemical Reactions in the Atmosphere, Edinburgh, Scotland, Apr. 2, 3, 1964, Paper 3429.

Discussion of a subject which is stated to be classifiable under the general heading of Paleo-atmospheres or Fossil Atmospheres, comprising a critical quantitative study of the history of planetary atmospheres.

Berkofsky, L. and Shapiro, R., "Some Numerical Results of a Model Investigation of the Atmospheric Response to Upper-Level Heating," Planetary and Space Science, Vol. 12, Mar. 1964.

Presentation of typical results of calculations to determine whether a perturbation could be induced on a zonal flow at the atmosphere mean level by the addition of a certain amount of solar energy.

Blagonravov, A. A., "Explorations of Outer Space and the Outer Layers of the Atmosphere," Outer Space Explorations, 4 Dec. 1963 (See N64-12889 04-01).

The principal results of explorations of outer space were carried out with the aid of (1) the automatic interplanetary station, "Mars-1;" (2) satellites of the "Kosmos" type intended for study of the outer layer of the atmosphere and the outer space which surrounds the Earth; (3) the launching of exploratory rockets with the purpose of recording the temperature, density, and winds in the upper layers of the atmosphere; and (4) radiolocation of the planets Mercury, Venus, and Mars with the aid of ground-based means.

III,

H. EARTH ATMOSPHERE (CONT.)

Block, L. C. and Zachor, A. S., "Inflight Satellite Measurements of Infrared Spectral Radiance of the Earth," Applied Optics, Vol. 3, Feb. 1964.

Description of spectrographic measurements of the atmospheric and terrestrial radiation to outer space made by an interferometer from an Air Force satellite. Spectra are obtained in the infrared region between 1.8μ and 15μ over a period of seven days. Small parts of these data have been reduced and some of the reduced data have been compared to "theoretical" spectra computed from the meteorological conditions that prevailed during the time of the orbits.

Boischot, A., "Effects of the Sun on the Ionosphere," Radio Astronomical and Satellite Studies of the Atmosphere, Edited by Jules Aarons (Conference sponsored by NATO), Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers Div., John Wiley and Sonc, Inc., 1963. In French, with summary in English.

Bowen, P. J. Boyd, R. L. F., Davies, M. J., Dorling, E. B., Groves, V., and Stebbings, R. F., "Upper Atmosphere Wind and Temperature Structure By Skylark Rocket-Grenade Experiments at Woomera, Australia, 1957-59," Royal Society (London), Proceedings, Series A, Vol. 280, July 21, 1964.

Description of the first grenade experiments carried out at the Woomera rocket range in 1957-59, together with the optical and acoustical instrumentation used to determine the burst positions and to find the times of travel of the sound waves to the ground.

Bozhkon, R. D., "Variations in the Total Amount of Ozone and Their Relationship to Temperature Changes in the Stratosphere," Transl. into English from Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No. 1, 1964 (NASA-TT-F-9016).

The correlation coefficients, R, were calculated for diurnal variations of the total amount of ozone and the corresponding temperature changes at 100-, 50-, 25-, and 10-mb levels over Oxford, Arosa, and Rome during the period of the IGY. It was found that $R > 0$, but it changes very rapidly without any regularity in the course of a year.

Brady, A. H., Crombie, D. D., Jean, A. G., Murphy, A. C., and Steele, F. K., "Long-Lived Effects in the D Region After the High-Altitude Nuclear Explosion of July 9, 1962," Journal of Geophysical Research, Vol. 69, May 1, 1964 (ARPA-supported research).

Discussion of the Starfish nuclear detonation at an altitude of 400 km over Johnson Island, showing the presence of certain effects in the D-region which lasted for at least one week.

Brown, R. R., Balloon Flight Study of the Atmosphere, Final Report, Mar. 1964, (AF AFOSR Grant 62-422).

Features of the summer balloon-flight study of the earth atmosphere are discussed.

Bryant, R., "Densities Obtained from Drag on the Explorer 17 Satellite," Journal of Geophysical Research, Vol. 69, April 1, 1964.

Presentation of data on orbit elements for the active experiment lifetime of the Satellite Explorer 17 (1963 Alpha 9) and application to the determination of atmospheric density in the region of the perigee of the satellite.

Buxton, E. B. and Molloy, R. C., "Radiometer Readings During Eclipse, July 20, 1963," Journal of Geophysical Research, Vol. 69, Mar. 15, 1964.

Presentation of radiometer readings from Blue Hill, Maine (100 percent shadow) and Hartford, Connecticut (90.5 percent shadow), with plotted curves giving an indication of the relative variation of incoming and outgoing radiation. Readings have been converted to equivalent blackbody temperatures.

Cadle, R. D., "Daytime Atmospheric $O(^1D)$," Faraday Society, General Discussion on Chemical Reactions in the Atmosphere, Edinburgh, Scotland, April 2, 3, 1964, Paper 2190.

Estimate of atmospheric $O(^1D)$ concentrations for the altitude range 10-240 km. The estimates for the 100-240-km region are based on calculations of the 6300-Å line intensity by Brandt, while those for the region below 100 km are based on calculations of the rates of photolysis by UV radiation of O_3.

Carver, J. H., Mitchell, P. and Murray, E. L., "Molecular Oxygen Density and Lyman-α Absorption in the Upper Atmosphere," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964. Research supported by the Australian Department of Supply.

Rocket measurements of the absorption of solar Lyman-α radiation (1216 Å), for the determination of O_2 density above 70 km.

Carver, J. H., Mitchell, P., Murray, E. L., and Hunt, B. G., Molecular Oxygen Density and Lyman-α Absorption in the Upper Atmosphere, Adelaide U. (Australia) (WRE, Salisbury), 1963.

Rocket measurements of the absorption of solar ultraviolet radiation provide a powerful method for the determination of the composition of the upper atmosphere.

Casaverde, M. and Giesecke, A., Measurements of the Night Sky Radiations at the Magnetic Equator, Huancayo, Peru, Final Technical Report (Contract AF 19(604)-7213), Oct. 1963.

Essentially the main effort has been to carry out a continuous and reliable program of night sky observations at Huancayo, Peru, in the magnetic equatorial region. Observations were made with a scanning photometer, at various azimuths and altitudes all over the sky, on three wavelengths - 6,300 A, 5.893 A, and 5.577 A. Data analysis and correlation with other geophysical parameters are reported.

III,

H. EARTH ATMOSPHERE (CONT.)

Chamberlain, J. W., "Air glow and the Physics of Upper Atmospheres," Science, Vol. 142, Nov. 15,1963.

General discussion of recent theoretical and experimental investigations concerning the interrelation of atmospheric physics and the phenomenon of airglow.

Chandra, S., "Plasma Diffusion in the Ionosphere," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Jan. 1964.

Evaluation of the equations of motion appropriate to the conditions existing in the ionosphere, discussed with a view to examining the condition for ambipolar diffusion ($v_e = v_i$).

Chandra, S. and Goldberg, R. A., Geomagnetic Control of Diffusion in the Upper Atmosphere, May 1964 (NASA-TM-X-55046; X-615-121).

In many recent papers concerned with providing an explanation for the geomagnetic anomaly, agreement with measured data was obtained from the equations of motion for electrons and ions when used with an empirical boundary condition, whereas poor agreement has resulted from attempts to numerically integrate the commonly employed form of the continuity equation.

Charney, J. G. and Pedlosky, J., "On the Trapping of Unstable Planetary Waves in the Atmosphere," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963 (Contract No. Nonr 562(34).

Demonstration that the vertical energy flux of unstable planetary-scale waves in a statically stable atmosphere decreases at least exponentially with increase in altitude in a layer containing neither horizontal nor vertical shear in the mean zonal wind.

Checha, V. A., "Some Results of Investigations of the Parameters of the Inhomogeneous Structure of the Ionosphere with Consideration of the Coherently Reflected Part of a Signal in the F_2 Region," Geomagnetism and Aeronomy, Vol. 3, No. 1, 1963. Translation.

Discussion of the parameters of the inhomogeneous structure of the ionosphere.

Chernigovskiy, N. T., "Surface Albedo of Land and Sea in the Arctic," Actinometry, Atmospheric Optics and Nuclear Meteorol.

A systematic study of the reflecting power of the Arctic land surface was begun in 1949. Data on numerous fixed and field observations from 14 polar stations from 1935 to 1957 were processed. The results of these observations are presented.

Chivers, H. J. A. and Hargreaves, J. K., "Ionospheric Absorption in Conjugate Regions and Possible Oscillation of the Exosphere," Nature, Vol. 202, May 30, 1964, NSF Grant No. 23788.

Investigation of the sporadic-absorption ratios between three pairs of magnetically conjugate stations situated at high magnetic latitude.

Chizhov, A. F., "Temperature Measurement of the Free Atmosphere Taking into Account the Recombination of Atoms," Transl. into English from Tr. Tsentr. Aerolog. Observ. (Moscow), No. 46, 1963 (NASA-TT-F-215).

The problem of measuring the temperature in the free atmosphere at altitudes above 100 km is considered when taking into account the recombination phenomenon.

Cote, O., On the Question of Turbulence in the Upper Atmosphere, Oct. 1962 (NASA Contract NAS5-215).

Coutrez, R., Gonze, R., Koeckelenbergh, A., Pourbaix, E., and Roquigny, R., "Contribution to the Study of Sudden Enhancement of Atmospherics (Sea's) and Associated Events," Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of the Atmosphere, Corfu, Greece, June 1962. Radio Astronomical and Satellite Studies of the Atmosphere, Edited by Jules Aarons, Conference sponsored by NATO.

Study of correlations between sudden enhancements of atmospherics (Sea's) and related solar-geophysical occurrences, on the basis of 340 Sea's observed in 1959, and homogeneous data on Sea's recorded on 27 kc with short time constant equipment in the period 1959-1962.

Cummack, C. H., "A Simple Form of the Ionospheric Diffusive Operator," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Jan. 1964.

Derivation of a relatively simple expression for the diffusive operator which occurs in the ionization continuity equation. This operator has been derived by Kendall and, more recently, by Goldberg and Schmerling.

Danilkin, N. P., "Vertical Movements in the Ionosphere Over Simferopol' During the Solar Eclipse of 1961," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963, Translation.

Presentation of results of computation of N(h) profiles. An estimate is made of the value and character of vertical movements at different heights in the F region.

Danilov, A. D., "Ionization of Argon in the Upper Atmosphere," Transl. into English from Kosmich. Issled. (Moscow), Vol. 1, No. 2, Jan. 1964 (NASA-TT-F-8817).

The problems of the formation and disappearance of argon ions in the atmosphere are discussed. It is shown that radiative recombination along cannot be the mechanism of the disappearance of these ions.

Danilov, A. D., "Ion Exchange Processes in the Upper Atmosphere," Transl. into English from Iskusstv. Sputniki Zemli (Moscow), No. 17, 1963 (NASA-TT-F-8525).

Theoretical considerations concerning the mechanisms of formation of various ions in the atmosphere and experimental studies of the rate coefficients of various reactions in the laboratory suggest that rapid ion-exchange processes take place in the upper atmosphere.

Dave, J. V., "Importance of Higher Order Scattering in a Molecular Atmosphere," Optical Society of America, Journal, Vol. 54, Mar. 1964.

Presentation of the results of computations of the intensity, degree of polarization, and the direction of polarization of the radiation transmitted after one, two, and three scatterings according to Rayleigh's law, for the case of a plane-parallel, homogeneous atmosphere of finite optical thickness.

Delcourt, J., Revah, I., and Spizzichino, A., "Goniometric Study of the High-Altitude Atmosphere Structure," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Edited by P. Muller. In French.

DeMore, W. B. and Raper, O. F., "Deactivation of $O(^1D)$ in the Atmosphere," Astrophysical Journal, Vol. 139, May 15, 1964.

Discussion of the mechanism for quenching $O(^1D)$ by N_2. It is suggested that the mechanism involves the reaction of $O(^1D)$ with N_2 which gives a vibrationally excited N_2O^*.

Dessler, A. J., "The Dissipation of Hydromagnetic Wave Energy in the Ionosphere," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper, NSF Grant No. GP-2228.

Review of the basic concepts of ionospheric heating by hydromagnetic waves. It is considered that the theoretical aspects are well understood.

Dikiy, L. A., "Free Oscillation Frequencies of the Earth's Atmosphere," Transl. into English from Dokl. Akad. Nauk SSSR, Ser. Geofiz. (Moscow), Vol. 157, No. 3, 31 Aug. 1964 (Contract NAS5-3760).

The frequencies of free oscillations of atmosphere on a rotating spherical earth are computed for real temperature stratifications, based on the standard atmosphere values (CIRA 1961). All types of oscillations, from waves of synoptic scale to fast acoustic waves, are incorporated in the obtained graph.

Doherty, G. and Jonathan, N., "Laboratory Studies of the Chemiluminescence from the Reaction of Atomic Oxygen with Nitric Oxide Under Upper Atmosphere Conditions," Faraday Society, General Discussion on Chemical Reactions in the Atmosphere, Edinburgh, Scotland, Apr. 2, 3, 1964, Paper 3227, NASA-supported research.

Observation of light emission from the reaction of atomic oxygen with nitric oxide over the pressure range 0.85-400μ Hg. By calculation of the partial pressures of atomic oxygen and nitric oxide, it is concluded that the light emission shows a first-order dependence with respect to the atomic oxygen and nitric oxide partial pressures, but is independent of the total pressure.

Dunaway, G. L., An Empirical Technique for Improving Aerobee-Hi Impact Predictions, Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex., May 1964.

An empirical technique is presented for the improvement of Aerobee-Hi impact predictions. The variables used in the prediction equations are the theoretical wind displacements from the surface to 2,000 feet and from 2,000 to 100,000 feet. The results are presented in tabular form.

Duntley, S. Q., Measurements of Atmospheric Boil, Sept. 1963 (Rep.-6-5, Contract NObs-72039).

The apparatus measured atmospheric boil in terms of its effect in limiting the resolving power of telescopes and tracking camera. It was used in an experiment to explore the effect on measured rms ray deviation of increasing the entrance pupil diameter of the telescope beyond 6 inches. Curves plotted from the shimmer data are shown.

Edwards, H D., Theoretical and Laboratory Experimental Research in Chemical Releases at High Altitudes, Semi-Annual Status Report No. 3, 1964 (NASA Grant NsG-304-63, NASA CR-53933).

The mathematical equations and computer programs developed during the previous period have been improved and extended to other aspects of atmospheric motion.

Elias, L., "Some Chemical Aspects of Upper Atmosphere Research," Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin, No. 1, 1963.

Description of the chemical properties of that part of the atmosphere which extends from about 15 to 200 km.

Ellis, G. R. A., "On External Radio Emission from the Earth's Outer Atmosphere," Australian Journal of Physics, Vol. 17, March 1964.

Discussion of the possibility that cyclotron radiation, generated by fast, bunched electrons in the Earth's outer atmosphere, may be observable outside the geomagnetic field.

III,
H. EARTH ATMOSPHERE (CONT.)

Elterman, L., "A Representative Vertical Ozone Distribution for Atmospheric Transmission Studies," Applied Optics, Vol. 3, May 1964.

Brief discussion of the concept of a representative ozone distribution as a function of altitude and necessary for carrying out exploratory calculations in studies of ultraviolet and infrared transmission of the atmosphere.

Fatkullin, M. N., "Electrical Conductivity of the Upper Atmosphere. I. Middle Latitudes," Transl. into English from Geomagnetizm i Aeronomiya (Moscow), Vol. 4, No. 11, 1964 (NASA-TT-F-9014).

The altitude distribution of the coefficients of anisotropic conductivity in the upper atmosphere is analyzed. Proceeding from various models of the upper atmosphere, the limits for the variation in the values of the coefficients of conductivity in regions E and F2 are obtained.

Fea, G., "Interplanetary Plasma and the Earth's Atmosphere," Rivista di Meteorologia Aeronautica, Vol. 23, Oct.-Dec. 1963. In Italian, with summaries in English and French.

Fedorova, N. I., "Physics of the Upper Atmosphere," Transl. into English from Vestn. Akad. Nauk SSSR (Moscow), No. 7, July 1962.

This article reviews papers presented at a Soviet conference on upper-atmospheric physics. The papers discussed the results of observations of night-glow emissions. Aurorae Polaris, twilight emissions, and other phenomena that occur in the upper atmosphere.

Fiocco, G. and Smullin, L. D., "Detection of Scattering Layers in the Upper Atmosphere (60-140 km) by Optical Radar," Nature, Vol. 199, Sept. 28, 1963 (USAF-Navy-supported research and Grant No. NsG-419).

Brief review of observations of optical echoes from atmospheric constituents (presumably dust) at heights of 60-140 km, using an optical radar consisting of a ruby laser delivering short pulses of approximately 50 nanosec, 0.5 joule at a wavelength of 6940 Å.

Fite, W. L. and Rutherford, J. A., "Negative Ions in Afterglows in Atmospheric Gases," Faraday Society, General Discussion on Chemical Reactions in the Atmosphere, Edinburgh, Scotland, Apr. 2, 3, 1964, Paper 3161. Contract No. DA49-146-XZ-041.

Application of mass spectrometric monitoring of ions in afterglows in atmospheric gases to the study of negative ions. It is noted that it seems likely that many of the atmospheric phenomena usually attributed to O_2^- and NO_2^- involve these and other heavier ions.

III,
H. EARTH ATMOSPHERE (CONT.)

Fomenko, B. D., Bonelis, I. V., and Kubyshkin, V. V., "Latitude and Height Dependence of Atmospheric Disturbances Caused by Type M Solar Corpuscular Streams," Soviet Astronomy, Vol. 7, Jan.-Feb. 1964. Translation.

Fominov, A. M., "The Determination of Some Parameters of the Earth's Atmosphere from the Motion of Satellites," Transl. into English from Astron. Tsirkulyar, No. 255, 1963.
From the variations in the orbital periods of the satellites Vanguard 3 and Explorers 1, 8, and 11, an attempt is made to derive upper atmosphere density and its variation with latitude, longitude, and solar activity.

Frank, L. A., Van Allen, J. A., and Craven, J. D., Large Diurnal Variations of Geomagnetically Trapped and of Precipitated Electrons Observed at Low Altitudes, March 1964 (NASA Grant NsG-233-62, Contract Nonr-93803).
A large, similar diurnal variation of the intensities of geomagnetically trapped and of precipitated electrons is observed in data obtained with the low-altitude satellite Injun III over the period December 1962 to September 1963.

Fraser, R. S., "Apparent Contrast of Objects on the Earth's Surface as Seen from Above the Earth's Atmosphere," Optical Society of America, Journal, Vol. 54, 1964.
The apparent contrast of objects lying on the surface of the Earth, when observed in the visible spectrum from above the Earth's atmosphere, is calculated for three model atmospheres.

Friedman, R. M., Rawcliffe, R. D., and Meloy, G. E., "Radiance of the Upper Atmosphere in the Middle Ultraviolet," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963 (Contract No. AF 04(695)-169.
Description of an experiment that measured the radiance of the upper atmosphere in the middle UV from an Air Force satellite (1962 Alpha Eta 1).

Friend, J. P., Feely, H. W., and Leo, M. W. M., Project Star Dust, Eighth Quarterly Report, 7 April 1964 (Contract DA-49-146-XZ-079).
High concentrations of total beta activity and of short-lived fission products, such as barium^{140}, were found in the stratosphere of the Northern Hemisphere during late 1962 and early 1963, mainly as a result of the late 1962 Soviet series of nuclear weapons tests.

Fritz, S., "The Variable Appearance of the Earth from Satellites," Monthly Weather Review, Vol. 91, Oct.-Dec. 1963.
Discussion of the continuous changes in the appearance of the Earth, as seen from space. All these effects are illustrated with pictures and measurements from TIROS satellites. A high resolution picture recovered from the Mercury project is also included.

III,
H. EARTH ATMOSPHERE (CONT.)

Fritz, S., Rao, P. K., and Weinstein, M., "Satellite Measurements of Reflected Solar Energy and the Energy Received at the Ground," Journal of the Atmospheric Sciences, Vol. 21, Mar. 1964.

Presentation of a method whereby satellite measurements of reflected solar radiation can be compared with pyrheliometric measurements at the ground and with measurements from aircraft.

Gal'perin, Y. I. and Krasovskiy, V. I., "Investigations of the Upper Atmosphere with Satellites Cosmos-3 and Cosmos-5. 1: Instrumentation," Cosmic Res., 29 Oct. 1963.

Instruments carried on satellites Cosmos-III and Cosmos-V are described. Instrumentation included two traps for fast charged particles, five fluorescent-screen electron indicators, and a Geiger counter.

Galperin, I. I. and Krassovski, V. I., "Investigations of the Upper Atmosphere Using the Artificial Earth Satellites Cosmos 3 and Cosmos 5," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, edited by P. Muller.

Description of the radiation-measuring instrumentation on the Cosmos-3 and the Cosmos-5 satellites. The systems consisted of two ion traps, five indicators with fluorescent screens, and a Geiger counter. The design, capabilities, and operation of the equipment are considered.

Gauger, J., "Atmospheric Neutron Flux Measurements," Journal of Geophysical Research, Vol. 69, June 1, 1964.

Measurement of the energetic neutron flux at atmospheric depths from 160 to 300 g/cm^2 and from the equator to 55°N geomagnetic. An anomalous increase in the flux of high-energy neutrons detected on July 21, 1962 is attributed to a possible dumping of protons temporarily trapped in the slot between the inner and outer Van Allen zones.

Gawin, J., Hibner, J., Maze, R., and Zawadzki, A., "Large Atmospheric Photonic Sheaves," Académie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 1, Jan. 6, 1964. In French.

Glagolev, I. A., "Experimental Data on the Microstructure of the Temperature Field at Heights of 20 to 30 KM," Akademija Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, June 1964. In Russian.

Golovina, L. A., "The Effect of Atmospheric Dispersion on Photographic Positions of Stars," Astronomicheskii Zhurnal, Vol. 40, Sept.-Oct. 1963. In Russian, with summary in English.

III,
H. EARTH ATMOSPHERE (CONT.)

Green, A. E. S., "Attenuation by Ozone and the Earth's Albedo in the Middle Ultraviolet," Applied Optics, Vol. 3, Feb. 1964.
Development of an approximate analytical expression for the attenuation of middle ultraviolet radiation along slant paths through the atmosphere.

Groube, W., "A Strange Luminous Phenomenon," Transl. into English from L'Astronomie (Paris), May 1964 (Contract NAS5-3760).
On 9 February 1964, around 1835 hours, a large, luminous, elliptical spot, hazy in outline, was seen in the southeastern sky at Fez, Morocco. Its color was red in the highest part and blue-greenish in the remainder; the line of separation between the colors was rather clear.

Groves, G. W., "Meteorological and Atmospheric Structure Studies with Grenades," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.
Presentation of the results of wind and temperature measurements by acoustical and photographic observations of grenades released in the 1962 series of the Skylark firings at Woomera, South Australia.

Groves, G. V., "Atmospheric Densities Obtained from Satellite Orbits," Rocket and Satellite Meteorology, Proceedings of the First International Symposium on Rocket and Satellite Meteorology, Washington, D.C., April 23-25, 1962, edited by H. Wexler and J. E. Caskey, Jr.
Establishment, based on observations of satellite orbits, of the general features of the air density distribution between about 180 and 700 km.

Gul'medov, K., "Turbulence in the Upper Atmosphere as Revealed by Optical Observations of Meteor Trails at Ashkhabad and Kazan'," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963. Translation.
Determination of the vertical changes in wind velocity and direction, using a series of photographs of the drift of meteor trails.

Hall, L. A., Schweizer, W., and Hinteregger, H. E., "Diurnal Variation of the Atmosphere Around 190 Kilometers Derived from Solar Extreme Ultraviolet Absorption Measurements," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963.
Consideration of measurements of the atmospheric attenuation of solar extreme UV radiation in early morning, June 1962, and late afternoon, Oct. 1962.

Hanson, W. B. and Patterson, T. N. L., "Diurnal Variation of the Hydrogen Concentration in the Exosphere," Planet, Space Sci., Vol. 11, 1963. (Grant NsG-269-62)
Three effects that must contribute to the diurnal variation of the abundance of atomic hydrogen in the exosphere of the earth are enhanced escape of hydrogen from the sunlit exosphere associated with the higher daytime temperatures.

III,
H. EARTH ATMOSPHERE (CONT.)

Hanson, W. B., "Dynamic Diffusion Processes in the Exosphere," Electron Density Distribution in Ionosphere and Exosphere, Proceedings of NATO Advanced Study Inst., Skleikampen, Norway, 17-26 Apr. 1963. (Grant NsG-269-62)

The diffusion of protons into and out of the protonosphere is unlikely to be large enough so that interhemisphere is unlikely to be large enough so that interhemisphere ion transport can be important in determining the F2 peak ionization.

Hanson, K. J. and Viebrock, H. J., "Albedo Measurements Over the Northeastern United States," Monthly Weather Review, Vol. 92, May 1964 (NSF-supported research).

Description of measurements made on September 16, 1961, by means of Eppley pyranometers mounted in a P2V-7 aircraft, of the incoming and outgoing solar radiation fluxes at elevations of 7,500, 9,500, and 25,000 ft along flight paths between Atlantic City, N.J., and Erie, Pa. Albedo values are determined from the solar radiation at the flight level. Simultaneous photographs and radiation values were obtained on the 25,000-ft flight. It is stated that the albedo for the high-level flight varies from 0.158 for no undercast to 0.538 for a complete altocumulus undercast. Two selected observations at 1722 GMT and 1737 GMT are further discussed. A solar radiation budget is prepared for the 1737 GMT measurement, using high-level flight data and ground data from Thornthwaite Laboratories near Elmer, N.J.

Harris, I. and Priester, W., "Relation Between Theoretical and Observational Models of the Upper Atmosphere," Journal of Geophysical Research, Vol. 68, Oct. 15, 1963.

Comparison of recently developed theoretical models for the solar-cycle variation of the upper atmosphere, with air density data observed within the period from 1958 to 1963.

Harteck, P Reeves, R. R., Jr., and Albers, E. W., Fundamental Atom Chemistry with Applications to the Chemistry of the Upper Atmosphere, Technical Status Report No. 5, 1 Jul. 1963-31 Dec. 1963. (NASA Grant NsG-158-61).

Investigations of the nitrogen system has continued using N_2^{14-14} and N_2^{15-15} under various conditions. A small change was observed in the nitrogen system conversion at 1.5°K.

Haurwitz, B., "Atmospheric Tides," Science, Vol. 144, June 19, 1964.

Theoretical analysis of the atmospheric oscillations (tides) caused by lunar and solar gravitational forces and by the Sun's thermal effects. The respective variations in overall atmospheric tides and in semidiurnal lunar and solar tides are investigated.

Haymes, R. C., "Fast Neutrons in the Earth's Atmosphere. I - Variation with Depth," Journal of Geophysical Research, Vol. 69, Mar. 1, 1964 (Contract NAS 7-100).

Description of a series of balloon flights at $\lambda = 41°N$ to atmospheric depths of about 3.6 g/cm^2 conducted in 1963. A phoswich type of scintillation counter, which has a high efficiency for neutrons in the 1- to 14-mev range of energies, was employed.

III,
H. EARTH ATMOSPHERE (CONT.)

Hines, C. O., "Minimum Vertical Scale Sizes in the Wind Structure Above 100 Kilometers," Journal of Geophysical Research, Vol. 69, July 1, 1964 (Grant No. NsG-467).
Presentation of an explicit formula for the theoretical curve of the minimum scale sizes. The formula yields a curve which is a revision of a similar one presented earlier, which was stated to be in error. The new curve is then compared with data points presented by Zimmerman.

Hinteregger, H. E., "Notes on Wright's Interpretation of Temporal Variation of O/N_2 Ratio in the Thermosphere," Journal of Geophysical Research, Vol. 69, July 1, 1964.
Presentation of an answer to Wright's criticism that Hall et al.'s rocket experiment results involved a predominantly seasonal variation rather than a predominantly diurnal variation. The previous conclusions that the presented data showed a predominantly diurnal variation are reaffirmed and corresponding arguments are given.

Holmes, J. C., Johnson, C. Y., and Young, J. M., "Ionospheric Chemistry," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.
Presentation of day and night observations of the positive ion composition of the ionosphere between 120 and 230 km at White Sands, New Mexico.

Houghton, J. T., "Stratospheric Temperature Measurements from Satellites," British Interplanetary Society, Journal, Vol. 19, May-June 1964.
Presentations of the principles underlying the measurements. Radiated power from the Earth-atmosphere system in a narrow frequency range of the IR spectrum is functionally related to a temperature T which corresponds to the mean temperature of a thin slab of atmosphere.

Hrasky, W. C. and McKee, T. B., Radiance of the Earth and Its Limb in the Middle Ultraviolet, July 1964 (NASA-TN-D-2355).
The equation for the calculated radiance in the middle ultraviolet region (0.20μ to 0.30μ) emerging from the top of a 200-k-thick spherical atmosphere is derived from the geometry and physics of Rayleigh scattering and ozone absorption.

Hubbard, E. L., Calculation of the Intensity of the Light Scattered in the Atmosphere in the Wavelength Region 2300A to 3100 A with Absorption by Oxygen and Ozone Considered, Sept. 1963 (ARPA SD-71).
The diffuse field approach has been used to calculate the intensity of the scattered light in the earth's atmosphere. Emphasis was placed on the ultraviolet region in the solar spectrum, with the absorption of ozone and oxygen included where appropriate.

III,
H. EARTH ATMOSPHERE (CONT.)

Hultqvist, B., "Riometer Measurements, with Special Regard to Some Relevant Properties of the Upper Atmosphere," AGARD Advan. in Upper Atmosphere Res., 1963 (Contract AF 61(514)-1314).

Riometer measurements are discussed, with special regard being given to the absorption cross section of electrons, the electron-density profile, the time constants of the lower ionosphere, the ratio of collision detachment to photo detachment coefficients, and the relation between electron production rate and observed absorption.

Hundley, R. O., Ultraviolet Spectroscopy of the Upper Atmosphere, July 1964 (Contract NASr-21(07)).

This memorandum surveys the middle and vacuum ultraviolet spectroscopy of the upper atmosphere. The various physical and chemical processes involved in the interaction of radiation with the atoms and molecules of the upper atmosphere are reviewed.

Hunten, D. M., "Optics of the Upper Atmosphere," Applied Optics, Vol. 3, Feb. 1964.

Review of the present knowledge of the upper atmosphere, and discussion of the various absorption and emission phenomena. Topics included are: chemical composition, ionization, temperatures, aurora, night airglow, and twilight and day glow.

Imyanitov, I. M., Gdalevich, G. L., and Shvarts, Y. M., "Measurement of the Electrostatic Field Intensity at the Surface of Geophysical Rockets Moving in the Upper Atmospheric Layers," Transl. into English from Iskusstv. Sputniki Zemli (Moscow), No. 47, 1963 (NASA-TT-F-8529).

The following aspects of the problem are discussed: (1) measurement technique - the use and components of an electrostatic generator; (2) theoretical basis of the operations of the instrument - error in measurement of field intensity at the surface of a body; (3) effect of space charge at surface of sounding bodies on results of measurements; and (4) results of measurements.

Israel, G., "Variations of Characteristic Parameters of the Memosphere Above Hammaguir," Académie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 5, Feb. 3, 1964. In French.

Istomin, V. G., "Detection, in the Upper Atmosphere, of O^+ Ions Energized in Excess of the Thermal Energy," Kosmicheskie Issledovaniia, Vol. 1, Sept.-Oct. 1963. In Russian.

Ivanov-Kholodnyi, G. S., "Maintenance of the Night Ionosphere and Corpuscular Fluxes in the Upper Atmosphere," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Discussion of the results of rocket and satellite investigations of electron density in the night ionosphere. Various mechanisms, determining the maintenance of the night ionosphere due to residual daytime ionization conservation, diffusion, and corpuscular fluxes, are considered.

Izakov, M. N., "On Measuring the Density of the Atmosphere with the Aid of Instruments Mounted in an Unoriented Satellite," Transl. into English from Kosmich. Issled. (Moscow), Vol. 1, No. 1, Jul-Aug. 1963 (NASA-TT-F-8568).

A method is presented for using six manometers (mass spectrometers), mounted in a satellite in a definite manner, to determine the density and, at certain moments in the rotation of the satellite, the temperature of the atmosphere, without the need for auxiliary instruments to determine the orientation of the instruments to the incident flux.

Izakov, M. N., "Measurements of the Atmospheric Density by an Instrumented Non-oriented Satellite," Cosmic Res., 29 Oct. 1963.

This article suggests a method of measuring the atmospheric density by 6 manometers or mass spectrometers installed on a satellite, without additional instruments for determining orientation.

Izakov, M. N., "Measurements of Atmospheric Temperature by an Instrumented Satellite," Cosmic Res., 29 Oct. 1963.

The accuracy of determining atmospheric temperature by the readings of two mass spectrometers or manometers installed on a satellite is evaluated. Conclusions are made concerning the requirements for orientation of the satellite and the expedient arrangement of the instruments.

Izakov, M. N., "Some Problems of Investigating the Structure of the Upper Atmosphere and Constructing Its Model," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Discussion of problems encountered in the interpretation of data and construction of models associated with investigations of the upper atmosphere.

Izakov, M. N., "Measuring the Temperature of the Atmosphere with the Aid of Satellite-Borne Instruments," Transl. into English from Kosmich. Issled. (USSR), Vol. 1, No. 1, Jul.-Aug. 1963 (NASA-TT-F-8569).

The accuracy is determined of computations of atmospheric temperature based on the readings of a pair of mass spectrometers or manometers mounted in a satellite. Conclusions are drawn concerning the necessary orientation of the satellite and the most favorable arrangement of the instruments.

III,
H. EARTH ATMOSPHERE (CONT.)

Jacchia, L. G. and Slowey, J., Temperature Variations in the Upper Atmosphere During Geomagnetically Quiet Intervals, 15 Jun. 1964 (Grant NsG-87-60, NASA-CR-45882).

These temperature variations are very nearly proportional to the variations in the K_p index, in contrast with the temperature variations during magnetic storms, which show proportionality with the a_p index.

Jacchia, L. G. and Slowey, J., "An Analysis of the Atmospheric Drag of the Explorer IX Satellite from Precisely Reduced Photographic Observations," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller, Grant No. NsG 87-60.

Analysis of the atmospheric drag of the Explorer 9 satellite, derived over an interval of 283 days by using precisely reduced photographs taken with the Baker-Nunn cameras.

Jacchia, L. G., "Influence of Solar Activity on the Earth's Upper Atmosphere," Planetary and Space Science, Vol. 12, May 1964.

Discussion of the results of satellite observations of the effects of solar activity on the Earth's upper atmosphere, covering variations in atmospheric structure, the diurnal variations, the 27-day atmospheric fluctuations, and the 11-year cycle (the decimetric solar flux).

Jarrett, A. H., McGrattan, G. J., and Smith, F. J., "The Measurement of High Altitude Wind Velocities from Vapour Releases. III - Trails Released from Flights SL16 and SL63 at Woomera," Planetary and Space Science, Vol. 11, Nov. 1963.

Comparison of the projector and computer methods for two sodium trails (SL16 and SL63) ejected from Skylark rockets fired from Woomera range on November 30, 1959 and March 6, 1961.

Jarrett, A. H., McGrattan, G. J., and Rees, J. A., "The Measurement of High Altitude Wind Velocities from Vapour Releases. I - Projector Method," Planetary and Space Science, Vol. 11, Nov. 1963.

Description of an experimental method for reducing the photographic data resulting from a sodium trail. The magnitude and direction of winds in the upper atmosphere between altitudes of 100 and 200 km have been determined by the reprojection of photographs of a sodium trail. The analysis of simultaneous exposures taken from at least two camera sites can lead to the measurement of wind velocities.

Johnson, E. R. and Lloyd, K. H., "Determination of Diffusion Coefficients from Observations on Grenade Glow Clouds," Australian Journal of Physics, Vol. 16, Dec. 1963.

Discussion of observations made on the glow produced by contaminants resulting from grenade explosions in the upper atmosphere. Theoretical derivation of two methods of determining diffusion coefficient of cloud brightness is given: (a) based on radial distribution of brightness, and (b) based on center point brightness.

III,
H. EARTH ATMOSPHERE (CONT.)

Johnson, F. S., "Composition Changes in the Upper Atmosphere," Electron Density Distribution in Ionosphere and Exosphere, Proc. of NATO Advanced Study Inst., Skeikampen, Norway, 17-26 Apr. 1963. (Grant NsG-269-62; Contract CwB-10531)

Composition changes can occur at various altitudes in the upper atmosphere as a result of temperature changes that cause the atmosphere to expand or contract.

Kallmann-Bijl, H., "Structure and Composition of the Atmosphere," (Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of the Atmosphere, Corfu, Greece, June 1962.) Radio Astronomical and Satellite Studies of the Atmosphere, Edited by Jules Aarons, Conference sponsored by NATO.

Presentation of numerical values of atmospheric parameters, in the form of tables and graphs. Average values of density, pressure, and temperatures for both daytime and nighttime atmospheres were calculated for a time of medium solar activity.

Kallmann, H. K. and Sibley, W. L., Diurnal Variation of Temperature and Particle Density Between ~100 KM and ~500 KM, Nov. 1963, Contract AF 49(638)-700; Proj. RAND).

Rocket and satellite observations made in the U.S.A. and in the U.S.S.R. of atmospheric densities and oxygen ratios $n(O)/n(O_2)$ were used to determine the diurnal variations of pressure, temperature, and composition in the region between 100 and 500 km.

Kallmann-Bijl, H. K. and Sibley, W. L., "Diurnal Variation of Temperature and Particle Density Between ~100 KM and ~500 KM," Planetary and Space Science, Vol. 11, Dec. 1963.

Kasner, W. H. and Phelps, A. V., Atomic Collision Processes Relating to the Atmosphere, 27 May 1964 (Contract DA-31-124-ARO(D)-99; DASA-WEB-07.010).

Combined microwave, mass spectrometric, and optical techniques have been used to study the afterglow decay of electrons, ions, and excited atoms from microwave discharges in gas mixtures.

Kastner, S. O., "Hydrogen Diffusion in the Thermosphere by Monte Carlo Method," Journal of Geophysical Research, Vol. 69, Jan. 1, 1964.

Application of the Monte Carlo method to the problem of hydrogen diffusion in the thermosphere, in order to avoid hypotheses such as the of hydrostatic equilibrium, and to simulate actual collisions as closely as possible.

Kaula, W. M., "Determination of the Earth's Gravitational Field," Reviews of Geophysics, Vol. 1, Nov. 1963.

Review of methods for determining the gravitational field of the Earth, emphasizing wide-scale variations of the field rather than local variations.

III,

H. EARTH ATMOSPHERE (CONT.)

Kauth, R. J., Multicolor Atmospheric Models, Chicago Univ., Ill.,(ARPA-SD-71)Sept.1963.
It is the purpose of this paper to prepare the groundwork for the computation of the joint probability density function of apparent radiances in several spectral regions, seen looking down at the atmosphere from above.

Kazachevskaia, T. V. and Ivanov-Kholodnyi, G. S., "Interpretation of Data Obtained by Rocket Measurements in the Upper Atmosphere Using a Thermoluminescent Phosphor," Planetary and Space Science, Vol. 11, Dec. 1963.

Kazimirovskii, E. S., "Wind Systems in the Lower Ionosphere," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963. Translation.
Presentation of results of the processing of measurement data for the horizontal drift of ionization inhomogeneities in the ionosphere. Data were obtained for the E and E_s regions by use of spaced antennas with a short base and radar observation of meteor trails.

King, G. A. M., "The Dissociation of Oxygen and High Level Circulation in the Atmosphere," Journal of the Atmospheric Sciences, Vol. 21, May 1964.
Presentation of ionospheric evidence to show that oxygen at ionospheric heights is dissociated much more in the winter hemisphere than in the summer.

King-Hele, D. G., "Values of Upper-Atmosphere Scale Height from the Orbits of Vostoks 3 and 4," Planetary and Space Science, Vol. 12, June 1964.
Application of orbital information recently made available to make possible calculation of the height.

King-Hele, D. G., "The Rotational Speed of the Upper Atmosphere, Determined from Changes in Satellite Orbits," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.
Determination of the angular velocity of the upper atmosphere by examining the changes in orbital inclination of all suitable satellites. It is stated that, because the atmosphere rotates, a satellite is subjected to a small lateral aerodynamic force which has the effect of slightly changing the inclination of the orbit to the equator.

King-Hele, D. G., "Upper-Atmosphere Densities," British Interplanetary Society, Journal, Vol. 19, May-June 1964.
Discussion of air density and its variation at heights of 200 to 1000 km as revealed by analysis of satellite orbits. A general picture of the atmosphere is presented: temperature, terminology, composition, and density of molecules and particles.

III,
H. EARTH ATMOSPHERE (CONT.)

King-Hele, D. G., "Rotational Speed of the Upper Atmosphere, at Heights of 200-300 KM," Nature, Vol. 202, May 30, 1964.

Calculation of the angular velocity of the upper atmosphere from data on the changes in orbital inclination of Earth satellites. Because the atmosphere rotates, a close satellite is subjected to small lateral aerodynamic forces that effectively change the inclination of the orbit to the equator.

King-Hele, D. G., "Variations in Upper-Atmosphere Density Between Sunspot Maximum and Minimum," Nature, Vol. 203, Aug. 29, 1964.

Presentation of data showing that, at heights of 200-800 km, the atmospheric density and temperature are strongly under solar influence, depending on the presence or absence of solar radiation (the day-to-night effect), and also responding vigorously to changes in solar activity.

Klein, M. M., Yu, K., and Harrison, R. H., Calculation of the Spatial Diffusion of Small Particles in an Exponential Atmosphere, Jun. 1963 (Contract DA-49-146-XZ-075; ARPA Order 188-61).

Previously, in obtaining analytic solutions for both three-dimensional and one-dimensional motion in atmospheres having exponential and parabolic intensity distributions, numerical work was confined to the one-dimensional problem for the exponential atmosphere.

Kochanski, A., "Atmospheric Motions from Sodium Cloud Drifts," Journal of Geophysical Research, Vol. 69, Sept. 1, 1964 (AEC-supported research).

Examination of horizontal motions from 25 sodium cloud experiments, in the altitude range from 70 to 190 km. It is stated that the outstanding characteristics of the apparent motion are pronounced velocity oscillations in the 70- to 130-km layer; they reach a maximum near 105 km and attenuate at greater heights.

Kockarts, G. and Nicolet, M., Helium and Atomic Hydrogen in a Period of Solar Activity Minimum, Transl. into English from a Paper Presented at the 4th COSPAR Space Sci. Symp., Warsaw, Jun. 1963 (Contract NAS5-2078).

The vertical distribution of helium and of atomic hydrogen has been determined for the case of minimum solar activity corresponding to temperatures reaching 850°K in daytime and lowering to about 650°K in nighttime. The effect of thermal diffusion in the thermosphere plays an important part in the concentration of helium and hydrogen.

Kockarts, G., "The Effect of Thermal Diffusion on the Distribution of Helium in the Heterosphere," Institut Royal Météorologique de Belgique, Publications, Série B, No. 88, 1964. In French.

III,
H. EARTH ATMOSPHERE (CONT.)

Krassovski, V. I., Galperin, I. I., Jorjio, N. V., Mularchik, T. M., and Boliunova, A. D., "Investigations of the Upper Atmosphere Using the Artificial Earth Satellites Cosmos 3 and Cosmos 5," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

Presentation of the results of the measurements obtained with the ion traps and electron indicators on the Cosmos-3 and Cosmos-5 satellites. Directional fluxes of positive ions with superthermal energies are studied.

Krassovskii, V. I. and Shefov, N. N., "On the Mechanism of Production of Metastable Orthohelium Atoms in the Upper Atmosphere," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Discussion of the mechanism of production of metastable orthohelium atoms in the upper atmosphere by the detection of fluxes of "fresh" photoelectrons in the upper atmosphere, above the F_2 species.

Kurt, V. G., "Neutral Hydrogen Near the Earth and in Interplanetary Space," Soviet Physics - Uspekhi, Vol. 6, Mar.-Apr. 1964, Translation.

Lastochkin, V. K. and Stankevich, K. S., "Measurement of the Absorption Coefficient in the Atmosphere at Decimeter Wavelengths," Izv. VUZov: Radiophys., 18 May 1964.

The results and methods are described of measurements of radio-wave absorption in the atmosphere at the 25-, 32.5-, 44.3-, and 56.5-cm wavelengths by using radioastronomical methods.

Lavrova, Y. V., "Geographic Distribution of Ionospheric Disturbance in the F2 Layer," Transl. into English of an article from Tr. Inst. Zemnogo Magnetiyma, Ionosferi i Rasprostraneniya Radiovoln Akad. Nauk SSSR (Moscow), issue 19 (29), 1961.

Lawrie, J. A., "Sudden Local Conductivity Changes in the Ionosphere," Geophysical Journal, Vol. 8, May 1964.

Presentation of an attempt to describe the transient magnetic change caused by a sudden local change of conductivity in the ionosphere. In a rough illustrative model, electric current is assumed to be flowing uniformly in a thin plane rigid sheet of uniform isotropic integrated conductivity.

Lee, H. S. and Bowhill, S. A., "A Statistical Study of Apparent Horizontal Ionospheric Movements Using 300 kc/s Radio Waves," Journal of Atmospheric and Terrestrial Physics, Vol. 25, Nov. 1963 (Contract No. AF 19(604)-4563).

Investigation of apparent horizontal ionospheric movements in the nighttime lower E-region of the ionosphere. Vertical incidence pulsed soundings at 300 kc were made over a period of one year, and the amplitude of the reflected wave was recorded at spaced receivers.

III,
H. EARTH ATMOSPHERE (CONT.)

Leonas, V. B., "A Possible Method for Measurement of the Temperature of the Upper Layers of the Atmosphere," Geomagnetism and Aeronomy, Vol. 3, No. 3, 1963, Transl.
Use of analysis of time of flight of particles in a molecular beam to measure temperature directly, involving the recording of particles with an identical time of flight relative to a known base.

Leovy, C., "Radiative Equilibrium of the Mesosphere," Journal of the Atmospheric Sciences, Vol. 21, May 1964.
Presentation of results of joint photochemical-radiative equilibrium calculations for the mesosphere and upper stratosphere. The major assumptions were that only oxygen allotropes participate in the chemistry and that the radiative balance is maintained between absorption of solar radiation by molecular oxygen and ozone, and infrared emission by carbon dioxide and ozone.

Lepechinsky, D. and Rolland, P., "On Plasma Instabilities and Their Probable Role in Ionospheric Phenomena," Journal of Atmospheric and Terrestrial Physics, Vol. 26, Jan. 1964.
Brief survey of the important problem of plasma instabilities and of the criteria available for internal instabilities. It is shown that a beam of solar particles penetrating the ionosphere will eventually excite enhanced plasma oscillations in the lower frequency band and generate an electromagnetic noise detectable on the ground. This concept explains the so-called VLF emission and also leads to a new interpretation of the ionospheric "wind" phenomenon.

Lincoln, J. V., "The Listing of Sudden Ionospheric Disturbances," Planetary and Space Science, Vol. 12, May 1964.
Discussion of sudden ionospheric distrubances (SID) created abruptly by large increases in absorption in the D-region of the ionosphere. Techniques considered to be most useful in providing data for worldwide coverage of these events are mentioned.

Link, F. and Sekera, Z., "Dioptric Tables of the Earth's Atmosphere; and, Extension of the Dioptric Tables of the Earth's Atmosphere," Transl. into English from Publ. of the Prague Natl. Obs. (Prague), No. 14, 1940 (NAVWEPS-8504; NOTS-TP-3483).

Link, F., "Absorbing Layer High Above the Earth," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller. In French.

III,
H. EARTH ATMOSPHERE (CONT.)

Maclay, G. J. and Babrov, H. J., "Errors in Spectral Absorption Measurements Due to Absorbing Species in the Atmosphere," Optical Society of America, Journal, Vol. 54, March 1964 (ARPA-NASA-supported research).

The accuracy of spectroscopic absorptance measurements can be seriously affected by the presence of absorbing species in the atmosphere anywhere in the optical train. The error is due to the band-pass nature of a monochromator, and therefore is just as severe when a double-beam spectrometer is used as when a single-beam spectrometer is used.

Malville, J. M., "Ionization of N_2 in the Upper Atmosphere by Geomagnetically Trapped Electrons," Journal of Geophysical Research, Vol. 69, May 1, 1964 (NASA-supported research).

Sunlit auroral rays extend to heights in the atmosphere at which the ionization equilibrium of N_2 may be dominated by trapped electrons of the outer radiation belt.

Marcum, J. I., Energy Deposition in the Atmosphere From High Altitude Gamma Ray Sources, Nov. 1963 (Contract AF 49(638)-700).

This report gives results for the deposition of energy in the atmosphere from two high altitude sources of gamma rays. In two particular cases, the deposition of energy from high altitude sources of gamma rays over a large volume of space does not differ from the equivalent problem with a uniform atmosphere by more than a factor of 2.

Marov, M. I., "Density of the Upper Atmosphere from the Data of Soviet Satellite Drag," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Determination of numerical values of atmospheric density during the period of maximum solar activity. Calculations were made on the basis of the analysis of secular accelerations of Sputniks 1, 2, and 3 (1957 Alpha 1, 1957 Beta 1, and 1958 Delta 2) and their carrier rockets.

Marov, M. Y., "Investigations of the Upper Atmosphere with Satellites Cosmos-3 and Cosmos-5. 4: Density of the Upper Atmosphere at Heights of 200-230 KM," Cosmic Res., 29 Oct. 1963.

Data are given on the deceleration of Cosmos-III and Cosmos-V, and estimates are made of the atmospheric density in the region of their perigees.

Marov, M. Y., "The Density of the Upper Atmosphere at Heights of 200-230 KM," Transl. into English from Kosmich. Issled. (USSR), Vol. 1, No. 1, 1963.

Information is given on the retardation of the satellites Cosmos 3 and Cosmos 5, and estimates are made of the density of the atmosphere in the region of their perigee.

III,
H. EARTH ATMOSPHERE (CONT.)

May, B. R., "A Note of the Features and Cause of the Diurnal Variation of Neutral Air Density at 205 KM," Planetary and Space Science, Vol. 11, Nov. 1963.
Description of the main features of the marked diurnal variation revealed in studies of upper-air density at height above 200 km.

May, E. E. and Kahle, A. B., The Satellite Determination of High-Altitude Water Vapor, February 1964, NASA Contract NASr-21(07).
Studying high-altitude water vapor by satellite observation of the 1.35-cm water-vapor line profile appears unfeasible. The water-vapor density distributions expected suggest that observations of this line will seldom, if ever, show large, easily discernible peaks. Since emission from the earth greatly reduces the line profile as seen by a satellite, ground observations are preferable.

Meadows-Reed, E. and Smith, C. R., "Mass Spectrometric Investigations of the Atmosphere Between 100 and 227 Kilometers Above Wallops Island, Virginia," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964.
Study of the diffusive separation of atmospheric constituents, by measuring the relative densities of argon and of molecular nitrogen at altitudes up to 227 km.

Mikhnevich, V. V., "Atmosphere Density at the Heights of 100-350 KM," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.
Discussion of atmospheric density measurements conducted during the period of maximum solar activity (1958) and during years which are close to minimum solar activity (1962, 1963). Pressure gages are used to determine the atmospheric density.

Mikirov, A. E., "Investigations of the Atmosphere Brightness at the Heights of 120-450 KM," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.
Presentation of experimental data obtained during a geophysical rocket firing. The investigations were carried out with a sensitive photometer.

Millman, G. H., "The Incoherent Scatter Technique for Studying the Earth's Atmosphere," (Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of the Atmosphere, Corfu, Greece, June 1962.) Radio Astronomical and Satellite Studies of the Atmosphere. Edited by Jules Aarons, Conference sponsored by NATO (Contract No. AF 30(602)-2244.
Brief discussion of theories of the incoherent scattering of electromagnetic waves by the free electrons in a plasma. The theoretical predictions of the characteristics of this phenomenon are compared with ionospheric experimental measurements. The application of this technique for probing the Earth's atmosphere is also considered.

III,
H. EARTH ATMOSPHERE (CONT.)

Millman, G. H., "Radar-Lunar Measurements of the Electron Content of the Ionosphere," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964 (Contracts No. AF 30(602)-1625; No. AF 30(602)-2244).

Analysis of the characteristics of the ionosphere medium based on the radar-lunar observations made at Trinidad, West Indies (10.7°N, 61.6°W) between January and July 1960.

Minzner, R. A., Sauermann, G., and Peterson, L. R., A New Method for Atmospheric Temperature Determination, Scientific Report No. 3, June 1963 (Contract AF 19(628)-1633).

Number-density versus altitude data for two gases having large differences in molecular weight permit the accurate determination of the temperature of planetary atmospheres in diffusive equilibrium.

Montanari, D., "Ozone - Some Aspects of Its Origin and Distribution in the Terrestrial Atmosphere," Rivista di Meteorologia Aeronautica, Vol. 24, Jan.-Mar. 1964. In Italian.

Muller, H. G., "Energy Equilibrium and Winds in the Upper Atmosphere," International Council of the Aeronautical Sciences, Congress, 4th, Paris, France, Aug. 24-28, 1964, Paper 64-549. In German.

Mulyarchik, T. M., "The Discovery in the Upper Atmosphere of Electrons with Energies From 40 eg to 5 kev," Cosmic Res., Vol. 2, No. 2, 8 Jun. 1964.

By means of fluorescent screen indicators on board Cosmos IV, electrons were recorded that had an energy of 0.04 to 4 kev. These electrons are recorded primarily during the daytime; they disappear several minutes after the satellite enters the earth's shadow and reappear again several minutes after it comes out of the shadow.

Nagy, A. F., Brace, L. H Carignan, G. R., and Kanal, M., "Direct Measurements Bearing on the Extent of Thermal Nonequilibrium in the Ionosphere," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963 (Contract No. AF-19(604)-6124).

Presentation of data obtained by two rocket-borne direct ionospheric measurement techniques. Two ejectable instrument packages, consisting of a spherical ion trap and a cylindrical electrostatic probe, were flown above Eglin Air Force Base, Florida.

Neo, Y. P. and Shepherd, G. G., "Measurements of the Daytime Abundance of Upper Atmospheric Sodium," Canadian Journal of Physics, Vol. 42, July 1964. Research supported by the National Research Council of Canada.

Report on measurements of the daytime upper atmospheric sodium abundance made at Saskatoon, Canada, by observing the variation of absorption of solar radiation by the terrestrial sodium as a function of the solar elevation.

III,

H. EARTH ATMOSPHERE (CONT.)

Newkirk, G., Jr. and Eddy, J. A., Light Scattering by Particles in the Upper Atmosphere," Journal of the Atmospheric Sciences, Vol. 21, Jan. 1964 (Contract No. Nonr 393(05).

Analysis of the data obtained on the two successful balloon flights of 10 September and 3 October 1960 made from the High Altitude Observatory.

Newkirk, L. L. and Walt, M., "Longitudinal Drift Velocity of Geomagnetically Trapped Particles," Journal of Geophysical Research, Vol. 69, May 1, 1964 (Contract No. DA 49-146-XZ-204).

Calculation of the longitudinal drift velocities for charged particles trapped in a realistic representation of the geomagnetic field for the magnetic shell L = 1.25.

Nicolau, E., "The Study of the Earth's Atmosphere and of Cosmic Space with the Help of Soviet Cosmic Rockets and Artificial Satellites," Transl. into English from Telecomunicatii, No. 2, 1960.

Radio-engineering methods employed in the exploration of the ionosphere are described, and the results obtained from the data collected by Soviet space rockets and artificial satellites are discussed.

Nicolet, M. and Swider, W., Jr., "Ionospheric Conditions," Planetary and Space Science, Vol. 11, Dec. 1963 (NSF Grant No. G18983; Contract No. AF19(604)-4563).

General analysis of ionospheric conditions to determine the nature of ionic reactions occurring in the upper atmosphere. Data obtained on such parameters as ionic production and recombination show that precise knowledge of the spectral distribution of solar radiations is required to understand the ionic reactions.

Nier, A. O., Hoffman, J. H , Johnson, C. Y., and Holmes, J. C., "Neutral Composition of the Atmosphere in the 100- to 200-Kilometer Range," J. Geophys. Res., Vol. 69, No. 5, 1 Mar. 1964 (NASA Grant NsG-286-63).

The neutral composition of the atmosphere in the altitude range 100 to 200 km has been studied with a simple magnetic mass spectrometer flown on an Aerobee rocket.

Nier, A. O., Hoffman, J. H., Johnson, C. Y., and Holmes, J. C., "Neutral Composition of the Atmosphere in the 100- to 200-Kilometer Range," Journal of Geophysical Research, Vol. 69, Mar. 1, 1964 (NSF-supported research; Grant No. NsG 286-63).

Study of the neutral composition of the atmosphere in the altitude range 100-200 km observed with a simple magnetic mass spectrometer flown on an Aerobee rocket.

III,

H. EARTH ATMOSPHERE (CONT.)

Nordberg, W., Rocket Soundings in the Mesosphere, presented at the Meeting on Meteorol. Support for Aerospace Testing and Operation, Colo. State U., Ft. Collins, 10-12 Jul. 1963 (NASA TM X-54618; X-651-63-244), Nov. 1963.

The following topics are discussed: (1) physics of the mesosphere; (2) experimental techniques - launch vehicles, radar tracking of chaff, sodium vapor ejection, acoustic grenades, falling sphere, pitot-static tube; (3) present rocket sounding programs; (4) results of recent rocket soundings - including a map of locations from rocket soundings in the mesosphere that have been conducted during and since IGY.

Obasi, G. O. P., "Poleward Flux of Atmospheric Angular Momentum in the Southern Hemisphere," Journal of the Atmospheric Sciences, Vol. 20, Nov. 1963 (Contract No. AF 19(604)6108).

Tabulations of daily winds from IGY data at eight pressure levels (850, 700, 500, 400, 300, 200, 100 and 50 mb) for 121 Southern Hemisphere plus 22 Northern Hemisphere equatorial stations during the calendar year 1958, in order to study by seasons the poleward flux and convergence of relative angular momentum.

O'Brien, B J., "High-Latitude Geophysical Studies with Satellite Injun 3. III - Precipitation of Electrons into the Atmosphere," Journal of Geophysical Research, Vol. 69, Jan. 1, 1964 (Contract No. N9onr 93803; Grant No. NsG 233-62).

Analysis of the precipitation of electrons with energy (E_e) greater than or equal to 40 kev into the atmosphere over North America, based on measurements made principally with three directional Geiger tubes on the magnetically oriented satellite Injun 3 (1962 Beta Tau 2).

Oelbermann, E. J., Jr., "Expected Radio Noise Levels in the Upper Atmosphere from 100 cps to 100 kmc/s," IEEE International Convention Record, Vol. 12, pt. 6, 1964.

Presentation of experimental and theoretical data on the expected noise levels in and below the ionosphere at altitudes from 100 to several thousand km, for frequencies from 100 cps to 100 Gc. The noise sources discussed are atmospheric, man-made, galactic, and local thermal noises.

Oppenheim, I., "Transport Equations for the Upper Atmosphere," Journal of Geophysical Research, Vol. 68, Nov. 1, 1963 (ARPA-supported research).

Derivation of the transport equations that describe irreversible processes in the very dilute, reacting, ionized gas mixture which comprises the upper atmosphere.

Paetzold, H. K., "New Results About the Annual and Semi-Annual Variation of the Upper Terrestrial Atmosphere," (COSPAR, International Space Science Symposium, 4th, Warsaw, Poland, June 3-11, 1963, Paper.) Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

III,

H. EARTH ATMOSPHERE (CONT.)

Pavleko, V. A., et al., "A Series of Small Mass Spectrometers for Investigating the Composition of Neutral and Ionized Gases in the Upper Layers of the Atmosphere," Transl. into English from Kosmich, Issled. (Moscow), Vol. 1, No. 2, Sept.-Oct. 1963. (NASA-TT-F-8821)

The theory of the radiofrequency mass analyzer is briefly presented, and the schematic diagram and construction of the MX6401, MX6403, and MX6405 spectrometers are described.

Paulikas, G. A. and Freden, S. C., "Precipitation of Energetic Electrons into the Atmosphere," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964 (Contract No. AF 04(695)-169).

Description of measurements of electron fluxes and spectra above 900 kev at altitudes between 200 and 700 km in early September and October 1962 aboard two near-polar Air Force satellites.

Peterson, J. W and McWatters, K. D., The Measurement of Upper-Air Density and Temperature by Two Radar-Tracked Falling Spheres, April 1964 (NASA Contract NASw-138).

Two major lines of investigation have been pursued: the measurement of neutral composition with mass spectrometers, and the measurement of neutral density with falling spheres.

Peterson, L. R. and Minzner, R. A., Considerations on Analysis of Atmospheric Structure Data with Emphasis on the Computation of the Angular Distance from the Subsolar Point, Scientific Report No. 4, Jan. 1964 (Contract AF 19(628)-1633).

Petrov, V. P. and Sochivko, A. A., "The Upper Atmosphere and Its Investigation with Satellites and Rockets," Weather Satellites and Rockets, 24 Apr. 1963.

The general structure and composition of the upper atmosphere are reviewed, and satellite and rocket discoveries regarding the upper atmosphere are discussed. Two of the most important of these discoveries have led to the establishment of two facts of utmost importance in geophysics. These facts are: (1) The earth is surrounded by layers of intense cosmic radiation. (2) The density of the atmosphere above 500 km is sixteen to forty times higher than was estimated prior to 1955.

Pfeffer, R. L., "A Multi-layer Model for the Study of Acoustic-Gravity Wave Propagation in the Earth's Atmosphere," J. Atmospheric Sci., Vol. 19, No. 3, May 1962 (Grants NsG-160-61; NSF G-9412; Contract Nonr-266(70)).

An iterative numerical procedure, suitable for use on electronic computers, is presented for calculating the horizontal propagation speeds of acoustic-gravity waves in a stratified atmosphere.

III,
H. EARTH ATMOSPHERE (CONT.)

Pokhunkov, A. A., "Mass-Spectrometer Measurements of Helium, Nitrogen and Argon Distribution in the Earth's Atmosphere Above 130 KM," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

Presentation of the results of measurements of the atmospheric composition, obtained with a radio-frequency mass spectrometer. He^+ ions are found at altitudes of more than 370 km.

Pokhunkov, A. A., "Mass-Spectrometric Measurements on the Distribution of He^+, N^+, O^+, NO^+, and O_2^+ Ions in the Earth's Atmosphere up to an Altitude of 430 KM," Transl. into English from Kosmich. Issled. (Moscow), Vol. 1, No. 2, Sept.-Oct. 1963. (NASA-TT-F-8819)

The absolute concentrations of atmospheric ions obtained with a radio-frequency mass spectrometer, installed in a geophysical rocket, are given for an altitude of 130 to 430 km. Helium ions were detected at altitudes above 370 km.

Pokhunkov, A. A., "The Distribution of Helium, Nitrogen, and Argon in the Earth's Atmosphere up to a Height of 430 KM," Cosmic Res., 29 Oct. 1963.

This article examines the results of experimental investigations of the neutral composition of the atmosphere by a radiofrequency mass spectrometer on a geophysical rocket.

Priester, W., "Discussion of Atmospheric Heat Sources Based on the Analysis of Satellite Drag Data," Dynamics of Satellites; Proceedings of the IUTAM Symposium, Paris, France, May 28-30, 1962. Edited by Maurice Roy.

Review of the main effects found to affect the physical properties of the upper atmosphere; the solar activity effect, the diurnal variation, the geomagnetic activity effect, and the semiannual and annual variation.

Prince, C. E., Jr., Bostick, F X., Jr., and Smith, H. W., A Study of the Transmission of Plane Hydromagnetic Waves Through the Upper Atmosphere, 15 Jul. 1964 (Contract Nonr-375(14)).

A new conductivity dyadic was used to study the propagation of ordinary and extraordinary modes of wave propagation in a partially ionized gas.

Rabinovich, Y. I. and Guseva, L. N., "Experimental Researches of Spectral Transparency of Atmosphere," Transl. into English from Issled. Radiats. Protsessov, Trudy, Glavnaya Geofiz. Observ. (Leningrad), No. 118, 1961.

Results of the spectral measurements of direct solar radiation in visible region of the spectrum are presented. An analytic relation between the spectral and the general coefficients of transparency is presented.

III,
H. EARTH ATMOSPHERE (CONT.)

Ragsdale, G. C. and Wasko, P. E., Wind Flow in the 80-400 KM Altitude Region of the Atmosphere, 5 Jun. 1962, NASA-TM-X-51724).

An attempt is made to deduce the wind characteristics in the 80- to 400-km ionospheric region of the atmosphere for the purpose of establishing wind input data for launch vehicle and spacecraft design-and-performance studies.

Rawcliffe, R. D., Meloy, G. E., Friedman, R. M., and Rogers, E. H., "Measurement of Vertical Distribution of Ozone from A Polar Orbiting Satellite," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963 (Contract No. AF 04(695)-169).

Brief review of the determination of the vertical distribution of ozone at high altitudes, measured with a satellite-borne radiometer. The attenuation, due to the ozone, of solar UV radiation passing obliquely through the atmosphere was measured at times of sunrise and sunset, as seen by the orbiting vehicle.

Rees, M. H., "Note on the Penetration of Energetic Electrons Into the Earths' Atmosphere," Planetary and Space Science, Vol. 12, July 1964, NSF Grant No. GP-620.

Presentation of the results of computations of the penetration altitude of electrons impinging on the Earth's atmosphere. The altitude at which electrons of a given energy produce the maximum ionization rate is listed in a table for three latitudes.

Reid, G. C., "Physical Processes in the D Region of the Ionosphere," Reviews of Geophysics, Vol. 2, May 1964.

Summary of present knowledge of the physical processes likely to be of major importance in determining the characteristics of the D region of the ionosphere. The basic processes are divided into three categories: (1) primary ionizing mechanisms; (2) interactions involving free electrons, ions, and the neutral gas; and (3) mechanical and electrodynamic mechanisms that lead to redistribution of ionization.

Roberts, W. T., Latest Wind Estimates from 80 KM to 200 KM Altitude Region at Mid-Latitudes, 16 Jun. 1964 (NASA TM-X-53064).

The data from a total of 40 rocket launches fired specifically to determine wind characteristics by the release of chemiluminescent trails were compiled and studied in an attempt to clarify seasonal and diurnal trends in upper atmospheric winds above 80 km.

Roemer, M., "Exospheric Densities Deduced from Satellite Drag Data," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

Presentation of exospheric densities in the altitude range of 900-1500 km derived from Echo 1 drag data taking full account of the diurnal density

variation. A diurnal dependence of the amplitude of the 27-day density variation due to the solar activity effect is found for this altitude range, and an empirical correlation formula is presented.

Rosenberg, N. W., Edwards, H. D., and Wright, J. W., "Ionospheric Winds - Motions Into Night and Sporadic E Correlations," (COSPAR, International Space Science Symposium 4th, Warsaw, Poland, June 3-11, 1963, Paper.) Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller. Grant No. NsG 304-63; Contracts No. AF 19(604)-5467; No. AF 19(628)-398.

Rosenberg, N. W. and Edwards, H. D., "Observations of Ionospheric Wind Patterns Through the Night," Journal of Geophysical Research, Vol. 69, July 1, 1964.

Study of ionospheric wind patterns using chemiluminous gas trails in the altitude region 90-130 km from sunset to midnight on Dec. 3, 1962, and from sunset to dawn on May 17-18, 1963, over Eglin Air Force Base, Fla. (86°W, 30°N).

Rosenberg, N. W., Golomb, D., and Allen, E. F., Jr., "Chemiluminescence of Trimethyl Aluminum Released into the Upper Atmosphere," Journal of Geophysical Research, Vol. 68, Oct. 15, 1963.

Brief review of an experiment conducted over Eglin AFB, Fla., on May 18, 1963, in which trimethyl aluminum (TMA) was released at 94-km altitude.

Rossoni, J. P., Sconzo, P., Greenfield, R. J., and Champion, K. S., "Atmospheric Density Determination from Satellite Observations," American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, New York, N.Y., Jan. 20-22, 1964, Preprint 64-31.

Description of a procedure developed to obtain detailed quantitative information about the perturbing effects of atmospheric drag by appropriate analysis of satellite motion, and, from this analysis, determine density values.

Rossoni, J. P., Sconzo, P., Greenfield, R. J., and Champion, K. S., "Atmospheric Density Determination from Satellite Observations," Celestial Mechanics and Astrodynamics (Progress in Astronautics and Aeronautics. Volume 14). Edited by Victor G. Szebehely.

Sagalyn, R. C. and Smiddy, M., "Rocket Investigation of the Electrical Structure of the Lower Ionosphere," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Edited by P. Muller.

Sagalyn, R. C. and Smiddy, M., "Electrical Processes in the Nighttime Exosphere," Journal of Geophysical Research, Vol. 69, May 1, 1964.

Presentation of the results of nighttime measurements of positive ion densities between 240 and 1875 km. The ion scale height is found to

change abruptly around 600 km, increasing from 120 km at 500 km to 1400 at 640 km; it increases gradually with height above this level.

Sayers, J. and Smith, D., "Ion and Charge Exchange Reactions Involving Atmospheric Gases," Faraday Society, General Discussion on Chemical Reactions in the Atmosphere, Edinburgh, Scotland, Apr. 2, 3, 1964, Paper 3223. USAF-supported research.

Description of experiments carried out to study reactions between ions and neutral particles, using time resolving mass-spectrometric monitoring of the afterglows in atmospheric gases produced by radio-frequency discharges.

Schaefer, E. J. and Brown, J., Additional Rocket-Borne Mass Spectrometer Measurements of the Dissociation of Oxygen, Jan. 1964 (NASA Contract NASr-54(05)).

An experiment is discussed to measure the ambient neutral composition of the upper atmosphere by a rocket-borne "massenfilter."

Schaefer, E. J. and Brown, J., "Additional Rocket-Borne Mass Spectrometer Measurements of the Dissociation of Oxygen," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964.

Description of a repeated experiment to measure the ambient neutral composition of the upper atmosphere. The following changes were made in the second experiment: (1) a Nike-Apache rocket was used, which permitted measurements to 190 km instead of to 134.5 km; (2) the sensitivity of the massenfilter was increased by a factor of 3, requiring a reduction in scan rate from 2 per second to 1 per second; (3) improvements in the airborne circuitry yielded a reduction in noise level to one-quarter that of the previous flight; (4) the instrumentation was ejected from a canister evacuated to a pressure of a few microns instead of from a canister back-filled with helium.

Schilling, G. F., Theoretically Permissible Altitudes and Seasons for the Occurrence of Clouds Near the Mesopause, presented at Symp. on Noctilucent Clouds, Stockholm, 4-6 May 1964.

A thermodynamic exclusion principle is used to determine those regions in the earth's upper atmosphere where the formation of clouds due to condensation or sublimation of water vapor is or is not possible.

Schmelovsky, K. H., "Theoretical Investigations of the Structure of the F^2 Layer and the Outer Ionosphere," Geomagnetism and Aeronomy, Vol. 3, No. 2, 1963. Translation.

Determination of the electron distribution in the region between 200 and 1500 km by means of photoionization, recombination, and diffusion.

Schmelovsky, K. H., "Plasma Temperatures and Recombination Parameters in the Outer Ionosphere," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings. Organized by the Committee on Space Research (COSPAR) and the Polish Academy of Sciences. Edited by P. Muller.

Theoretical investigation based on rocket and satellite data and on Faraday-fading observations at Kühlungsborn (54.1°N, 11.8°E). It is shown that the electron temperature in the outer ionosphere is much higher than the neutral gas temperature, especially at summer noon.

Schwentek, H., "The Variation of Ionospheric Absorption From 1956 Till 1963," Journal of Atmospheric and Terrestrial Physics, Vol. 25, Dec. 1963.

Presentation of the results of determinations of the diurnal variation of radio wave absorption in the ionosphere by recording the field strength of a distant CW-transmitter during the period 1956-1963.

Sekera, Z., Optical Studies of The Atmosphere, Final Report, Apr. 1964 (AFCRL-64-366; AD-602004).

A balanced program of experimental and theoretical investigations of the problems encountered in atmospheric optics has been pursued. Investigation of the effect of a turbid layer on the radiation emerging from a planetary atmosphere has been completed for an idealized case.

Sergeyev, A. V., and Luzov, A. A., "The Barometric Coefficient of The Neutron Component," Cosmic Rays, Jul. 1964.

Computations of barometric coefficients (β%/mb) of the neutron component are presented for the summer and fall of 1958, the winter of 1958 and 1959, and the spring of 1959. The barometric coefficient for the neutron component is presented for high, medium, and equatorial latitudes.

Shcheglov, P. V., "The Flat Hydrogen Cloud Around The Earth," Sov. Res. in Atmospherology and Geol., Nov. 12, 1963. Transl. into English from Priroda (Moscow), No. 8, 1963.

Problems connected with the spectrographic observation of hydrogen in the earth's atmosphere are discussed. Resulting observations have shown that the emission of the red hydrogen line is enhanced considerably with an approach to the ecliptic and to the sun.

Shefov, N. N., "The Helium Emission in The Upper Atmosphere, Aurorae and Airglow, May 1964.

This paper describes the excitation mechanism of the helium emission λ10.830 A in sunlit aurorae and in twilight without aurorae. Observations of the twilight emission λ10.830 A were used to determine the helium content in the earth's atmosphere at altitudes of about 1,000 km.

Sheppard, L. M., and Lloyd, K. H., "Atmospheric Density and The Diffusion of Grenade Glow Clouds," Planetary and Space Science, Vol. 12, Apr. 1964.

Comment on Whitehead's suggestions concerning the determination of upper atmospheric densities from contaminant experiments at an altitude of 120 km. In the present paper, it is stated that the contaminant glow cloud technique is not as inaccurate as Whitehead implied, provided that the brightness distribution across the glowing cloud is observed.

III,
H. EARTH ATMOSPHERE (CONT.)

Shifrin, K. S., and Shubova, G. L., "Statistical Characteristics of Vertical Atmospheric Transparency," Akademiia Nauk SSSR, Izvestiia, Seriia Geofizicheskaia, Feb. 1964. In Russian.

Shifrin, K. S., and Shubova, G. L., "The Statistical Characteristics of The Vertical Transparency of The Atmosphere," Academy of Sciences, USSR, Bulletin, Geophysics Series, Feb. 1964. Translation.

Siedentopf, E., and Unz, F., Temperature Fluctuations in The Atmospheric Ground Layer Observed at Zeekoegat and Flat-Hill (South Africa), European Southern Observatory Publication, Mar. 1964.

Test measurements of temperature fluctuations in the atmospheric ground layer are described. From the measurements, it was noted that the ground layer significantly contributes to the seeing values registered.

Simmons, R. W., An Introduction To The Theory and Data Reduction Method For The Pitot-Static Technique of Upper Atmosphere Measurement, Mar. 1964 (Contract NAS4-3335) (NASA-CR-56411; RS-1).

This paper serves to briefly introduce the terminology and nature of the upper atmosphere for data reduction. The theory, equations, conversions, and transformation required in data processing are developed in detail.

Sims, W. E., and Bostick, F. X., Atmospheric Parameters For Four Quiescent Earth Conditions, 1 Sep. 1963 (Contract Nonr-375(14)) (Rept. 132: AD-422548).

Certain parameters as functions of altitude and magnetic latitude were tabulated for the following four different quiescent earth conditions: daytime maximum sunspot activity; daytime minimum sunspot activity; nighttime maximum sunspot activity; and nighttime minimum sunspot activity.

Singer, S. F., "Observing Coronal Emission and Absorption by Means of Atomic Oxygen in The High Atmosphere," RAND Corp, The Appl. of Passive Microwave Technol. to Satellite Meteorology: A symp., Aug. 1963.

A technique is described for measuring the total amount of oxygen in the atmosphere between the earth and a satellite.

Singer, S. F., "Earth Environment Effects," In Md. U. Proc. of the Space Communications Inst., Md. U., College Park, Jun. 23-28, 1963.

The earth's magnetosphere covers the region in which ionized gas (plasma) plays an important part in the dynamics of the atmosphere, and therefore, the geomagnetic field occupies an important role.

III,
H. EARTH ATMOSPHERE (CONT.)

Slowey, J., Atmospheric Densities and Temperatures From The Drag Analysis of The Explorer 17 Satellite, 1 Jul. 1964 (Grant NsG-87-60) (NASA-CR-58032: SAO Special Rept. 157).

Atmospheric densities were obtained from the drag analysis of the Explorer XVII satellite. Temperatures from the densities were computed, using a modified version of Nicolet's atmospheric model.

Smith, R. E., An Automated Model For Predicting Aerospace Density Between 200 and 60,000 Kilometers Above The Surface of The Earth, 10 Jun. 1964 (NASA-TM-X-53062).

This paper describes the derivation of a computer routine for predicting the vertical distribution of aerospace density in the terrestrial space environment above ths surface of the earth. Solar activity, geomagnetic storm, diurnal heating, latitude, and the earth's orbital eccentricity effects are included in this model. Densities can be predicted for any time through December 1962.

Surtees, W. J., An Outline of Some Characteristics of The Upper Atmosphere, Mar. 1964

This report described, mainly in graphical form, some of the principal characteristics and the composition of the upper atmosphere to an altitude of 700 k. Temporal and geographic variations and extremes are emphasized. Experimental and theoretical determinations are indicated, and estimates of experimental accuracies are given.

Tatarskiy, V. I., and Golitsyn, G. S., "The Scattering of Electromagnetic Waves By Turbulent Inhomogeneities of The Troposphere," Nov. 4, 1963, Transl into English from Tr. Inst. Fiz. Atmos. (Moscow), No. 4, 1962.

Contents:

1. The Earth's Mantle and Crust, L. S. Tarasov, p. 1-31 (See N64-10282 01-12
2. How to Increase The Accuracy of Weather Forecasting - An Automatic Telemetering Hydrometeorological System, V. P. Petrov, p. 32-44 (See N64-10282 01-12).
3. Optical Phenomena in The Atmosphere, A. D. Zamorskiy, p. 45-54 (See N64-10284 01-12).
4. The Flat Hydrogen Cloud Around The Earth, P. Shcheglov, p. 55-62 (See N64-10285 01-12).
5. Paleogeography and The Quest For Rich Oil Deposits, N. I. Markovskiy, p. 63-69.

Taylor, G. N., "The Electron Content of The Ionosphere at Middle Latitudes in Summer," Royal Society (London), Proceedings, Series A, Vol. 279, June 16, 1964.

Presentation of measurements of the electron content of the ionosphere obtained from observations of the differential Faraday rotation of Moon-reflected signals on two closely spaced frequencies.

III,
H. EARTH ATMOSPHERE (CONT.)

Taylor, G. N., "Lunar Radar Studies of The Earth's Atmosphere," Radio Astronomical and Satellite Studies of The Atmosphere, Edited by Jules Aarons, Conference sponsored by NATO, 1963.

Brief discussion of the parameters determining the SNR of lunar echoes, and survey of the history of lunar radar studies. Measurements of ionospheric Faraday rotation and the total electron content by this method are summarized.

Taylor, H. A., Jr., Brace, L. H., Brinton, H. C., and Smith, C. R., "Direct Measurements of Helium and Hydrogen Ion Concentration and Total Ion Density to an Altitude of 940 Kilometers," Journal of Geophysical Research, Vol. 68, No. 19, Oct. 1, 1963 (NASA RP-63).

A Bennett-type ion mass spectrometer and a cylindrical electrostatic probe were carried to 940 km above Wallops Island, Virginia. The raw data from each unit (ion currents versus altitude) are presented and are interpreted in terms of helium, hydrogen, oxygen, and total ion concentration.

Temny, V. V., "Investigations of The Upper Atmosphere Using The Artificial Earth Satellites Cosmos 3 and Cosmos 5," Space Research IV; International Space Science Symposium, 4th, Warsaw, Poland, June 4-10, 1963, Proceedings, Edited by P. Muller.

Presentation of the investigation results obtained with a heavily shielded Geiger counter. Two regions are distinguished at low altitudes near the Earth surface: (1) the region without trapped high-energy radiation, and (2) the region of trapped protons with energies of more than 50 Mev.

Temny, V. V., "Investigations of The Upper Atmosphere With Satellites Cosmos-3 and Cosmos-5. 3: High Energy Particles," Cosmic Res., 29 Oct. 1963.

Two regions about the earth were recorded by a shielded Geiger counter: the region of no captured particles, and the region of captured protons with an energy more than 50 Mev. The boundary of the capture region at heights less than 500 km is determined by atmospheric scattering; at greater heights is located along the surface of an equal magnetic field strength B.

Thomas, J. A., McInnes, B. A., and Crouchley J., "High Frequency Exospheric Duct Propagation Experiments," Journal of Atmospheric and Terrestrial Physics, Vol. 25, Nov. 1963 (Contract No. AF 64(500)-9.

Analysis of backscatter experiments performed at Brisbane, Australia, to investigate the possibility of long-range HF radio propagation by way of exospheric field-aligned ionization. The existence of field-aligned irregularities as shown by radar, scintillation and whistler observations is noted.

III,
H. EARTH ATMOSPHERE (CONT.)

Thomas, L., "Some Current Views About The Ionosphere," British Journal of Applied Physics, Vol. 15, May 1964.
Discussion of the advances made during the last decade in the knowledge and understanding of the ionized regions occurring at heights above 60 km in the Earth's upper atmosphere. Present ideas about the ionosphere are reviewed, and an attempt is made to point out some of the problems still outstanding.

Tolbert, C. W., Krause, L. C., and Straiton, A. W., "Attenuation of The Earth's Atmosphere Between The Frequencies of 100 and 140 Gigacycles Per Second," Journal of Geophysical Research, Vol. 69, Apr. 1, 1964 (Contract No. AF 33(657)-8716.
Study of the attenuation by atmospheric oxygen and water vapor of electromagnetic energy between the frequencies of 100 and 140 Gc/s described by calculations based on measurements of the attenuation of simulated atmospheres in an absorption cell and by direct measurements of the total attenuation through the Earth's atmosphere.

Tolbert, C. W., and Straiton, A. W., "Synopsis of Attenuation and Emission Investigations of 58 to 62 KMC Frequencies in The Earth's Atmosphere," IEEE, Proceedings, Vol. 51, Dec. 1963, ARPA Order No. 216-61; Contract No. AF 33(657)-7333.
Review of an investigation of the emission and absorption of the Earth's atmosphere between sea level and 100,000 ft, over the frequency interval of 58 to 62 Gc. The emission temperature is found to be a function of bandwidth and, within the variability limits of the atmosphere, independent of incident solar radiation.

Trombe, F., Gondet, H., and Cabannes, F., "On Some Aspects of Thermal Exchanges Between a Terrestrial Surface, The Atmosphere, and Space in The Clear Sky at Night," Académie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 19, May 11, 1964. In French.

Van Hulsteyn, D. B., Theoretical Study of Atmospheric Pressure Pulse Propagation, Final Report, 1 Mar. 1962-29 Feb. 1964 (Contract AF 19(628)-304).
An investigation to formulate a theoretical explanation of the nature and propagation characteristics of atmospheric pressure pulses generated by nuclear explosions is discussed.

Van Zandt, T. E., and Knecht, R. W., "The Structure and Physics of The Upper Atmosphere," Space Physics, Edited by Donald P. LeGalley and Alan Rosen, 1964.
Discussion of the principal properties of the ionosphere and the neutral atmosphere between the bottom of the ionosphere, at about 50 km, and the limit of the magnetosphere, at many Earth radii.

Vagner, Kh. U., "Investigation of The State of Lower Ionosphere at Sunrise," Geomagnetizm i Aeronomiia, Vol. 4, No. 1, 1964. In Russian.

Vassy, E., "Optics of The Upper Atmosphere," Agard Advan. in Upper Atmosphere Res., 1963. In French.

Wahl, E. W., "The Determination of Upper Air Densities From The Frictional Heating of a Satellite Probe," Journal of The Atmospheric Sciences, Vol. 20, Sept. 1963.
Discussion of the determination of density values from the frictional heating of a satellite probe during the passage of the satellite through its perigee. The magnitude of the heating effect is assessed, and a design for such a probe is proposed. Considerations relevant to the maximization of the effect are outlined.

Walt, M., and Newkirk, L. L., Interaction of Trapped Electrons With The Atmosphere, 1964 (Sponsored by DASA).
The time dependence of the geomagnetically trapped electron flux resulting from a high-altitude nuclear explosion was calculated assuming that the only forces perturbing the trapped electron motions are collisions with atmospheric constituents.

Wark, D. Q., Alishouse, J., and Yamamoto, G., "Variation of The Infrared Spectral Radiance Near The Limb of The Earth," Applied Optics, Vol. 3, Feb. 1964.
Calculation of the infrared spectral radiance near the limb of the Earth, using a curved refracting atmosphere. Radiance was calculated in narrow spectral intervals for four atmospheric models representing a wide range of meteorological conditions.

Webb, H. D., and Daniels, F. B., "Ionospheric Oscillations Following a Nuclear Explosion," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.
Discussion of the possible cause of an ionospheric phenomenon observed after a recent Soviet nuclear test.

Wescott, E. M., DeWitt, R. N., and Akasofu, S., "The S_q Variation at Geomagnetically Conjugate Areas," Journal of Geophysical Research, Vol. 68, Dec. 15, 1963 (Contract No. AF 19(628)-2779; Grant No. NsG 201-62).
Examination of the solar quiet-day daily (S_q) variation at geomagnetically conjugate areas, using the San Juan-Trelew pair. It is shown that there is no particular similarity of the S_q variation at the two stations and that the northern and southern foci of the S_q current system are not geomagnetically conjugated.

Wescott, J. W., Acoustic Detection of High-Altitude Turbulence, Mar. 1964 (Contract DA-20-018-ORD-22840).

Background noise at frequencies from 0.2 to 200 cps was monitored with free-floating, balloon-borne acoustic probes at altitudes of 55,000 to 73,000 ft.

White, J. A., and Johnson, K. G., Approximate Solutions For Flight-Path Angle of a Re-entry Vehicle in The Upper Atmosphere, Jul. 1964 (NASA-TN-D-2379).

Two basic equations for approximating the flight-path angle of a re-entry vehicle in the upper atmosphere are derived from the equations of motion. These solutions for flight-path angle are obtained (1) by assuming constant velocity over the portion of the trajectory under consideration, and (2) by approximating the velocity value for use in the development of the equation for flight-path angle.

Wickersham, A. F., Jr., "Identification of Ionospheric Motions Detected By The High-Frequency Backscattering Technique," Journal of Geophysical Research, Vol. 69, Feb. 1, 1964.

Study of the velocity distribution of moving ionospheric disturbances, showing that these disturbances can be interpreted as the velocity spectrum of neutral acoustic modes propagating in the sound duct at 85-km altitude.

Wright, J. W., "Diurnal and Seasonal Variations of The Atmosphere Near The 100-Kilometer Level," Journal of Geophysical Research, Vol. 69, July 1, 1964.

Presentation of a criticism of the conclusions which Hall et al. derived from their rocket experiments in which the neutral particle concentrations were inferred from measurements of solar extreme UV absorption.

Young, R. A., "Optical Radar Study of The Upper Atmosphere," Faraday Society, General Discussion on Chemical Reactions in The Atmosphere, Edinburgh, Scotland, Apr. 2, 3, 1964, Paper 3376.

Discussion of the possibility of constructing and testing an optical radar system based on the recent development of high-power (100 watts or more) pulsed molecular-nitrogen gas lasers.

Young, R. A., Measurement of Nitric Oxide in The Earth's Atmosphere, Final Report, 22 Jul. 1963 (Contract DA-49-146-XZ-112).

The results of an investigation of a possible technique to measure the nitric oxide in the lower ionosphere and to develop realistic specifications for rocket-borne instrumentation are discussed. The technique developed is based on the controlled photoionization of nitric oxide by a local photoionization source, with subsequent collection and quantitative measurement of the resulting ions and electrons.

III,
H. EARTH ATMOSPHERE (CONT.)

Young, J. M., Johnson, C. Y., and Holmes, J. C., "Neutral Gas Temperature From The Ionospheric NO^+ Distribution," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Presentation of an alternative indirect method for measuring neutral-gas temperatures by means of an ion mass spectrometer.

Zanorskiy, A. D., "Optical Phenomena in The Atmosphere," Sov. Res. in Atmospherology and Geol., Nov. 12, 1963. Transl. into English from Priroda (Moscow), No. 8, 1963.

The accounts of sightings of halos near the Moon and the appearance of two images of the Sun, the planet Mercury, and pilot balloons are presented.

Zhevakin, S. A., and Naumov, A. P., "Absorption of Centimeter and Millimeter Radiowaves by Atmospheric Water Vapor," 23, Sep. 1964, Transl. into English from Radiotekhn i Elektron (Moscow), Vol. 9, No. 8, 1964.

Presented are the calculations of the absorption factors of radiowaves in the 0.7-mm to 32-cm band by water vapors contained in the atmosphere.

Zimmerman, S. P., "Small-Scale Wind Structure Above 100 Kilometers," Journal of Geophysical Research, Vol. 69, Feb. 15, 1964.

Evaluation of Hines' method of estimating the minimum scale size of atmospheric gravity waves by considering variations from the mean value of wind velocity magnitude that are observed in visible meteor trails at 80 to 100 km altitudes.

No Author, "Determination of the Temperature of The Upper Atmosphere From The Profiles of Nightglow Emissions Using a Fabry-Perot Pressure Scanning Interferometer," Res. on Phys. of The Upper Atmosphere, 30 Jun. 1963.

The 7-cm-aperture Fabry-Perot pressure scanning interferometer has been in an operational state at L'Observatoire de Haute Provence during the period October to December 1962.

No Author, Experimental Study on The Dynamics and Structure of The Upper Atmosphere, Final Report, Jun. 1964 (Contract NASw-712).

The purpose of this paper is to measure the upperatmospheric winds and diffusivity from analysis of the motions of sodium and lithium vapor trails ejected from sounding rockets during twilight.

No Author, "Investigations of The Upper Atmosphere and Outer Space Carried Out in The USSR in 1963," COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper.

Review of investigations of the upper atmosphere and outer space conducted in the USSR during 1963 by means of meteorological rockets, geophysical

satellites of the Cosmos series, maneuverable space vehicles of the Polyot series, automatic stations, manned satellites, and ground-based methods.

No Author, "Radio Astronomical and Satellite Studies of the Atmosphere," (Advanced Study Institute of Corfu, Conference on Radio Astronomical and Satellite Studies of The Atmosphere, Corfu, Greece, June 1962.) Edited by Jules Aarons. Conference sponsored by NATO.

Collection of papers concerning investigations of the structure and composition of the atmosphere, performed through radio astronomical and satellite studies.

No Author, "The 'Elektron' Studies The Earth's Radiation Belt,", 28 Apr. 1964, Transl. into English from Priroda (Moscow), Feb. 1964.

The scientific stations "Elektron-1," with an apogee of 7,000 km, and "Elektron-2," with an apogee of 70,000 km, were successfully launched by the Soviet Union on January 30, 1964.

No Author, "The Electron Cosmic Station," Jul. 1964, Transl. into English from Kosmich, Issled, (USSR), Vol. 2, No. 3, May-Jun. 1964.

A complete list of the equipment mounted on Elektron 1 and Elektron 2 is presented. Elektron 1 equipment consists of equipment for the study of the soft corpuscular radiation: a beacon system for studying the electromagnetic properties of the ionosphere and of interplanetary space; and ballistic piezoelectric micrometeorite detectors.

No Author, Interplanetary Explorer Satellites, 1964 (NASA Facts, Vol. II, No. 1).

Basic facts are presented about the Interplanetary Explorer series of satellites, the first of which, Explorer XVIII, was launched Nov. 26, 1963. Preliminary analyses of data from Explorer XVIII have provided significant information about a shock wave that envelops the earth, and about a band of radiation lying above the Van Allen region.

No Author, Radiation Processes of Charged Particles Moving in The Upper Atmosphere and Composition and Properties of The Magnetosphere, Final Report, 1 May 1962-30 Apr. 1963 (Grant NsG-165-61).

This report summarizes four problems - radiation from a rotating point charge, thermionic screening of hot objects in planetary atmospheres and interplanetary space.

No Author, TIROS II Radiation Data Catalog, Volume One, Aug. 15, 1961. Work performed jointly with Weather Bureau, Washington.

This catalog describes the mapping procedures which have been employed in processing the TIROS II radiation data utilizing Final Meteorological Radiation (magnetic) Tapes and automatic data-processing equipment.

III. INTERPLANETARY SPACE

I. INTERPLANETARY MAGNETIC FIELDS

Bazarzhapov, A.D., "Determination of Components of the Total Vector of the Solar Magnetic Field Strength by Means of an Electronic Computer," Astronomicheskii Zhurnal, Vol. 41, Jan. - Feb. 1964 (In Russian)

Beard, D.B., "The Effect of an Interplanetary Magnetic Field on the Solar Wind," Journal of Geophysical Research, Vol. 69, April 1, 1964.

A weak interplanetary magnetic field is shown to be compressed into a boundary layer of high magnetic-field intensity several Earth radii deep at the surface of the magnetosphere. Particles in the solar wind travel smoothly around to the dark side of the Earth where their pressure and the compressed interplanetary magnetic pressure may be expected to close the hollow the geomagnetic field creates in the solar wind.

Coleman, P.J., "The Characteristics of the Region of Interaction Between the Interplanetary Plasma and the Geomagnetic Field-Pioneer 5," Journal of Geophysical Research, Vol. 69, Aug. 1, 1964 (Grant No. NsG 249-62).

Analysis of measurements by the Pioneer 5 interplanetary probe on the magnetic fields in the distance geomagentic cavity and in the region of interaction between the solar wind and the magentosphere. This evidence is discussed in terms of two models for the interaction of the interplanetary medium and the magnetosphere.

Dolginov, S.S., and Pushkov, N.V., "Study of the Magnetic Field in Outer Space," Cosmic Res. 29 Oct. 1963.

This article reviews experimental data on the magnetic field of the earth, the moon, and interplanetary space obtained with the aid of earth satellites and space rockets in the Soviet Union and the U.S.A.

Dolginov, S.S., and Pushkov, N.V., "Investigation of the Magnetic Field in Space," Kosmich. Issled (Moscow) (Translation), Vol. 1, No. 1, July - August 1963 (NASA-TT-F-8562).

A survey is presented of the experimental data on the magnetic field of the earth, the moon, and interplanetary space, obtained by earth satellites and space rockets in the Soviet Union and in the United States.

Forward, R.L., Zero Thrust Velocity Vector Control for Interstellar Probes, American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, New York, N.Y., Jan. 20-22, 1964, Preprint 64-53.

Examination of the fundamental equations and conditions governing the interaction of an interstellar probe with the magnetic fields existing in intersteller space. The interaction investigated are the Lorentz force on a moving charge, the eddy currents induced in a moving conductor, the Meissner-effect repulsion of a super-conductor, and the magnetic gradient force on a permanent magnetic dipole.

III,
I. INTERPLANETARY MAGNETIC FIELDS

Gros, C.G., The Combined Effects of Space Environmental Parameters upon Satellite Systems and Components: An Annotated Bibliography, Contract AF 04(647)67 (Rept.-3-35-64-3; SB-64-4; AD-445142), Jan. 1964.

This bibliography cites material on space environmental parameters in their combined effects upon satellites, satellite systems, and components. Included among these parameters are ablation, acceleration, acoustics, atmospheric and ground conditions, cryogenics, electromagnetism, gravity (including weightlessness), heat, instrumentation, meteoroids and other interstellar matter, radiation, shock, vacuum, and vibration.

Lathourakis, J.P., Interplanetary Magnetic Fields. A Bibliography of the Open Literature, January 1958 - April 1964, (LR-17860), May 1964.

This unannotated bibliography comprises a search of the recent unclassified literature on interplanetary magnetic fields. The citations provided refer to direct and indirect observations; theoretical work was not considered. References to interactive forces and the earth's magnetosphere are not complete and are treated in separate sections.

Morris, D., Clark, B.G., and Wilson, R.W., An Attempt to Measure the Galactic Magnetic Field, (Contract Nonr-220(19)), 1963.

This paper describes measurements made in November 1961 and February 1962 in an attempt to determine the galactic magnetic field by the Zeeman splitting of the 21-cm line.

Polosukhina, N.A., "Polarimetric Observations of the Magnetic Variable HD 215441," Soviet Astronomy, Vol. 7, Jan. - Feb. 1964 (Translation).

Smith E.J., "Interplanetary Magnetic Fields," Space Physics, Ed. by Le Galley, D.P., and Rosen, A., New York, John Wiley and Sons, Inc., 1964.

Review of the present knowledge of interplanetary magnetic fields, based on the theoretical and experimental achievements of the last 5 years. The effect of the solar plasma on magnetic fields and the transport of solar fields into space to form the interplanetary field are discussed, together with the physics of field transport.

Stern, D., A Simple Model of the Interplanetary Magnetic Field. Part 2: The Cosmic Ray Anisotropy, (NASA-TN-D-2404), Aug. 1964.

Three explanations for the observed cosmic ray anisotropy were investigated. The possibility that the anisotropy is due to trapped orbits in the interplanetary magnetic field is explored by analyzing the motion of charged particles in the stretched dipole field.

Walters, G.K., "Effect of Oblique Interplanetary Magnetic Field on Shape and Behavior of the Magnetosphere," Journal of Geophysical Research, Vol. 69, May 1, 1964. Contract No. AF 19(628)-3858.

The oblique angle made by the spiral interplanetary magnetic field with the radially expanding solar wind is shown to result in an easterly deflection of the solar wind as it traverses the standing hydromagnetic shock wave a few Earth radii upstream of the magnetosphere.

IV. THE LUNAR ENVIRONMENT

The successful mission of Ranger VII was the highlight of the lunar scientific study in 1964. Resolution sufficient to identify craters less than one meter in diameter was obtained. In spite of this, the conflict regarding the nature of the surface has continued. Not only are interpretations of the photographs in dispute but the area of impact (a ray of Tycho) is atypical of the lunar surface. A great amount of work is being done, however, and a unified surface model is slowly developing.

The atmosphere defies every attempt to measure its density and composition although certain limits are clearly defined. Accurate determinations of the strength of the magnetic field, its distribution, and the electrical characteristics of the surface will probably remain unknown until probation by Surveyor or some other soft-landing vehicle.

IV. LUNAR ENVIRONMENT

A. GENERAL REFERENCES

Baldwin, R.B., The Measure of the Moon, University of Chicago Press, 1963.

Bobrovnikoff, N.T., "Natural Environment of the Moon," WADC Phase Technical Note 3, Ohio State University Research Foundation, June 1959.

Jones, C.D. et al., "Preliminary Investigation of Interplanetary Lunar and Near Planet Environments and Methods of Simulation," Ohio State University Research Foundation, Report ASDTR 61-267, Contract AF33(616)-5914, July 1961.

Kiess, Carl C., and Kassorzsky, K., "The Known Physical Characteristics of the Moon and the Planets," Georgetown College Observatory, July 1958.

Niedz, F.J., Survey of the Physical and Environment Parameters of the Moon, Contract NASw-410, General Electric Company, February, 1963.

Rogers, J.R., and Vaughan, O.H. Jr., Lunar Environment: An Interpretation of the Surface of the Moon and Its Atmosphere, NASA TM X-53124, 3 Sept. 1964.

Smith, R.E., Space Environment Criteria Guidelines for Use in Space Vehicle Development, NASA TM-53142, 30 September 1964.

Urey, H.C., "The Moon," in Science in Space, McGraw-Hill, New York, 1961.

B. GRAVITY

Alexandrov, I., "The Lunar Gravitational Potential," in Advances in the Astronautical Sciences, Vol. 5, Proceedings of the Second Western National Meeting of the American Astronautical Society, Los Angeles, California, Aug. 4-5, 1959, Plenum Press, Inc., New York, 1960.

Levenstein, H., Savet, P.H., Stateman, M.J., and Wessbecher, F., "On a Study of Specific Methods of Measuring Lunar Gravity," (Final Report)American Bosch Arma Corp., Contract AF 19(628)-3855, April 1964.

C. MAGNETIC FIELD

Dolginov, Sh. Sh., Eroshenko, E.G., Zhuzgov, L.N., and Pushkov, N.V., "Investigation of the Magnetic Field of the Moon," AIAA Journal, Vol. 1, Feb. 1963, p. 514-516 (Translation).

Lunik II (1959 Xi) made magnetic field measurements near moon. Result: dipole magnetic moment $< 10^{-4}$ that of earth.

D. METEOROIDS AND EJECTA

Boyle, W.S., and Orrok, G.T., "Penetration of Spacecraft by Lunar Secondary Meteoroids," AIAA Journal, Vol. 1, October 1963, p. 2402-2404.

Examination of vehicle at rest on lunar surface. It is concluded that probability of puncture due to secondary particles is, at most, only slightly greater.

Bradford, D.C., and Dycus, R.D., "A Review of the Meteoroid Environment in Cis-Lunar Space and on the Lunar Surface," AIAA Aerospace Sciences Meeting, New York, New York, 20-22 January 1964, Preprint No. 64-63.

McCracken, C.W., "Dust Bombardment on the Lunar Surface," in The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. by Salisbury, J.W., and Glaser, P.E., Academic Press, Inc., New York, 1964, p. 179-214.

It is concluded that ejecta from hypervelocity impacts on a low-density, porous structure would be largely retained by the surface layer, thereby leading to positive accretion. The lunar surface thus formed, therefore, would consist of lunar and interplanetary material from 10 cm to 1-in. thick.

McCracken, C.W., and Dubin, M., "Dust Bombardment on the Lunar Surface," (NASA TN D-2100), Dec. 1963.

Porous, low-density surface layer is assumed to exist. Assuming constant flux, interplanetary accretion of particulate mass $< 10^{-4}$ gm is 1 gm/cm^2 over 4.5×10^9 yr. Porous surface layer acts as a protective covering against hypervelocity impact by dust particles

Shoemaker, E.M., Moore, H.J., and Gault, D.E., "Spray Ejected from the Lunar Surface by Meteoroid Impact," (NASA TN D-1767).

Experimentally determined mass-size distributions of ejecta from hypervelocity impacts were combined with estimates of meteoroid influx on lunar surface to get secondary ejecta fluxes.

Conclusions: Almost all of ejecta has velocity less than escape (2.42 km/sec). Some particles will escape. This implies, dust cloud of flying particles. Estimated spatial density at lunar surface is 10^5 to 10^7 that of interplanetary debris. Therefore particles are continually abrading the lunar surface. Vehicles on surface can expect to be subjected to higher rates of impact than in cis-lunar space.

D. METEOROIDS AND EJECTA (CONT).

Whipple, F.L., "On Meteoroids and Penetration," Journal of Geophysical Research, Vol. 68, No. 17, 1 September 1963.

E. RADIATION

Candell, L.M., "Incident Lunar Emission on Orbiting Surfaces," American Institute of Aeronautics and Astronautics, Annual Meeting, 1st, Washington, D.C., June 29-July 2, 1964, Paper 64-336.

Dorman, L.I., "The Nature of the Lunar Diurnal Variation of Cosmic Rays," in Cosmic Rays, June 1964, p. 383-386.

Ryan, J.A., "Corpuscular Radiation Produced Crystalline Damage at the Lunar Surface," in The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. Salisbury, J.W., and Glaser, P.E., Academic Press, Inc., New York, 1964, p. 265-312.

Wehner, G.K., "Sputtering Effects on the Lunar Surface," The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. Salisbury, J.W., and Glaser, P.E., Academic Press, Inc., New York, 1964, p. 313-322.

Experimental estimate of sputtering rates for an unprotected body orbiting sun and investigation of target surfaces bombarded by solar wind. Effects noted include leveling and smoothing of macroscopic surfaces, cementing of loose particles into a porous, brittle, fibrous crust. It is concluded that many of the unusual properties of the lunar surface can be explained by the action of solar-wind bombardment.

Wehner, G.K., Kenknight, C.E., and Rosenberg, "Modification of the Lunar Surface by the Solar-Wind Bombardment," Planetary and Space Science, Vol. II, Nov. 1963, p. 1257-1261.

It is predicted that the lunar surface is somewhat enriched in heavy metals.

F. SURFACE GEOGRAPHY AND GEOLOGY

Augason, G.C., "Infrared Radient Intensities of the Sun and the Moon in the 2-to 6-Micron Region (Measured by an Airborne Radiometer)," China Lake, Calif., NOTS, 3 May 1960, 16 pp.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT).

Baldwin, R.B., "The Nature of the Lunar Surface and Major Structural Features" in Va. Polytech. Inst. Proc. of the Conf. on Lunar Exploration, Aug.12-Aug. 17, 1962, May 1963.

Barabashav, N.P. "The Rocks That May Consitute the Lunar Surface," (Kharkov Astronomical Observatory, Kharkov, USSR). (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960.) in The Moon, New York, Academic Press, Inc., 1962, p. 379-384.

Study based on statistical comparison of terrestrial rocks with photometric data. Parameters: brightness, smoothness, spectral dist. of reflectivity, degree of polarization depends upon angle of incidence, reflection, and phase; heat cond.; and luminescence. Conclusion: Moon is covered by tuff-like rocks in broken-up state, with grain size 3-10 mm, sharp edged fragments, and rectilinear grooves with vertical and tapered walls.

Chistyakov, Y.N.,"Lunar Temperature Measurements," Izv. Akad, Nauk SSSR. Komis, Fiz. Planet, No. 2, 1960, p. 46-54.

Dollfus, A., "The Polarization of Moonlight," in Physics and Astronomy of the Moon, New York, Academic Press, 1962.

Evans, J.V., "Radio Echo Studies of the Moon," in Physics and Astronomy of the Moon, New York, Academic Press, 1962.

Evans, J.V. and Pettengill, G.H., "The Scattering Properties of the Lunar Surface at Radio Wave Lengths," The Moon, Meteorites, and Comets, Vol. IV- The Solar System, University of Chicago Press, 1963, p. 129-161.

Discussion of characteristics of signals reflected from the moon in light of most reliable results. Two kinds of surface roughness are known: (1) large scale structure 10's of km and (2) small scale structure well below limit of optical resolution from earth. Radar observations yield information regarding intermediate structure sizes. About 5% of surface has scale size $\approx$ 1 metre. Remainder a random distribution of "smooth" (scale $<$ 1 metre) surfaces of 10-1000 metres in extent and have rms slope of 5°-8°. Dielectric constant is in the range of 2.7 which $\approx$ terrestrial sand.

Fielder, Gilbert, "Erosion and Deposition on the Moon," Planetary and Space Science, Vol. 11, Nov. 1963, p. 1335-1340.

It is concluded that, on the moon, intrinsic erosion is more important than extrinsic erosion.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Fielder, Gilbert, "Nature of the Lunar Maria," Nature, Vol. 198, June 29, 1963, p. 1256-1260.

Study of physical and chemical characteristics of lunar maria results in conclusion that the maria are essentially lava fields.

Fielder, Gilbert, The Structure of the Moon's Surface, Pergamon Press, Oxford, London, New York, Paris, 1961.

Fielder, Gilbert, "Terrestrial Oceanic Ridges and Lunar Mare Ridges," Nature, Vol. 199, Aug. 3, 1963, p. 473.

Discussion of possible analogy between terrestrial ocean ridges and lunar wrinkle ridges. No evidence exists for recent continental drift on Moon.

Fudali, R.F., Lunar Surface Characteristics, (NASA Contract NASw-417), June 25, 1963 (rev.)

Fung, A.K., and Moore, R.K., "Effects of Structure Size on Moon and Earth Radar Returns at Various Angles," University of Kansas, Journal of Geophysical Research, Vol. 69, No. 9, 15 March 1964.

Giraud, A., "Characteristics of the Moon's Surface Layer: An Analysis of its Radio Emission," Astrophys, J., Vol. 135, No. 1, Jan. 1962, p. 175-186.

Theoretical analysis of thermal radio emission:

Granule size $\approx$ 10-300 μ
Dielectric Constant $\approx$ 1 to 1.5
Thermal Conduct. $\approx 5.10^{6}$ to 10^{-5} cal sec $^{-1}$ cm^{-1}
Volumetric Specific heat $\approx$ 0.1 or 0.2 cal deg^{-1} cm^{-3}

Gold, Thomas, "New Evidence Concerning the Lunar Surface," American Astronautical Society, 10th Annual Meeting, New York, May 4-7, 1964. Preprint 64-2.

Gold, T., "Processes on the Lunar Surface," (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960.) in The Moon, New York, Academic Press, Inc., 1962, p. 443-439.

Electrostatic effects seem most likely method of transport of dust from high ground to low ground on Moon; (1)"Electrostatic hopping" due to erratic charge distributions, (2) "Gliding" caused by emission of electrons from surface.

IV,

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Gold, Thomas, "Ranger Moon Pictures - Implications," Science, Vol. 145, Sept. 4, 1964, p. 1046-1048.
The implication is that dust is the main constituent of the lunar lowlands.

Gold, Thomas, "Structure of the Lunar Surface," in School of Aerospace Med. Lectures in Aerospace Med., 3-7 Feb. 1964, p. 239-271.
It is concluded that the majority of the moon's surface has a low-density and high-porosity structure, as well as a deposit of fine rock dust.

Gold, Thomas, "Structure of the Moon's Surface," in The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. Salisbury, J.W., and Glaser, P.E., Academic Press, Inc., 1964, p. 345-353.
It is concluded that in order to account for the unique properties of Tycho it must be assumed that a crushable layer many meters deep exists.

Halajian, J.D., "The Case for a Cohesive Lunar Surface Model," Presented at the Conf. on Geol. Probl. in Lunar Res., Sponsored by the NY Acad. of Sci., New York, May 1964, June 1964.

Halajian, J.D., "Gravity Effects on Soil Behavior," in The Lunar Surface Layer: Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Academic Press, Inc., New York, 1964.
The effect of lunar gravity on the performance of landing and roving vehicles is considered.

Halajian, J.D., "Old and New Lunar Photometric Models and What They Mean," Presented at the Meeting of the Environment and Resources Subgroup, Comm. of Extraterrest. Resources, Golden, Colo., April 1964.
It is concluded that: (1) Any final conclusion regarding the consistency, bearing strength, chemical composition, and absolute roughness of the lunar surface layer on the basis of photometry alone is unjustified. (2) The surface of the moon, whatever its origin, is covered with a dark, highly porous material having interconnected cavities. (3) An underdense rigid silicate promises to reconcile the photometric and infrared portions of the lunar data better than a loose fluff.

Hapke, B., "Packing Properties of Fine Powders and the Depth of the Lunar Dust Layer," Journal of Geophysical Research, Vol. 69, March 15, 1964, p. 1147-1151.
It is considered possible that lunar soil may be unconsolidated to a depth of one metre or more.

IV,

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Hapke, B., "Photometric and Other Laboratory Studies Relating to the Lunar Surface," in The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. Salisbury, J.W., and Glaser, P.E., Academic Press, Inc., New York, 1964, p. 323-344.

It is concluded that the lunar surface is everywhere covered by a layer of rock dust whose particles have an average size of the order of 10 μ. It is thought that the grains of rock are darkened by exposure to solar radiation or some other agent and arranged by micrometeorite bombardment into a porous material with a bulk density only 1/10 that of solid rock. The depth of the dust layer is unknown but is considered to be at least a few mm.

Hapke, B.W., "A Theoretical Photometric Function for the Lunar Surface," Journal of Geophysical Research, Vol. 68, Aug.1, 1963, p. 4571-4586.

Theoretical derivation of formula describing the observed photometric properties of lunar surface. A layer of fine, loosely compacted dust is in category of surfaces described by this model but volcanic foam is not. Bulk density $\approx$ 0.1 is implied.

Hibbs, A.R., "The Physical Nature of Lunar Surface Material," Proc. of the (13th) Lunar and Planetary Exploration Colloq., Vol. 3, No. 3, Nov. 1963, p. 23-28.

Laboratory experiments on condensation of material from a vapor to a solid phase indicates that fraction of lunar material which has been subject to vaporization and redeposition should be deposited on the surface of the moon in the form of whisker crystals or needles.

Hevervari, P., "A Theory About the Internal Composition and Development of the Moon," University of Kyoto, 3 January 1962.

Kinsman, F.E., and Van Lojuk, J.R., "Radar Analysis of the Moon," Phase I: Feasibility of Laboratory Simulation, Texas Instruments Inc., Science Services Division, 30 Nov. 1962

Kokhan, Y.K., "Lunar Light Polarization," Izv. Akad, Nauk SSR. Komis, Fiz. Planet, No. 1, 1959, p. 41-53.

Conclusions:

(1) All details show greater polarization in blue than in yellow light
(2) Polarization at $\phi \pm 27.5^{\circ} = 0$ in all light
(3) Polarization between $\phi \pm 27.5^{\circ}$ negative
(4) Polarization shows maximum negativity at $\phi \pm 14.^{\circ}$
(5) Maria yield greatest polarization
(6) Plane of polarization depends upon phase angle ϕ
(7) Plane of polarization not dependent upon color
(8) At moment of full moon, rapid rotation of plane of polarization takes place.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Khodak, Y.A., "Main Structural Elements of the Moon," in Kosmicheskiye Issledovaniya, Izdatel' stvo, Akademic Nauk SSSR, Moscow, 1963.

Klass, P.J., "New Type Radar Probing Surface of Moon," Aviation Week and Space Technology, Vol. 78, May 6, 1963, p. 91.
New, high resolution radar telescope probing moon at 35,000 Mcps; 250 mile width at surface. Surface is farily rough with respect to wavelengths (0.85 cm).

Kopal, Z., "Topography of the Moon," in Physics and Astronomy of the Moon, New York, Academic Press, 1962.

Kozyrev, N.A., "Physical Observations of the Lunar Surfaces," in Physics and Astronomy of the Moon, New York, Academic Press, 1962.

Krotikov, V.D. and Troitskii, V.S., "Measurements of Lunar Radio Emission," (Astronomicheskii Zhurnal, Vol. 40, Jan.-Feb. 1963, p. 158-160). Soviet Astronomy, Vol. 7, July-Aug. 1963, p. 119, 120.
Determination of thermal parameter, $\gamma = (K\rho C)^{-\frac{1}{2}}$, from radio and infrared wavelengths gives 350 ± 75 (cgs units). If $\rho \approx 0.5$ g/cm^3 then K is of the order of 10^{-4} cal/cm sec deg, which is 50 times greater than generally accepted values for dust in vacuo. Conclusion: upper layer of lunar surface is not dust but a solid porous material akin in pumice.

Krotikov, V.D. and Troitskii, V.S., "Detection of the Moon's Hot Interior," in Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Interscience Publishers, New York, 1964, p. 145-154.
Experimental determination of the temperature increase below the lunar surface down to approximately 20 m in depth. The temperature gradient in this layer is about constant and equal to 1.6°C/metre. This means that the material of the whole 20-metre layer is in the same greatly porous state and, therefore, cannot be dust.

Kuprevich, N.F., "New Data on the Structure of the Lunar Surface," Soviet Astronomy, Vol. 7, March - April 1964, p. 677-685.
Observations in the 0.9-2.3μ region support the theory that the dust on the lunar surface is likely to be thin or completely absent.

Liu, N.C., and Dobar, W.I., "The Nature of the Lunar Surface - The Thermal Conductivity of Dust and Pumice," in The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. Salisbury, J.W., and Glaser, P.E., Academic Press, Inc., 1964, p. 381-387.
It is found that the photometric properties of pumice and scoria do not match those of the moon. The thermal conductivity of pumice material, however, makes it a possible candidate for a subsurface material on the Moon.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Markov, A.V., "Physical Nature of Different Zones of the Lunar Surface," (Main Astronomical Observatory, Pulkovo, USSR). (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960) in The Moon, New York, Academic Press, Inc., 1962, p. 371-378.

Examination of data and hypothesis concerning surface layer. Gold's hypothesis incorrect. Areas showing large temperature variations during eclipses may have cracks up to 1 m wide. In other areas, negative polarization and low thermal conductivity indicate surface covered with five grain material less than 4 cm. If meteor-slag hypothesis is correct, the outer layer is harder than a powder layer.

Mason, A.C., and Hackman, R.J., "Photogeologic Study of the Moon," (U.S. Geological Survey, Washington, D.C.) in The Moon, New York, Academic Press, Inc., 1962, p. 301-315.

Photogeologic study of moon tends to support the suggestion that most craters are meteoric in nature but some craters and other features are interpreted as volcanic.

Muhleman, Duane O., "Interences Concerning the Lunar Surface from Radar, Radio, and IR Measurements," American Astronautical Society, 10th Annual Meeting, New York, 4-7 May 1964, Preprint 64-3.

Murray, B.C. and Wildey, R.L., "Surface Temperature Variations During the Lunar Nighttime," Astrophysical Journal, Vol. 139, Feb. 15, 1964, p. 734-750.

Observations in the 8-14μ region support the theory that surface redistribution processes are operative on the lunar surface over at least a 10-metre range, but are not important over distances much in excess of a kilometre.

Öpik, E.J., "Surface Properties of the Moon," Progress in the Astronautical Sciences, Vol. I, Amsterdam, North-Holland Publishing Co., 1962, p. 215-260.

Most craters are of meteoric impact origin. Primeval craters have been obliterated in maria. Dust layer thin: ≈ 5 cm on slopes and ≈ 20-100 cm on plains. There should be adequate superficial support for lunar landing anywhere. The geometrical shape of lunar surface is closer to sphere than is the dynamical shape of moon as a whole. Average level of maria is 2.52 ± 0.13 km below continents. Author believes moon accreted from ring of fragments orbiting earth, not from interplanetary matter. (From collisional probability theory of accretion). The Moon could have been formed in about 80 years at about 37000 km from the earth.

IV,

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Orlova, N.S., "Slope Angles of Loose Materials and Hypotheses of the Dust Nature of the Lunar Surface," Joint Publications Research Service, 15 July 1963, p. 1-9.

Laboratory experiments were performed with various loose materials to determine natural slope angles. They were visually examined in different illuminations. Conclusions: If angles of natural slope of materials have same value under lunar conditions as on earth, then enormous expanses covered by noncemented dry materials do not exist on the lunar surface.

Pettengill, G.H., and Henry, J.C., "Enhancement of Radar Reflectivity Associated with the Lunar Crater Tycho," Journal of Geophysical Research, Vol. 67, Nov. 1962, p. 4881-4885.

Radar (4.4×10^8 cps) reflections from the vicinity of Tycho are stronger than from other parts of the moon. Reasons possible: (1) Unusually rough area, (2) increase in bulk dielectric constant because of higher overall density or because of different constituents in the surface. It is difficult to separate reasons although roughness alone could explain the data.

Pohn, H., Murray, B.C., Brown, H., "New Applications of Lunar Shadow Studies," Astron. Soc. Pacific, Vol. 74, No. 437, April 1962, p. 93-105.

About 0.5% lunar surface is in permanent shade. Piton and Mösting exhibit slopes greater than 30°. About 1% of upland area near Argelander shows comparable roughness.

Polozhentseva, T.A., "Lunar Craters," Izv. Akad. Nauk SSSR. Komis. Fiz. Planet, No. 3, p. 46-49; and Barabashov, N.P., and Yezerskiy, V.I.

Re-examination of spectrograms of Alphonsus obtained just before eruption of 3 November 1958 show that neither gas nor a dust cloud preceded eruption.

Radlova, L.N., "The Colour of the Bright Rays on the Monn," (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960) in The Moon, New York Academic Press, Inc., 1962, p. 409, 410.

Review of visual and photographic measurements of some lunar rays. Rays differ in brightness but not in color. This indicates that the rays are of same material as their surroundings but more finely pulverized.

Runcorn, S.K., "The Interior of the Moon," JPL Technical Report No. 32-259, 15 Dec. 1963.

Saari, J.M., and Shorthill, R.W., "Infrared Mapping of Lunar Craters During the Full Moon and the Total Eclipse of September 5, 1960," Geo-Astrophysics Lab, July 1963.

Infrared measurements made during total eclipse of 5 Sept. 1960 show that five rayed craters cooled less rapidly than surroundings. In order: Tycho, Aristarchus, Copernicus, Proclus, and Kepler. Apparently craters are covered by a thinner layer of some poor conducting material. Craters also remained cooler than surroundings during solar illumination.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Sabaneev, P.F., "Some Results Deduced from Simulation of Lunar Craters," (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960) in The Moon, New York, Academic Press, Inc., 1962, p. 419-431.

Results deduced from simulation of lunar craters. The effects of: increased weight of material dropped, physical properties of impinging matter (form, velocity, size, angle) atmospheric medium, gravity, and mechanical properties of soil were studied. Conclusions: (1) Craters and maria with clearly defined perimeters were caused by infall of dense, homogeneous, and circular masses of loose matter, (2) an appreciable number of secondary craters must exist, (3) surface layer is hard rock with less firmness than deeper layers, (4) some surface fragments are ejected into space.

Salisbury, J.W., "The Lunar Surface," Air University Review, Vol. XI, No. 3, March - April 1964, p. 69.

Senior, T.B.A., Siegel, K.M., and Giraud, A., "Some Physical Constants of the Lunar Surface as Indicated by its Radar Scattering and Thermal Emission Properties," (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960) in The Moon, New York, Academic Press, Inc., 1962, p. 533-543.

Summary of radar-scattering and thermal-emission data. Theory to account for scattering in terms of a smooth body is postulated. In consequence, dielectric constant is about 1.1.

Shatsova, R.B., and Malysheva, T.G., "Distribution Function of the Diameters of Craterlets and Domes in the Proximity of the Copernicus Crater," Astronomicheskii Zhurnal, Vol. 41, March - April 1964, p. 418, 419.

Study of the lunar map showing that the linear diameters of 4336 craterlets and domes in the proximity of Copernicus exhibit a logarithmic normal distribution. This finding can be interpreted as a statistical proof of the hypothesis of their simultaneous formation.

Shemyakin, M.M., "Lunar Surface Formations," Vsesoyuznoye Astronomo-Geodezicheskoye Obshchestvo, Byull. No. 30 (37), 1962, p. 33-38.

Geometric patterns observed in distribution of parasitic crater chains in Clavius and Hipparchus cirques. Spiral in the case of Clavius. Two chains lying in same circumference in the case of Hipparchus. Larger craters are apparently older. If the chains are the result of single process, then this process was of long duration and therefore endogenic in origin.

Shoemaker, E.M., "Interpretation of Lunar Craters," in Physics and Astronomy of the Moon, New York, Academic Press, 1962.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Shoemaker, E.M., and Hackman, R.J., "Stratigraphic Basis for a Lunar Time Scale," in The Moon, New York, Academic Press, Inc., 1962, p. 289-300.

Overlapping material formations around Copernicus was studied to outline broad framework of lunar time scale.

Shorthill, R.W., "Measurements of Lunar Temperature Variations During an Eclipse and Throughout a Lunation," in Va. Polytech. Inst. Proc. of the Conf. on Lunar Exploration, Aug. 12-Aug. 17, 1962. May 1963.

Sinton, W.M., "Eclipse Temperatures of the Lunar Crater Tycho," (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960) in The Moon, New York, Academic Press, Inc., 1962, p. 469-471.

Tycho maintains a much more constant temperature during eclipse than does the surrounding landscape. Data taken at 8.8μ.

Sinton, W.M., "Temperatures on the Lunar Surface," in Physics and Astronomy of the Moon, New York, Academic Press, 1962.

Strom, R.G., "Fault Mechanics of the Lunar Straight Wall and the Nature of Mare Material," (NASA Grant NsG 145-61), Jan. 1963.

Analysis of the fault mechanics of the straight wall indicates that the mare material does not possess a strength comparable to earth granites or basalts. Materials most likely to account for the mechanical properties are (1) extremely porous, low density lava flows (rock froths), (2) very porous tuffs or semi-welded ignimbrites, (3) combination of (1) and (2).

Sytinskaya, N.N., "Lunar Microrelief," Izv. Akad. Nauk SSSR. Komis. Fiz. Planet, No. 1, 1959, p. 81-84.

Smoothness factor q determined from reflected radiant energy.

$q \to \infty$ indicates mirror surface
$q = 1$ for orthotropic surface
$q < 1$ for dissected surface

Amount of dissection $\propto q$

Investigations concluded that lunar microrelief irregularities are most likely 0.1 mm to 10 cm.

Sytinskaia, N.N., "Meteor-Slag Theory of the Lunar Surface," (International Astronomical Union, Symposium, 14th, Pulkovo, USSR, Dec. 1960) in The Moon, New York, Academic Press, Inc., 1962, p. 391-394.

Meteor-slag hypothesis based on: albedo, color, brightness changes, thermal radiation during eclipses and the monthly cycle.
Theory: That a large part of material condenses and precipitates near place of explosion, forming vesicular cavities are separated by thin walls.

Teyfel, V.G., "Spectrophotometry of the Lunar Surface," Glavnaya Astronomicheskaya Observatoriya, Akademiya Nauk SSSR, Leningrad, 1960.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT)

Troitskii, V.S., "Lunar Radio Emission," Izv. Akad. Nauk SSSR. Komis, Fiz. Planet, No. 3, 1961, p. 16-29.

Radio emissions at $0.4 < \lambda < 3.2$ cm. Show that surface layer is approximately homogeneous at least to a depth of about one metre. Relationship of electromagnetic penetration and thermal wave penetration shows that lunar cover may be compared to terrestrial rocks. Lunar cover is of low density, resulting from high porosity; i.e., a pumice type structure rather than loose dust.

Troitskii, V.S., "On the Nature of Lunar Seas and Continents' Matter Content," Izr. Vyssh, Ucheb, Zaved., Radiofizika, Vol.VI, No. 3, 1963.

Troitskii, V.S., "Some Results of Investigations of the Lunar Surface by Radio-Physical Methods," Space Research III; Proceedings of the Third International Space Science Symposium, 1962, Astronomicheskii Zhurnal, Vol. 41, January - February 1964, p. 104-109.

Observations at wavelengths of 1.6, 3.2, and 10 cm support the theory that the upper layer of the lunar surface is in a solid, porous state.

Urey, H.C., "Age of the Moon, Chemical Composition, Geological Aspects, Stress and Cooling History," in Va. Polytech. Inst. Proc. of the Conf. on Lunar Exploration, Aug. 12- Aug. 17, 1962. May 1963.

Valley, S.L., ed., Air Force Surveys in Geophysics No. 139, AFCRL-62-270, January 1962.

Warren, C.R., "Surface Materials of the Moon," Science, Vol. 140, April 12, 1963, p. 188-190.

Theory explaining large backscattering of light in direction of source. Surface of moon is probably covered with open-texture, highly porous meshwork of randomly oriented linear units, with or without nodes. Tinkertoy structure or perhaps snowflakes or reindeer moss is postulated.

Watson, K., Murray, B., and Brown, H., "On the Possible Presence of Ice on the Moon," J. Geophys. Research, Vol. 66, No. 5, May 1961, p. 1598-1600.

Water in the form of ice may exist in permanently shaded areas. Water is more stable on lunar surface than is SO_2 or noble gases. Rate of escape of H_2O is estimated at 1.6×10^{14} g $cm^{-1}m^{-2}$ sec^{-1}. It is believed that water is being added by meteoric impact.

F. SURFACE GEOGRAPHY AND GEOLOGY (CONT.)

Wechsler, A.E., and Glaser, P.E., "Thermal Properties of Postulated Lunar Surface Materials," in The Lunar Surface Layer; Proceedings of the Lunar Surface Materials Conference, Boston, Mass., May 1963, Ed. Salisbury, J.W. and Glaser, P.E., Academic Press, Inc., New York, 1964, p. 389-410.

Wright, F.E., Wright, F.H., and Wright, H., "The Lunar Surface: Introduction," in The Moon, Meteorites, and Comets, Vol. IV - The Solar System, University of Chicago Press, 1963.

G. ATMOSPHERE

Bernstein, W., Fredricks, R.W., Vogl, J.L., and Fowler, W.A., "The Lunar Atmosphere and the Solar Wind," Icarus, Vol. 2, Oct. 1963, p. 233-248.

Cohen, A.J., "Source of Evolution of Gas from the Lunar Crater Alphonsus," Nature, Vol. 201, No. 4923, 7 March 1964, p. 1015-1016.
Plausible mechanisms to account for the gas issuing periodically are discussed.

Hinton, F.L., and Taeusch, D.R., "Variation of the Lunar Atmospher with the Strength of the Solar Wind," Journal of Geophysical Research, Vol. 69, April 1, 1964, p. 1341-1347.

Kozyrev, N., "Volcanic Phenomena on the Moon," Nature, Vol. 198, June 8, 1963, p. 979, 980.
A summary of spectral observations of Aristarchus to determine cause of luminescent glow. Data indicate emissions are of a gaseous nature. Molecular hydrogen found cannot be due to photo dissociation of water vapor. Hence, it is assumed that hydrogen is formed and accumulated in the depths of the Moon.

Öpik, E.J., "The Lunar Atmosphere," (NASA Grant NsG 58-60) Technical Report No. 240, 1962.
Surface density ≈ 3 to 5×10^5 molecules cm^{-3} with uncertainty of 2.
Composition: 50-70% CO_2, 45-27% H_2O, 4-2% H_2
Source of Atmosphere:
(1) Interaction with Solar wind (2) Surface sputtering (3) Dubious volcanic sources
Surface Charge: neutral or slightly negative

G. ATMOSPHERES (CONT.)

Safronov, V.S., and Roskol, Y.L., "History of the Lunar Atmosphere and the Possibility of Ice and Organic Compounds Existing on the Moon," in Vopr. Kosmich, (USSR), V. 9, 1963, p. 203-213.

Singer, S.F., "Atmosphere Near the Moon," in Va. Polytech, Inst. Proc. of the Conf. on Lunar Exploration, Aug. 12-Aug. 17, 1962. May 1963.

Vestine, E.H., Evolution and Nature of the Lunar Atmosphere, The Rand Corporation, RM-2106 29 January 1958.

V. THE PLANETARY ENVIRONMENTS

Since most of the data on the planetary environments are obtained from ground based observations they are subject to various interpretations and in many cases direct measurement of a parameter is not possible. One such parameter is the atmospheric pressure at the surface of a planet. For example, the Martian atmospheric density measurements made by Dr. Guido Munch in late 1963 at Mt. Wilson Observatory showed surface pressures to be lower by nearly an order of magnitude than the previously accepted values.

V. PLANETARY ENVIRONMENT

A. GENERAL

Barabashov, N.P., "Physical Conditions on the Moon and Planets," in Forty Years of Astronomy in the USSR, 1917-1957 (Pt. 1) 20 Jan. 1964 (see N64-24646 17-05).

This is a review of Soviet studies of physical conditions on the moon and planets. Discussed are the methods of computation and observation; photometry, colorimetry, and polarimetry of the moon, radio emission and other problems in selenology; physical libration of the moon; observations of lunar eclipses; Venus; Mars, Jupiter: Saturn and its rings; and small planets.

Bash, F.N., Drake, F.D., Gundermann, E., and Heiles, C.E., "Observations of Jupiter, 1961-1963," Astrophysical Journal, Vol. 139, April 1, 1964.

Description of observations of Jupiter at 10-cm wavelength with the N.R.A.O. 85-foot radio telescope. A total of about 3930 observations of about 5 minutes' duration each is available. From these it has been determined that (1) the mean equivalent disk brightness temperature was about 690°K; (2) the mean total planetary 10-cm emission did not vary by more than 3 percent over the observing periods; (3) the period of rotation of the decimeter source system is $9^h55^m29^s.70 \pm 0^s.04$(m.e.), probably the same as the rotation period of the decameter sources; (4) the magnetic axis defined by-cm radiation is tilted 24°.3 with respect to the rotational axis; (5) the north pole of the magnetic axis is located at $\lambda^{III} = 186^\circ.8$; (6) the percentage polarization of the radiation is 7.8 percent; (7) the data indicate that the polarized component of the radiation is strongly concentrated in directions close to the quatorial plane of the polarized radiating system.

Cameron, A.G.W., "Physics of the Planets," Space Physics, Ed. by Le Galley, D.P., and Rosen, A., New York, John Wiley and Sons, Inc., 1964.

Attempt at the construction of a general framework of physical interpretations of the properties of the planets and presentation of pertinent observational evidence. The subjects considered are the origin of the planetary atmospheres, the atmospheres of the Earth, Mercury, Venus and Mars, the atmospheres of the giant planets, the surface of the Moon, and planetary interiors. It is shown that many crucial observations are needed before such a framework of physical interpretations of planetary properties can become sufficiently concrete to allow many predictions to be made about such properties.

Dole, Stephen, Habitable Planets for Man, (Contract AF 49(638)-700; Proj. RAND) (R-414 PR; AD-437264), March 1964.

Discussed are man's nonterrestrial destinations rather than methods of propulsion or other technical problems of space travel. Habitable planets are studied in terms of human requirements of temperature, light, gravity, atmosphere, water, and food. The solar system and beyond are surveyed as possible candidates. Impelling reasons are given for human emigration to other planets.

V,
A. GENERAL (CONT.)

Eshleman, V.R., Research at the Stanford Center for Radar Astronomy, Semi-Annual Status Report No. 2, 1 July - 31 December 1963, (NASA Grant NsG-377) (NASA CR-53205), February 1964.

Research conducted includes theoretical and experimental radio and radar studies of lunar and planetary ionospheres, atmospheres, and surfaces, and radar studies of the sun and interplanetary medium.

Lebedinskiy, A.I., "On the Hydrogen Content on the Major Planets," Probl. of Cosmogony, Vol. VII, 25 May 1964.

The differences in the chemical composition of the major planets are explained as being the result of the heating of the outer parts of the protoplanetary cloud by the motions of the massive bodies found in the region.

Levin, B.J.,"Comparative Analysis of the Internal Constitution and Development of Planets," in Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, 1963.

Comparative analysis of the internal constitution and evolution of planets. Included are comparisons of (1) mean densities of related groups of planets and satellites, and (2) thermal histories of terrestrial planets and the Moon. The mean densities of the planets and their satellites are tabulated.

Levin, B.Y., "Distances and Masses of Planets," Probl. of Cosmogony, Vol. VII, 25 May 1964.

The relationship between distances and masses of neighboring planets is discussed. It is considered that Oort's cometary cloud was formed by the ejection of bodies perturbed by massive embryos and major planets.

Lyttleton, R.A., On the Internal Constitution of the Terrestrial Planets, (NASA Contract NAS7-100) (NASA CR-53089; JPL-TR-32-522), 21 Sept. 1963.

The modern trend of ideas in the theory of the origin of the planets is toward the view that the Earth, other terrestrial planets, and the Moon formed in such a way that their internal temperatures were sufficiently low initially for them to have been solid throughout. Subsequent rise in temperature could have resulted from the radioactive release of energy, and certainly in the case of the Earth, some such energy release in the deep interior would be postulated to account for the present existence of the liquid core. The similarity of Venus to the Earth, in regard to size and mass, suggests that Venus also probably has a liquid core. However, Mercury, Mars, and the Moon are so much smaller in mass that there is no reason to suppose that they possess central liquid cores. These internal conditions of the planets were arrived at by calculating the hydrostatic equilibrium of the planets and the Moon, using the relations between pressure and density of a two-zone, initially solid Earth.

A. GENERAL(CONT.)

Macdonald, G.J.F., "The Internal Constitutions of the Inner Planets and the Moon," Space Science Reviews, Vol. 2, October 1963,

Detailed examination of the internal structures of the Moon, Mars, Venus, and Mercury, in terms of what is known about the constitution of the Earth. The gravitation figure of the Earth, as obtained from satellites, is used to estimate the possible deviations from hydrostatic equilibrium on other planets. It is shown that observations of the orbital and rotational motion of the Moon are consistent with the hypothesis that the interior of the Moon supports density inhomogeneities of the same order as those supported by the Earth. The moments of inertia and mass of Mars are calculated, and are shown to be consistent with a metallic core containing about 10% of the mass. The equation of state for silicates, determined by seismic investigations on Earth, is used to determine density variations within the other planets. Also considered are the body tides and rotation of the Earth, the elasticity of the Earth at high frequencies, and its chemical and thermal composition. Such considerations are then extrapolated to include the Moon and the planets.

Mayer, C.H.,"General Report on Planetary Radio Astronomy," Physics of Planets; Proceedings of the Eleventh Internation Astrophysical Symposium, 1963.

Discussion of the results of radio observations of the very weak radio radiation from Mercury, Mars, Saturn, Venus, and Jupiter. At wavelengths near 3, 10, and 21 cm, the observed intensity is nearly twice that predicted for the thermal radiation of the surface of Venus. A possible separation of the thermal and nonthermal components of the spectrum of Jupiter is given, based on the assumption that all the wavelengths contribute to the thermal radiation at 130°K. Observations of apparently significant changes in the decimeter emission of Jupiter with time are discussed.

Peebles, P.J.E., "The Structure and Composition of Jupiter and Saturn," Astrophysical Journal, Vol. 140, July 1, 1964 (NSF Grant No. GP-579).

Analysis, using a computer, of model-planet claculations for Jupiter and Saturn. The general model used consists of a high-density core, surrounded by a uniform mixture of helium and hydrogen. The mass of the core necessary to yield the correct total mass, and the first two nonzero gravitational multipole moments, are calculated for various helium abundances. Different assumptions about the depth of the atmosphere below the cloud layer are examined. The results of the model planet calculations are compared with observations of Jupiter and Saturn. Implications of the results, particularly the very high hydrogen abundance found for Jupiter, for theories of planetary origin, and for cosmology, are considered.

A. GENERAL (CONT.)

Roberts, D.L., The Scientific Objectives of Deep Space Investigations: The Satellites of Jupiter, (NASA Contract NASr-65(06)) (NASA CR-53736; P-2; Formerly part of Rept. 14P2 No. 2, Sept. 1963), 9 March 1964.

The satellites of Jupiter are arranged in three distinct groups, the outermost group having retrograde motion. The origins of the three groups are discussed and are followed by a summary of the known physical properties of the satellites. The majority of the available data is restricted to the four largest satellites that are in the group closest to Jupiter. The basic measurements suggested are (1) visual measurements, (2) spectrometry and polarimetry to provide data on the gross nature of the surface, (3) magnetic field measurements in interplanetary space, in the Jovian field, and, if possible, in any local satellite magnetic field, (4) micrometeorite and charged particle measurements, and (5) biological measurements.

Ross, S. et al., Space Flight Handbooks. Volume 3: Planetary Flight Handbook, (NASA Contract NAS8-5031) (NASA SP-35, Pt. 1).

Part one is given of a series of maps, graphs, and tables that will be of use to the preliminary-design analyst in scheduling round-trip interplanetary missions to Mars and Venus in the time period 1965-1999. The following are presented: maps for obtaining departure and arrival speeds for trips to these planets, a listing of useful constants and planetary ephemerides, tables of important occurrences, and a number of auxiliary graphs. Included are the calculation of interplanetary trajectories, stopover missions, nonstop missions, supplementary graphs and charts, tables of constants and planetary phenomena, and planetary positions and velocities.

Sadil, J., and Plavec, M., "The Planets - Siblings of Our Earth," To the Near and Distant Universe, 16 July 1963.

The various properties of the planets making up the solar system are briefly discussed. Subjects included in the discussion are: (1) distinguishing between a planet and a star; (2) properties of Mercury, Venus, Mars, Jupiter; (3) history of Jupiter's red spot and its properties; (4) storms on Jupiter; (5) Saturn's rings; (6) properties of Saturn, Uranus, Neptune, and Pluto; (7) the possibility of planets beyond Pluto; and (8) internal structure of planets.

Smith, B.A., "A Photographic Optical Semidiameter of Venus," Astron. J., Vol. 69, No. 2, March 1964 (Grant NsG-142-61) (NASA-CR-56364).

Measurements of the optical diameter of Venus are generally free from the usual systematic errors when such measurements are made of the illuminated crescent at phase angles approaching 180°. Fifty-four photographic images obtained within a few days of inferior conjunction in November 1962 were measured across the diameter connecting the geometric cusps. An optical semidiameter of 8."486 ± 0."004 (p.e.) at unit distance is found, and is in some disagreement with visual observations. A radius of 6.050 km for the solid globe of Venus and a resulting mean density of 5.25 g/cm^3 are inferred.

A. GENERAL (CONT.)

Tombaugh, C.W., Photographic Patrol and Study of the Physical Conditions on the Moon and Planets, Including Photoelectric and Spectrographic Studies, Annual Report, 1 July 1963-30 June 1964 (Grant NsG-142) (NASA-CR-58617), 1964.

Six hundred and ninety-two plates of Venus were taken on 172 days. A total of 890 plates were taken of Jupiter, on 198 nights, in blue, green, red, ultraviolet, and infrared, in order of abundance. A perihelic opposition of Jupiter occurred during this reporting period. A large number of Jupiter images were reduced for size of markings and zenographic coordinates. A total of 18 plates were taken of Saturn in blue and red light, in equal number. A total of 77 plates were taken of sections of the Moon. Thirty-five plates and 14 sheets of Ektachrome were taken of Aristarchus in blue and red light. Five plates were taken of Mare Tranquillitatis for the impact of Ranger VI. In addition, visual observations were made of approximately 100 Jovian markings, located in 15 different atmospheric currents, and of Aristarchus for possible signs of activity.

Wildt, R., "Planetary Interiors; Introductory Report," Repr. from "La Physique des Planetes," Les Cong. et Colloq. de L'Univ. de Liege, Vol. 24, 1962 (Grant NsG-312).

Planetary interiors are discussed by investigating how theories of planetary and stellar constitution are parallel, and how they differ. The subject is approached by looking into the mass-radius relation of planets; polymorphism of planets is considered; liquid phases and melting is mentioned; temperature gradient and radiative transfer is presented; and the shape of minor bodies is discussed.

Wildt, R., Smith, H.J., Salpeter, E.E. and Cameron, A.G.W.,"The Planet Jupiter," Phys. Today, Vol. 16, No. 5, May 1963 (NASA-RP-173).

What is known about Jupiter and what is merely speculated about it are summarized. Much discussion is generated about the interferometric observations on decimeter radiation. The suggestion is made that previous models of Jupiter's atmosphere are incorrect because they neglect changes produced by the condensation of ammonia and water vapor on the structure of the atmosphere. There is general agreement that the bulk structure of Jupiter is different from that of a cold planet. A rational explanation of the Great Red Spot, in terms of hydrohynamics, is provided for the first time by a general picture of the surface of Jupiter.

Anderson, Hugh R., "Energetic Particles Measured Near Venus by Mariner 2," Journal of Geophysical Research, vol. 69, July 1, 1964 (Contract No. NAS 7-100).

Discussion of the instrumentation aboard Mariner 2 (1961 Alpha Rho 1) and a presentation of the results obtained near Venus.

Barrow, C. H., "Polarization Observations of Jupiter at Decameter Wavelengths," Icarus, vol. 3, May 1964 (Grant No. NSG 224-61).

Study of the polarization of radiation from Jupiter conducted in 1963 at frequencies of 16, 18, 22, and 26 Mc. Data are tabulated in detail for 3800 bursts. Histograms of occurrence probability and numbers at bursts are prepared for each frequency. It is suggested that daily polarization variations may be caused by magnetic disturbances on Jupiter and are thus associated with solar activity.

Bigg, E. K., "Influence of the Satellite Io on Jupiter's Decametric Emission," Nature, vol. 203, Sept. 5, 1964.

Report of a correlation found between the period of revolution of the Jovian satellite Io and the occurrence of bursts of radio emission emanating from Jupiter at frequencies of about 20 Mc. The author indicates that it is perhaps premature to consider why Io should influence Jupiter's radiation, but it is believed that considerable revision may be required of ideas on the origin of the radiation and probably of the orientation of Jupiter's magnetic field.

Brandt, John C., "Hydrogen and Helium Resonance Radiation from the Planets," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Consideration of the possibility of hydrogen and helium emissions from the plants.

Carr, T. D., Brown, G. W., Smith, A. G., Higgins, C. S., Bollhagen, H., May, J., and Levy, J., "Spectral Distribution of the Decametric Radiation from Jupiter," Astrophysical Journal, vol. 140, Aug. 15, 1964 (NSF-Navy-Army-supported research).

Presentation of results of observations of the sporadic radiation from Jupiter. A method was developed for computing the mean flux density for the apparition from measurements of peak flux density in consecutive 10-min. intervals.

Clarke, David, Observations of the Frequency Dependence of Polarization of the Light of the Moon and of Mars, Technical Note No. 3, 13 Jan. 1964 (Contract AF 61(052)-378) (AFCRL-64-442; AD-602668).

Some equations are established for determining the degree of polarization of the light of the Moon and Mars. Summarized are the more recent results of measurements of lunar polarization, and listed are the results obtained by the double beam polarimeter.

V,

B. RADIATION (CONT.)

de Vaucouleurs, G., Geometric and Photometric Parameters of the Terrestrial Planets, Mar. 1964 (NASA Contract NASr-21(04)) (NASA CR-53507; RM-4000-NASA).

A critical examination is presented of the diameters, ellipticities, and spectral albedos of Mercury, Venus, and Mars derived by many observers in the course of the past 100 years. The systematic and accidental errors in the various methods are discussed, and the results are weighed accordingly, to produce best estimates of the diameters, ellipticities, and albedos for the three planets.

Douglas, James N. and Smith, Harlan J., "Observations Bearing on the Mechanism of Jovian Decametric Emission," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963 (NASA-NSF-supported research).

Presentation of results leading to conditions to be placed on Jovian decameter radiation. Considered are polarization anomalies, and power and energy associated with decameter storms.

Dowden, R. L., "Polarization Measurements of Jupiter Radio Bursts at 10.1 Mc," Australian Journal of Physics, vol. 16, Sept. 1963, p. 398-410.

Description of observations of Jupiter bursts of both senses of circular polarization at 10.1 Mc. The algebraic mean axial ratio is a strong function of Jovian longitude. The axial ratio distribution and other observations are compared with the predictions of the Doppler-shifted cyclotron theory.

Ellis, G. R. A. and McCulloch, P. M., "The Decametric Radio Emissions of Jupiter," Australian Journal of Physics, vol. 16, Sept. 1963.

Discussion of the cyclotron theory of the decametric radiations of Jupiter. Providing Jupiter is surrounded by an extensive ionized exosphere, it is shown that the theory accounts for the observed variation in the number of radiation bursts with planetary rotation, their polarization, and their spectra.

Franklin, K. L., "Radio Waves from Jupiter," Scientific American, vol. 211, July 1964.

General review of knowledge of Jupiter, with description of the ratio phenomena identified in 1955, and examination of theories to account for their origin.

Goldstein, Richard M., "Radar Observations of Jupiter," Science, vol. 144, May 15, 1964.

Report of studies conducted from Oct. 17 to Nov. 23, 1963, at the Goldstone Tracking Station, Mohave Desert, Calif. Parameters of the radar system are given.

V,
B. RADIATION (CONT.)

Gower, J. F. R., "Radiation from Jupiter at 178 Mc/s," Nature, vol. 199, Sept. 28, 1963.

Brief presentation of the results of observations of Jupiter at a frequency of 178 Mc, in order to determine if the origin of the emission is due to radiation by relativistic electrons trapped in the Jovian magnetic field.

Heiles, C. E. and Drake, F. D., "The Polarization and Intensity of Thermal Radiation from A Planetary Surface," Icarus, vol. 2, Nov. 1963.

Discussion of contemporary radiofrequency radiometry of planets. Presented is the theory applicable to radiometric observation of polarization and apparent temperature across the disk of a planet.

Inn, Edward C. Y., "Martian Airglow," Atmospheric Sci, vol. 21, no. 2, Mar. 1964 (NASA-RP-250).

A mechanism of blue Martian airglow, which can be expected to occur on Mars as well as on Venus, is discussed. It is assumed that the Martian atmosphere is composed of 2% CO_2 and the remainder is N_2, the surface pressure being about 100 mb.

Jelley, J. V. and Petford, A. D., "A Preliminary Search for Short-Period H(α) Activity from the Planet Jupiter, During the Apparition of 1960," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Experimental investigation of possible short-lived activity from Jupiter, during the sporadic and intense decameter radio storms of 1960.

Morris, D. and Bartlett, J. F., "Polarization of the 2840 MC/S Radiation from Jupiter," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Brief summary of measurements on the 2,840-Mc Jupiter radiation. The values found for the flux and polarization are displayed as a function of the System III longitude defined by Smith and Carr (1959).

Pokrovskiy, G. I., "Radiation Belts Near Celestial Bodies," Feb. 12, 1963 Translation of an article from Priroda (Moscow), No. 8.

Radiation belts are formed and exist in the proximity of the earth and other celestial bodies which possess a sufficiently intense magnetic field. Assuming that the composition of the celestial body is identical with that of the earth, the relation of the compressed core to the size of the celestial body can be determined. This shows that celestial bodies with a radius of less than 6000 km have no compressed core and, thus, no magnetic field and no radiation belt.

V,
B. RADIATION (CONT.)

Rea, D. G. and Welch, W. J., "The Reflection and Emission of Electromagnetic Radiation by Planetary Surface and Clouds," Space Sci. Rev., vol. 2, 1963 (NASA Grant NsG-101-61; NSF Grant 16741).

General considerations are presented of the theory of reflection from plane, layered, and rough surfaces, and from clouds. Principles underlying the radiometric determination of planetary temperatures are delineated.

Riihimaa, Jorma J., "High-Resolution Spectral Observations of Jupiter's Decametric Radio Emission," Nature, vol. 202, May 2, 1964.

Review of an experiment during the 1963 apparition of Jupiter relating to the fine structure in the dynamic spectra of Jovian decametric radiation. Typical spectra are presented.

Roberts, J. A. and Komesaroff, M. M., "Evidence for Asymmetry of Jupiter's Van Allen Belt," Nature, vol. 203, Aug. 22, 1964.

Discussion of features which suggest that the belt is not symmetrically disposed about the planet.

Roberts, M. S. and Huguenin, G. R., "The Radiation Belt of Jupiter," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Discussion of aspects of Jupiter's microwave radiation. Observational data for Jupiter are summarized in a table.

Smith, Alex G., Carr, T. D., and Six N. F., "Results of Recent Decameter-Wavelength Observations of Jupiter," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963 (Army-Navy-NSF-supported research).

Discussion of the application of mechanisms for the generation of planetary radio noise to the generation of decameter radio noise in the vicinity of Jupiter.

Smith, Harlan J., Search for Planetary Optical Emission, and Study of Flare Activity of Nearby Stars, (Final Report), 20 May 1964 (Grant Nonr(G)-00014-63) (ONR-14-63; AD-600154).

Stone, R. G., Alexander, J. K., and Erickson, W. C., "Low-Level Decameter Emissions from Jupiter," Astrophysical Journal, vol. 140, July 1, 1964 (NSF-supported research).

Study of the 26.3-Mc radiation from Jupiter, using a decametric antenna capable of detecting emission as weak as 5×10^{-24} wm^{-2}-$(cps)^{-1}$.

V,
B. RADIATION (CONT.)

Tombaugh, Clyde W., Planetary and Lunar Research in the Photographic Infrared, Visible and Ultraviolet (Semi-Annual Report), Oct. 1963 (Grant DA-ARO(D)-31-124-G41) (AD-428392).

Activities dealing with the observation of Venus, Mars, Jupiter, and Saturn are discussed.

Ueno, Sueo, Diffuse Reflection of Radiation by a Planetary Atmosphere. I., International Symposium on Space Technology and Science, Tokyo, Japan, August 27-31, 1962, 4th, proceedings, Tokyo, Japan and Rutland, Vt., Japan Publications Trading Co., 1963.

Exact treatment of the diffuse reflection problem of parallel rays by a finite, plane-parallel, inhomogeneous, non-emitting, and isotropically scattering atmosphere, whose bottom surface reflects the radiation according to Lambert's law with a constant albedo.

van de Hulst, H. C. and Irvine, W. M., "General Report on Radiation Transfer in Planets: Scattering in Model Planetary Atmospheres," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Review of simple models describing scattering in planetary atmospheres.

Warwick, James W., "Radio Astronomical Techniques for the Study of Planetary Atmospheres," Radio Astronomical and Satellite Studies of the Atmosphere (Conference sponsored by NATO), Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers Div., John Wiley and Sons, Inc., 1963 (USAF-supported research).

Discussion of radio observations of Mercury, Venus, the Earth, the Moon, Mars, Jupiter, and Saturn.

Warwick, James W., "Radio Emission from Jupiter," Annual Review of Astronomy and Astrophysics, Volume 2, Palo Alto, Annual Reviews, Inc., 1964.

Review of work since 1961 concerning the origin and nature of Jupiter's nonthermal emission. A summary is given of the observed properties of Jupiter's nonthermal radio emission.

Warwick, James W. and Dulk, George A., "Faraday Rotation on Decametric Radio Emissions from Jupiter," Science, vol. 145, July 24, 1964 (USAF-NASA-supported research).

Report of some decametric radio emissions from Jupiter. The recent observations exhibit effects which are attributable to Faraday rotation within the Earth's ionosphere. Evidence is presented for the presence of Faraday rotation, and its origin is discussed.

V. PLANETARY ENVIRONMENT

C. MAGNETIC FIELDS

Dauvillier, A., "Is the Earth the Only Magnetized Dwarf Planet"? Academie des Sciences (Paris), Comptes Rendus, Vol. 257, Nov. 25, 1963 (In French) No. 22.

Demonstration of the manner in which Mercury, Venus, the Moon, and Mars lost their magnetic momentum of paleovolcanic origin. Only the Earth, thanks to its oceans, experiences polar migrations which constantly renew its magnetism through the role played by volcanism and solar activity.

Link, F., "Planetary Conjunctions, Magnetic Perturbations, and Sunspots," Astronomical Institutes of Czechoslovakia, Bulletin, Vol. 15, No. 3, 1964, (In French).

Discussion of Bigg's failure to use all the explanations of the influence of Venus and Mercury on geomagnetic perturbations. It is stated that the statistics of sunspots taken at Ondřejov have revealed the existence of other very intriguing phenomena which have been presented in the form of other hypothesis of planetary influences on the Sun. It is thus that the number of Sunspots Ṙ shows periodic changes in the course of Venus' synodic revolution (Link and Ceplecha, 1949; Kopecký and Mayer, 1951).

Mlodnosky, R., Carpenter, D., and Helliwell, R., "Non-Thermal Noise Measurements Near Planets," Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, (Grant No. NsG-174-61), 1963.

Proposed study of planetary ionization and magnetic fields through measurements of nonthermal radio noise made near planets. Outlined are procedures for the measurements which require the determination of cutoff frequencies and time delays or echoing intervals. For deep space probes, the instrumentation would consist of many fixed-frequency receivers whose outputs would be digitally sampled. Noise measurements would increase the probability of overall success of a planetary probe without resorting to redundant instrumentation. It is therefore felt that nonthermal measurements should be included among the experiments to be performed on the first probes designed to study planetary atmospheres.

V. PLANETARY ENVIRONMENT

D. GRAVITATIONAL FIELDS

Chebotarev, G., "Gravitational Spheres of the Major Planets, Moon and Sun," Soviet Astronomy, Vol. 7, March-April 1964, (Translation).

In Russian, with summary in English.

Summary, based on a unified system of astronomical constants, of the numerical values of the radii of the gravitational spheres of large planets, the Sun and the Moon.

Yabushita, S., "Extension of the Betti-Ritter Formula to the Gravitational Energy of the Planets," in Royal Astronomical Society, Monthly Notices, Vol. 128, No. 3, 1964, (Grant No. NsG 58-60).

Presentation of a method. It is shown that, for a planet whose composition is such that a given relation holds, the gravitational energy takes extremely simple forms analogous to the well-known Betti-Ritter formula for a steller polytrope. Numerical results are derived for certain models of the Earth, Venus, and Mars.

V. PLANETARY ENVIRONMENT

E. ATMOSPHERES

Adamcik, Joe A., and Draper, Arthur L., "The Temperature Dependence of the Urey Equilibrium and the Problem of the Carbon Dioxide Content of the Atmosphere of Venus," Planetary and Space Science, Vol. 11, November 1963.

Development, by means of standard thermochemical equations, and application to the atmosphere of Venus, of the general relationship between temperature and the equilibrium pressure of carbon dioxide in the Urey equilibrium. The values of the carbon dioxide pressure computed by means of these equations for 700°K are greater than any reasonable estimate of its partial pressure at the base of the Cytherean atmosphere. It is concluded that there is no failure of the Urey equilibrium due to a lack of water, as has been supposed, but rather that the oxidized carbon abundance on the planet is insufficient to maintain the equilibrium pressure at the temperature of the planetary surface. Consequently, carbonates would be unstable on the Cytherean surface, and all oxidized carbon would be expected to be in the atmosphere.

Barabashov, N. P., "Preliminary Results of Observations of Mars," translated into English from Vestn. Akad. Nauk SSSR, no. 5, 1957 (Contract AF 19(628)-3880).

Coordinated observations of Mars were conducted by various observatories throughout the U.S.S.R. for 5 months during the 1956 opposition. All observers noted that the Mars atmosphere was not transparent but was filled with a fog, which interfered with the study of surface features. Considerable changes from past observations were noted, however, in the contrast between the seas and the continents, the appearance and brightness of the southern polar cap and the polar fringe, and the brightness variations of the same land areas with time. The observational data acquired are being processes more fully to get a more accurate picture of the physical conditions on Mars.

Barath, F. T., Barrett, A. H., Copeland, J., Jones, D. E., and Lilley, A. E., "Mariner 2 Microwave Radiometer Experiment and Results," Astron. J. 69, No. 1, Feb. 1964 (Grant NsG-250-62).

A microwave radiometer experiment aboard Mariner 2 successfully measured emission from Venus at wavelengths of 13.5 and 19 mm on three scans of the planetary disk. The results provide quantitative data for microwave limb darkening of Venus and thus give strong support to that class of model atmospheres that have high temperatures originating at, or near, the surface of the planet.

V,
E. ATMOSPHERES (CONT.)

Barrett, Alan H., "Microwave Spectral Lines as Probes of Planetary Atmospheres," Société Royale des Sciences de Liège, Memoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of Eleventh International Astrophysical Symposium, Liège, Belgium, July 9-12, 1962, University of Liège and USAF, Institut d'Astrophysique, Liège, Belgium, 1963, Army-Navy-USAF-supported research, Contract No. NASr-101 and Grant No. NsG-250-62.

Discussion of the possibility of detecting atomic and molecular spectral lines by radio techniques in planetary atmospheres. A microwave experiment is outlined for the determination of atmospheric properties.

Barrett, A. H., and Staelin, D. H., "Radio Observations of Venus and the Interpretations, Space Science Reviews, Vol. 3, July 1964, Contract DA-36-039-AMC-03200(E), Grants No. NsG 250-62, No. NsG 419.

Comparison of radio observations of Venus with theoretical microwave spectra computed for various models of the Venusian atmosphere. It is found that to match approximately the observed radio spectra with most models requires extreme conditions on Venus, such as surface pressures of more than 100 atmospheres, or dust densities of at least 10 gm/m^2 composed of large particles at the surface.

Barth, Charles A., Ultraviolet Spectroscopy of Planetary Atmospheres, "Dyn of Manned Lifting Planetary Entry," July 1963 (NASA Contract NAS7-100) (NASA CR-52461; TR-32-516).

The ultraviolet spectrum of a planetary atmosphere is produced by charged-particle bombardment and solar radiation. The ultraviolet aurora and dayglow may be observed from a rocket within the atmosphere, from a satellite above the atmosphere, and from a space probe flying by the planet. The spectrum of the ultraviolet dayglow is the result of molecular scattering, absorption, resonance reradiation, and fluorescence of the incident solar radiation. The composition of the upper atmosphere may be determined from a quantitative analysis of the dayglow spectra. The spectrum of the ultraviolet aurora identifies many of the atoms and molecules that are present in the atmosphere. The geographic distribution of the aurora is believed to be the result of the interaction of the solar plasma with the planet's magnetosphere. The details of the spectrum will provide information on the energy and nature of the bombarding particles.

Bibinova, V. P., Kislyakov, A. G., Kuzmin, A. D., Salomonovich, A. E., and Shavlovsky, I. V., "Radio Observations of Venus Carried out on the Radio Telescope of P. N. Lebedev Physical Institute, Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Presentation of results of observations of Venus by means of a 20-m radio telescope. The observing technique is described in detail. The results of measurements at 4 and 8 mm are plotted. Maximum values of the brightness temperatures at those wavelengths were obtained near the inferior conjunction and were equal to $375^\circ \pm 75^\circ K$ and $390^\circ \pm 120^\circ K$, respectively.

V,
E. ATMOSPHERES (CONT.)

The position of the minima does not coincide exactly with the moment of the inferior conjunction, but is somewhat shifted toward the eastern elongations.

Brayshaw, J. M., Mars Atmosphere Entry Parametric Study, 31 Oct. 1963 (NASA Contract NAS7-100) (NASA CR-53030; JPL-TR-32-458, Rev. 1).

The expected extreme model atmospheres, as well as the anticipated extremes of initial entry velocity, entry angle, and ballistic coefficient were included in the study. As functions of these variables, the following parameters are plotted in graphical form: (1) flight path acceleration vs altitude; (2) Mach no. vs altitude; (3) dynamic pressure vs altitude; (4) heating rate vs altitude; (5) flight path angle vs altitude; (6) atmospheric velocity vs altitude; (7) altitude vs time; and (8) altitude vs planet centered angle. In addition summary plots of peak heating rate, peak acceleration, unretarded impact velocity, and altitude for parachute deployment are shown as a function of entry angle for the extremes of ballistic coefficient and model atmosphere.

Bottema, Murk, Plummer, William, and Strong, John, "Water Vapor in the Atmosphere of Venus," Astrophysical Journal 139, 3 (April 1, 1964).

Measurements in the 1.13 μ band indicate water vapor on Venus of $22.2 \cdot 10^{-3}$ gm/cm^2 for a 90 mb pressure or $5.2 \cdot 10^{-3}$ gm/cm^2 for a 600 mb pressure, which is the same order as for the earth's upper atmosphere.

Briggs, Michael H., "Particulate Matter in the Atmospheres of the Terrestrial Planets," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Discussion of the evidence for the composition of the hazes of each of the inner planets. On the whole, the hazes of Mercury are likely to be fluorescent-free radicals or volcanic sulphur. For Venus, however, it is possible to construct only a hypothetical model system because of the uncertain chemical composition of the two hazes present in the atmosphere. The hazes of the Mars atmosphere are of three types: one due to dust storms, another to ice crystals, while the third one (the so-called "blue haze" or "violet layer") has an undefined chemical composition.

Cameron, A. G. W., "The Origin of the Atmospheres of Venus and the Earth," Icarus, Vol. 2, Oct. 1963.

Discussion of the evidence regarding the difference between the compositions of the atmospheres of Venus and the Earth. It is concluded that there are no detectable traces of the primitive solar nebula surviving in the Earth's atmosphere, and that the Venus atmosphere probably contains of the order of 100 times the amount of nitrogen in the Earth's atmosphere and negligible amounts of water vapor.

V,
E. ATMOSPHERES (CONT.)

Collins, Daniel J., Convective Heat Transfer in Planetary Atmospheres, 1 July 1964 (Contract NAS7-100).

Convective heat transfer rates for three model planetary atmospheres have been obtained. These atmospheres are characteristic of those about the planets Mars and Venus.

Coulson, K. L. and Lotman, M., "Molecular Scattering of Solar Radiation in the Atmosphere of Mars," Journal of Geophysical Research, Vol. 68, Oct. 15, 1963.

Application of the exact theory of radiative transfer in a Rayleigh atmosphere to compute the molecular optical thickness of the Martian atmosphere as a function of altitude above the planetary surface, for 16 different wavelengths in five atmospheric models.

Craig, Richard A., Tides in the Atmospheres of Earth and Mars, Sept. 1964 (Contract NASw-704).

The theory of atmospheric tides, as developed for Earth's atmosphere, is applied to the Martian atmosphere.

Danielson, R. E., Gaustad, J. E., Schwarzschild, M., Weiver, H. F., and Woolf, N. J., "Mars Observations from Stratoscope II," Symp. on Instrumental Astronomy, Ariz. U., 1964 (Sponsored by NASA, NSF, and ONR: Proj. Stratoscope).

On March 1, 1963, Stratoscope II, a balloon-borne telescope, was flown for the first time with the aim of investigating the infrared spectrum of Mars. A series of technical difficulties arose during the flight and severely restricted the number and quality of the spectrometer scans that were obtained. Nevertheless, the following results could be deduced from these scans: (1) It is improbable that the water vapor content of Mars is greater than 40 microns; (2) if the total pressure at the surface of Mars is assumed to be 87 mb, the amount of CO_2 in the atmosphere of Mars amounts to about 6,000 cm-atm rather than 3,000 cm-atm, as previously estimated.

Danilov, A. D., "Radio Astronomy Research and Current Concepts About the Atmosphere of Venus," Cosmic Res., 27 Apr. 1964.

There are currently two hypotheses in serious contention for explaining data on the characteristic radio-wave emission of Venus, the greenhouse effect and the ionosphere. Further research regarding the possibilities for both hypotheses is needed for a final decision to the question about the origin of radio-wave emission from Venus and the characteristics of its atmosphere.

V,
E. ATMOSPHERES (CONT.)

Danilov, A D. and Iatsenko, S. P., "On Ionosphere Interpretation of Venus Radio-Observations," Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963 (Sponsored by the Committee on Space Research (COSPAR)), eidted by M. Florkin and A. Dollfus, Amsterdam, North-Holland Publishing Co.; New York, Interscience Publishers, 1964.

Discussion of the ionospheric hypothesis as the most promising to account for the radio observations of Venus. Almost complete agreement between calculated and observed spectra occurs if one considers an optically thick porous ionosphere and takes into account a decrease of electron temperature in its upper part. It is noted that, in this case, it is easy to explain the radar results, as the reflection may take place from regions not covered by a thick ionosphere. If the ionospheric hypothesis is correct at wavelengths up to 3 cm, one should observe limb darkening, as was the case in recent experiments.

Davydov, V D., "Behavior of the Hydrosphere Under Martian Conditions and Its Observed Manifestations," Probl. of Cosmogony, Vol. VII, 25 May 1964, (See N64-24759 17-29).

The propriety of comparing water resources on Earth to those on Mars is confirmed, even though the spectral method could not be used to detect water vapors in the Martian atmosphere. Oceanographic techniques are employed instead.

Deirmendjian, D., A Water-Cloud Interpretation of Venus Microwave Continuum, Apr. 1964 (Contract AF 49(638)-700).

Based on the argument that the analysis of existing data does not conclusively demonstrate the absence of large amounts of water in the lower Venusian atmosphere, it is shown that a 600°K surface temperature and a planet-wide continuous and thick water-cloud veil are consistent with the observed microwave brightness distribution in the millimeter and centimeter range. The total water content of this veil is estimated at 10 gm cm^{-2}. The surface pressure of the sustaining atmosphere may be as low as 3 atm.

Dollfus, Audouin (ph.D. Thesis, Paris U.), Study of the Planets by Means of the Polarization of Their Light, July 1964, Translated into English.

The instruments developed permit the measurement of the ratio of polarized light and the direction of the favored vibration in small regions of the surface of the disks of planets, and within limited spectral regions. Measurements performed from 1948 to 1954 on Mercury, Venus, Mars, Jupiter, and lunar earthshine were compared with the determinations made on terrestrial samples. The natures of their soils and clouds and the densities of their atmospheres could thus be specified.

Edson, J. B., "The Twilight Zone of Venus," Advances in Astronomy and Astrophysics, Vol. 2, Edited by Zdeněk Kopal, New York, Academic Press, 1963.

Review of observational and theoretical examinations of the twilight zone of Venus.

Evans, D. C. and Wasko, P. E., Model Atmospheres for the Planet Mars, Douglas Aircraft Co., Santa Monica, Calif., Aug. 1963.

Four model atmospheres for the planet Mars are presented for use in engineering studies. Three are for a molecular weight of 28.0 with surface pressures of 85, 162, and 37 mb. They are representative of mean, maximum, and minimum conditions, respectively. The fourth model is for a molecular weight of 32.8 with a surface pressure of 37 mb, representing extreme minimum conditions. These models indicate the expected numerical range of the thermodynamic variables - pressure, temperature, and density - to be encountered in the Martian atmosphere from 0 to 400 km (1,312,300 ft) during the 11-year solar cycle, 1975 to 1985. The extreme atmospheric models are not artificial envelopes of all possible combinations, but represent physical conditions which may actually exist on Mars.

Fehrenback, Charles and Guérin, Pierre, "Anomaly in the Behavior of the NH_3 Band in the Spectrum of the Planet Jupiter," Académie des Sciences (Paris), Comptes Rendus, Vol. 258, No. 5, Feb. 3, 1964 (In French).

Feitis, Peter Hans, "Translational and Rotational Motion of a Body Entering the Martian Atmosphere," Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, and Deutsche Gesellschaft für Raketentechnik und Raumfahrtforschung, Jahrestagung, Berlin, West Germany, Sept. 14-18, 1964, Paper (In German).

Focas, J. H., "Preliminary Results Concerning the Atmospheric Activity of Jupiter and Saturn," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Considerations on the development of Jovian atmospheric phenomena. The appearance of brilliantly white and dark matter on Jupiter is the major sign of atmospheric activity. The total intensity of the activity seems to be slightly higher in the southern hemisphere of Jupiter.

Focas, J. H. and Banos, C. J., "Photometric Study of the Atmospheric Activity on the Planet Jupiter and Peculiar Activity in Its Equatorial Area," Annales d'Astrophysique, Vol. 27, Jan.-Feb. 1964.

Description of a program for studying the evolution of the activity in the atmosphere of Jupiter, and development of a photometric method for determining a coefficient of its intensity. Data covering the variation of the intensity of the total activity on the planet in the period 1952-1963 and the peculiar activity in the equatorial area in the period 1957-1963 are given.

Gifford, F. A., Jr., "The Problem of the Martian Yellow Clouds," Monthly Weather Review, Vol. 91, Oct.-Dec. 1963.

Observations on the problem of the yellow clouds of Mars - the usually isolated and more or less clearly delimited obscurations of comparatively small areas of the Martian disk which can be detected visually or in photographs with yellow or red filters. It is noted that, in view of the known dryness of the Martian atmosphere, the desert location of most of the yellow clouds shown in a table, and their occurrence in regions of comparatively high surface temperature, certainly tend to confirm the hypothesis that they are dust clouds, probably initiated by thermal convection. Their generally equatorward drift seems to imply that they are low-level phenomena, possibly steered by the tropical portion of a symmetric circulation cell. Considered as perturbations on some steady-state circulation regime, the dust storms appear to be damped out fairly rapidly. Moreover, they are fairly small, of the order of several hundred to 1,000 km in horizontal extent.

Given, L. P., "Line Inclinations in Equatorial Spectra of Jupiter and Saturn," Astrophysical Journal, Vol. 139, 2, Feb. 15, 1964.

With a high precision instrument no anomalous inclinations of NH_3 and CH_4 lines in Jupiter and Saturn were found exceeding twice the probable instrument error.

Goldsmith, Donald W., "Differential Refraction in Planetary Atmospheres with Linear Scale Height Gradients," Icarus, Vol. 2, Nov. 1963.

Discussion of the theory of differential refraction in an isothermal atmosphere, extended to the case of an atmosphere with a linear gradient of scale height caused solely by temperature changes. The atmospheric refraction with its approximations is presented.

Gray, E. L. and Coulson, K. L., Molecular Optical Thickness of Low-Density Models of the Atmosphere of Mars, General Electric Co., Philadelphis, Pa., Mar. 1964.

Values of volume scattering coefficient and normal optical thickness for the revised estimates of the Martian atmosphere are given, as a function of altitude above the planetary surface, for eight selected wavelengths from 2500 to 10,000 A. Four models of the Martian atmosphere, as given by the Jet Propulsion Laboratory, are used, the surface pressure for the models being 11 mb (2 models), 15 mb, and 30 mb.

Green, A. E. S., Lindenmeyer, C. S., and Griggs, M., "Molecular Absorption in Planetary Atmospheres," Journal of Geophysical Research, Vol. 69, 3, Feb. 1, 1964.

A simple and analytical model is proposed for computing IR transmission through planetary atmospheres.

Gross, S. H. and Rascool, S. I., The Upper Atmosphere of Jupiter, Jun. 1964 (NASA-TM-X-51917).

The properties of the upper atmosphere of Jupiter were theoretically investigated. The vertical temperature profile in the atmosphere above the clouds and the structure of the ionosphere were computed for two different model atmospheres: Model I corresponds to a H/He mixing ratio of 20:1 by volume, and Model II has a H/He ratio as low as 0.03:1.

Guerin, P., "Continuous Spectrophotometry (Between 6100 and 3200 Å) of a Bright Region of Mars at Opposition, and the Nature of the Violet Layer," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963, In French.

Hanel, R. A. and Bartko, F., Radiative Equilibrium in Planetary Atmospheres. I: Application of the Strong Line Absorption Law to the Atmosphere of Venus, Aug. 1964 (NASA-TN-D-2397).

The interpretation of the data obtained for Venus in the 8μ to 12μ atmospheric window clearly requires some knowledge of the temperature distribution in the planet's upper atmosphere. For this purpose temperatures, net fluxes, and specific intensities were calculated for a CO_2-N_2 atmosphere in radiative equilibrium. The wavelength, temperature, and pressure dependence of the CO_2 absorption, including the excited bands, was considered. Solar radiation absorbed in the clear atmosphere influences the temperature profile distinctly. The effects of various CO_2 concentrations, cloud-top pressure levels, and cloud reflectivities on the equilibrium temperatures are also discussed.

Inn, E. C. Y., "Martian Airglow," Journal of the Atmospheric Sciences, Vol. 21, Mar. 1964.

Discussion of the problem of whether an observable airglow from other planets, such as Mars and Venus, could be expected to occur, taking our present knowledge of the composition of these planetary atmospheres as a basis. An airglow mechanism that may be expected to take place on Mars or Venus is proposed, and its implications are discussed for the Martian atmosphere.

James, C. S., "Experimental Study of Radiative Transport From Hot Gases Simulating in Composition the Atmospheres of Mars and Venus," AIAA Journal, Vol. 2, Mar. 1964.

For abstract see Accession No. A63-20649 20-13.

Hide, R., "On the Hydrodynamics of Jupiter's Atmosphere," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963, 481-505, Contract No. AF 61(052)-216 and NSF Grant No. G-22390.

Brief description of the theory of the Great Red Spot, as a clue to the hydrodynamics of Jupiter's atmosphere. The principal properties of the Great Red Spot are summarized. Considered are previous theories of the Great Red Spot, Jupiter's internal structure and rotation, the "Taylor columns," the flow around the Great Red Spot, the critique of the simplest model, and the dynamical effects of compressibility in a highly rotating fluid.

Jastrow, R. and Rasool, S. I., Radiative Transfer in the Atmospheres of Venus and Mars, NASA-RP-251.

An approximate theory of radiative transfer in planetary atmospheres is developed and applied to atmospheres of Venus and Mars. The results for Venus indicate that the atmosphere of that planet must have an optical thickness of 60 in the infrared, corresponding to a transmission of 10^{-26}, to produce the observed surface temperature of 600°K. The surface temperature and tropopause height of Mars are also investigated.

Kaplan, L. D., Münch, G., and Spinrad, H., "An Analysis of the Spectrum of Mars," Astrophys. J., Vol. 139, No. 1, 1 Jan 1964 (NASA Contract NAS7-100).

On a high-dispersion spectrogram of Mars, rotational lines of H_2O near λ 8300 and CO_2 near λ 8700 have been detected. Recent laboratory measurements of line strengths have been used to determine the amounts of H_2O and CO_2 in the atmosphere of Mars: 14 $\pm$7μ precipitable water and 55 $\pm$20 m atm CO_2. From the absence of O_2 in the Martian spectra, an upper limit of 70 cm atm for the O_2 content has been set. By suitably combining the CO_2 amount with observations by Kuiper and Sinton of the strongly saturated bands in the 2μ region, a surface pressure of 25 $\pm$15 mb has been derived. The implications of the results on the composition of the Martian atmosphere are discussed.

King, J. I. F., "A Quantitative Greenhouse Model of the Venus Atmosphere," American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, New York, N. Y., Jan. 20-22, 1964.

Investigation of the plausibility of the greenhouse effect as an explanation of the high surface temperature of Venus, where the contrasting atmospheric opacity in the visible and far-infrared spectrum traps the absorbed sunlight and raises the surface temperature. A quantitative model of the greenhouse model is developed from first principles. The model, under the limitations set forth, is applied to the atmosphere of Venus.

V,
E. ATMOSPHERES (CONT.)

Korolkov, D. V., Parijsky, Ju. N., Timofeeva, G. M., and Khaikin, S. E., "High Resolution Radio Observations of Venus and Jupiter at the Pulkovo Observatory," Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963.

Presentation of the results of observations of Venus and Jupiter performed in 1962 with a radiotelescope and a highly sensitive wideband radiometer with a parametric amplifier at the input, in order to estimate the effective dimensions of the radiation area, and to discover the emission of the radiation belts on this wavelength. The temperature of the atmospheric layers responsible for the radiation at the 3-cm wavelength is higher than that of the layers observed in the IR; this is stated to mean that a considerable gradient of temperature exists in the atmosphere of Jupiter.

Kozyrev, N. A., "The Atmosphere of Mercury," Sky and Telescope, Vol. 27, June 1964.

Discussion of spectrographic studies of Mercury made with a fast prism spectrograph and a 50-in. reflecting telescope. Spectrograms of Mercury's immediate vicinity were obtained at various position angles and distances from the planet's limb. They showed no traces of emission lines or bands, thus eliminating the possibility of an appreciable extended atmosphere. However, a comparision of the Fraunhofer lines in the spectra of Mercury and the Sun does indicate the existence of atomic hydrogen on that planet. Other theoretical and experimental evidence supporting the possibility that there is hydrogen in Mercury's atmosphere is discussed.

Kozyrev, N. A., "Volcanoes on Venus," 29 Mar. 1963 (Translated into English from Zarya Vostoka (USSR), 18 Dec. 1962.

Photographs of the absorption spectra of the smoke flames from certain active volcanoes of the Klyuchevskiy group of Kamchatka were obtained. These photographs revealed the presence of two absorption bands in the visible region of the spectrum. Bands of this same type had been previously observed in the spectrum of Venus. Thus, the existence of such bands in the spectra of volcanic fumes provides a basis for assuming that there is strongly developed volcanic activity on Venus. These bands are entirely absent in the Martian atmosphere; therefore, there is a basis for assuming that volcanic activity on this planet, if it does exist, is significantly weaker than that on Venus and Earth.

Kotel'nikov, V. A., Dubrovin, V. M., Dubinskii, B. A., Kislik, M. D., Kuznetsov, B. I., Petrov, G. M., Rabotiagov, A. P., Rzhiga, O. N., and Shakhovskoi, A. M., "Radar Studies of the Planet Mars in the Soviet Union, Soviet Physics - Doklady, Vol. 8, Feb. 1964 (Translation).

V.
E. ATMOSPHERES (CONT.)

Kuiper, Gernard P., "Photometry of the Infrared Spectrum of Venus, 1-2.5 Microns," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d' Astrophysique, Liège, Belgium, 1963 (Contract No. AF 19(604)-7260 and Grant No. NsG-161-61).

Photometric investigation of the IR spectrum of Venus. Some of the original records obtained with the Kitt Peak and McDonald telescopes are reproduced. The Venus spectra give information on the CO_2 abundance on Venus, the abundance ratio, the oxygen-isotope ratio, and the hot bands.

Kuz'min, A. D., "Concerning the Ionospheric Model of Venus," Izv. VUZov: Radiophys, 18 May 1964.

A model of Venus with a discontinuous, semitransparent, ionized layer has been examined. This layer is responsible for the increased radio emission of the planet in the centimeter and decimeter bands. The layer and the planet's surface parameters have been derived and show agreement of the calculated spectrum with the experimental one. The ionospheric model is also discussed in which the emission layer is located on the lower dense layers of the planet's atmosphere. The cosmic rays and the radioactivity of the atmosphere are possible sources of ionization.

Kuzmin, A. D., and Salomonovich, A. E., "Some Conclusions About Physical Conditions on Venus According to Radio Astronomical Observations at P. N. Lebedev Physical Institute," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Proceedings of the Eleventh International Astrophysical Symposium. Liege, Belgium, July 9-12, 1962, University of Liège and USAF, Institut d'Astrophysique, Liège, Belium, 1963.

Conclusion from radio astronomical observations of physical conditions on Venus. For the first time it became possible to detect that the brightness temperature averaged over the visible disk of Venus grew with increase of the illuminated part of the planet disk. Conclusions are drawn on the surface temperature of the night and day sides of Venus, as well as on Venus rotation and ionosphere.

Link, F., "Atmospheric Edge of Mars," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963 (In French).

Calculation of the brightness of the edge of Martian atmosphere when the planet is at opposition. Curves show the brightness of the atmospheric edge as a function of altitude. It is concluded that, if the measurements of the brightness distribution on the disk seem to prove the existence of contaminated atmosphere on Mars, the enlargement of the optical edge does not necessarily require that this contamination be localized in the higher layers.

V,
E. ATMOSPHERES (CONT.)

Martynov, D. Ia., "Physical Conditions in the Venus Atmosphere," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d-Astrophysique, Liège, Belgium, 1963.

Discussion of physical conditions in the atmosphere of Venus. The presence of water vapor, observed with some uncertainty by Strong, is confirmed by the polarization image of the cloud layer of Venus. The presence of water vapor in the atmosphere exerts a strong influence on its thermal regimen. The very high temperatures of Venus inferred from radiometric observations cause large accidental errors and it is impossible, as yet, to be certain of the absence of the effects of non-thermal radiation from the planet.

McDonald, J. E., "On a Criterion Governing the Mode of Cloud Formation in Planetary Atmospheres," Journal of the Atmospheric Sciences, Vol. 21, Jan. 1964 (Navy-supported research).

The peculiar nature of meteorological processes in a planetary atmosphere in which latent heat considerations imply downdraft condensation is examined in some detail, and some implications of the null condensation criterion for studies of planetary atmospheres and their evolution are discussed.

Menzel, D. H., "The Atmosphere of Mars," Société Royale des Sciences de Liège, Mèmoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963 (Grant No. NsG-89-60).

General conclusions on the lower atmosphere of Mars. The redness of Mars, its low albedo, and the visibility of surface markings in the red and yellow indicate that the total amount of atmosphere is small. The Martian atmosphere contains two layers of particulate matter: a thick layer of large dust particles near the surface, and a very thin layer of fine particles above the layer of dust. It is implied that the upper layer consists of fine ice crystals.

Miller, J. E., Project Hiam (A Theoretical Investigation of the Properties of Planetary Atmospheres), (Progress Report, 1 Jul.-31 Dec.) 15 Jan. 1964 (NASA Grant NsG-499).

Miyamoto, S., "Meteorological Observations of Mars During the 1962-63 Opposition," Contrib. from the Inst. of Astrophys. and Kwasan Obs. 1963 (See N64-19355 12-29)

In Martian spring, the Propontis-Cerberus and Nilokeras-Lucus vapor courses were well developed and very dark, whereas the Utopia-Nodus

Laocoontis course was somewhat fainter than in the 1960 opposition. Compared with the 1960 opposition, the polar cap in 1963 was larger, and in late spring, the retreat of the cap stopped and even increased its dimension for a while. The Casius-Neith yellow cloud appeared at the same season as in the last opposition, and in summer, an outburst of the Noachis white cloud was observed across the equator. The doldrum was conspicuous in spring. It followed the subsolar point and faded in summer.

Miyamoto, S., "Observational Study on the General Circulation of Mars," Contrib. from the Inst. of Astrophys. and Kwasan Obs. 1963.

In the Martian atmosphere, contrary to Earth, meridional circulation is more important than lateral mixing. Energy flows from pole to equator in summer. The prevailing winds over the middle latitude turns into easterlies during this season. An attempt is made to prove these particular circulation regimes with the observational data available. It is pointed out that local topographic circulations made important contributions to the general circulation. The topographical difference of northern and southern hemispheres should be taken into account in establishing the actual circulation pattern.

Moroz, V. I., "Infrared Spectrum of Mars (λ1.1 - 4.1μ) Infrakrasnyi Spektr Marsa (λ1.1 - 4.1μ) , Astronomicheskii Zhurnal, Vol. 41, Mar.-Apr. 1964 (In Russian).

Moroz, V. I., "Recent Observations of the Infrared Spectra of Mars and Venus in Connection with the Space Investigations Problem," Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, sponsored by the Committee on Space Research (COSPAR), Edited by M. Florkin and A. Dollfus.

Discussion of the CO absorption band at 2.35μ (equivalent laboratory absorption approximately 4 cm) and of several unidentified absorption features which were found in the IR spectrum of Venus during observations made in 1963. New CO_2 bands were also found; the "ice" origin of polar caps and the presence of Sinton's "bands of life," were confirmed on the basis of the IR spectral investigations of Mars. It is noted that the observed equivalent widths of Martian CO_2 bands are narrower than those published earlier by Juiper. Two bands (3.53 and 3.56μ) were detected, instead of the single Sinton's 3.56-μ band.

Morozhenko, A. V., "Polarimetric Investigations of Mars at the Main Astronomical Observatory of the Ukrainian Academy of Sciences," Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Sponsored by the Committee on Space Research (COSPAR), Edited by M. Florkin and A. Dollfus.

Presentation of results of a polarimetric investigation, during the 1962-1963 opposition of Mars, of the relationship between polarization

and phase angle for the entire disk, as well as for some parts of it in 8 spectral intervals (350-600 mμ)

Mueller, R. F., "Stability of Hydrogen Compounds on Venus," Nature, Vol. 203, Aug. 8, 1964.

Discussion of the possibility of evaluating the stabilities of many hydrogen compounds on Venus. It is noted that it seems unlikely that any significant quantities of hydrocarbons could occur on the surface or in the lower atmosphere, and this seems also to preclude their occurrence in the higher atmospheric levels.

Musman, S., "An Upper Limit to a Rayleigh Scattering Atmosphere on Mars," Planetary and Space Science, Vol. 12, Aug. 1964.

Report of the use of Bellan's computations of the amount of light scattered from the top of a plane parallel layer of Rayleigh scatterers to construct models of spherical planets with completely absorbing surfaces and Rayleigh-scattering atmospheres. The Martian surface pressure for a nitrogen atmosphere is computed to be 27 mb, which is thought to be consistent with the 25 ± 15-mb pressure obtained by Kaplan, Münch, and Spinrad. The effects of non-Rayleigh scatters are discussed and Dollfus' use of the polarization properties of Rayleigh scattering are commented on.

Nicolet, Marcel, "Diffusion in Planetary Atmospheres," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963 (In French).

Norton, R. B., "A Theoretical Study of the Martian and Cytherean Ionospheres," July 1964 (NASA Order R-65) (NASA-TN-D-2333)

The approach to the theory of planetary ionospheres is made by reviewing the theory of the terrestrial ionosphere regions and applying this theory, with necessary modifications, to the planets Venus and Mars. Among the important procedures considered are the production of electrons, the exchange and recombination reactions, and finally, the diffusion of an electron-ion gas through the neutral gas.

Ohring, G., "A Theoretical Estimate of the Average Vertical Distribution of Temperature in the Martian Atmosphere," Rep. from Icarus, Vol. 1, No. 4, Jan. 1963 (Contract NASw-704) (GCA-TR-62-7-N).

The average variation of temperature with height in the Martian atmosphere is probably controlled by radiative and convective processes. The computed temperature profile is characterized by an adiabatic troposphere extending to about 9 km, above which the

temperature continues to decrease with height to an average value of about 90°K for the topmost 5-mb layer.

Ohring, G., "Theoretical Estimates of the Average Surface and Atmospheric Temperatures on Mars," Repr. from Mem. soc. roy. sci. Liege, ser. 5, Vo. 7, 1962, Presented at the Intern. Colloq., Liege, 9-11 Jul. 1962 (NASA Contract NASw-704).

From theoretical computations based upon radiative equilibrium considerations, the average surface temperature of the planet Mars is found to be in the range of 219° to 233°K. The computations also indicate that the maximum greenhouse effect on Mars is about 40% of the average greenhouse effect in the earth's atmosphere, and that carbon dioxide is the most important contributor to the Martian greenhouse.

Ohring, G., and Mariano, J., "The Effect of Cloudiness on a Greenhouse Model of the Venus Atmosphere," JGR Vol. 69, 1, Jan 1, 1964.

Calculations of the Venus atmosphere are made for both atmospheric gases and cloud-cover absorbing IR. The method is also briefly applied to Mars and Earth.

Öpik, E. J., Jupiter, Repr. from Irish Astron. J. (Armagh), Vol. 6, No. 4, Dec. 1963 (NASA Grant NsG-58-60).

This report proves that the theory of the hydrogen-snow-ball process of accretion concerning the planet Jupiter can give qualitatively, as well as quantitatively, an adequate account of the difference in composition between the planet's atmosphere and its main body - a mainly hydrogenic interior comprising the bulk of Jupiter's mass and a predominantly helium atmosphere.

Owen, Tobias, Richardson, E. H., Spinrad, H., "A New Ammonia Band in the Jovian Spectrum," Astrophysical Journal, Vol. 139, May 15, 1964 (Contract No. Nonr-G-00050-62).

Investigation of high-dispersion spectrograms of Jupiter taken at the Victoria and McDonald Observatories which show many weak planetary lines near the telluric A-band at λ7600. These absorption lines are identified as a new band of ammonia observed in the laboratory with a multiple-path absorption tube.

Paetzoid, H. K., "On the Problems of a Martian Ozonosphere," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

V,
E. ATMOSPHERES (CONT.)

Discussion of ozonospheric problems of Mars. Since ozone formation depends not on the absolute intensity of the solar UV-radiation, but on the temperature, more ozone is found on Mars than on Earth for the same oxygen concentration because of the lower air temperature on Mars. A diagram shows the total thickness of the ozone layer on Mars for different oxygen concentrations. It is concluded that the ozone content can be used as a sensitive indicator for the oxygen concentration in a planetary atmosphere. The exospheric temperature may be estimated at 1,300°K on Mars. An explanation is found for the lack of water and oxygen on Mars.

Peebles, P. J. E., "The Structure and Composition of Jupiter and Saturn," Astrophysical Journal, Vol. 140, 1, July 1, 1964.

Pressure, density and mass distributions of Jupiter and Saturn are given from 0.2 to 1.0 planetary radii. The composition of material above the core is considered to be hydrogen, X = .80; helium, Y = .18; and heavier elements, Z = .02. The cores are considered small. Evidence is given that the abundance of helium in inter-stellar matter has increased a factor of 2 in about 5 billion years. Comments are offered on the age of the galaxy and on a gravitational constant decreasing in time.

Prokofjev, V. K. and Petrova, N. N., "On the Question of the Presence of Oxygen in the Atmosphere of Venus," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Consideration of the question of spectroscopic discovery of Venus oxygen. Qualitative confirmation is obtained for the presence of weak oxygen absorption in the Venus spectrum.

Rasool, S. I., and Jastrow, R., "The Atmospheres of Mars, Venus and Jupiter," Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Sponsored by the Committee on Space Research (COSPAR), Edited by M. Florkin and A. Dollfus.

Review of the general properties of the atmospheres of Mars, Venus, and Jupiter.

Robinson, J. C., "Photographic Observations of Mars at New Mexico State University in 1960-61," 9 Aug. 1963 (Grant NsG-142-61) (NASA-CR-51173; TN-557-64-3).

Photographic observations of Mars were made on a regular basis during the fall, winter, and spring, including the Martian vernal equinox. Among the phenomena observed and described are the following: Margaritifer Sinus, Cerberus I canal, Blue clouds and blue clearings, atmospheric belts, activity in the Tharsis-Amazonis region. Photographs and charts are included.

Ryan, J. A., "Notes on the Martian Yellow Clouds," Journal of Geophysical Research, Vol. 69, 18, Sept. 15, 1964.

The interaction of surface winds, surface pressure, and dust particle size are investigated. Martian dust storms must be more violent than those on earth. Dust grain size may be indirectly measured by the absence or presence of sand dumes.

Sagan, C., "On the Atmosphere and Clouds of Venus," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Considerations of atmospheric and cloud conditions on Venus. The effect of Rayleigh scattering on a cloudless day on Venus is to yellow the sky and redden the Sun. The radiation scattered back to space will also have a yellow cast, and may explain the apparent color on Venus.

Sagan, C., "On the Nature of the Jovian Red Spot," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963. (Grant No. NsG-126-61).

Discussion of various hypotheses on the nature of the Great Red Spot in the South Tropical Zone of Jupiter's atmosphere.

Salomonovich, I. Ye., "Concerning the Detection of Water in the Atmosphere of Venus," Izv. VUZov: Radiophys., No. 1, 1964, 19 Jun 1964. (See N64-27151 19-08).

In light of new data on the spectrum of the radio emission of the unilluminated side of Venus, the question is considered of the nature of the cloud layer of the planet and the possibility of observing water vapor in the atmosphere.

Schilling, G. F., "Parametric Limits for the Upper Atmosphere of Mars," Nov. 1963 (Contract AF 49(638)-700; Proj. RAND).

Probable upper and lower limits are calculated for the distribution of atmospheric pressure and mass density in the upper atmosphere of Mars.

Shane, E. D., "Equilibrium Electron Density of Mars," AIAA Journal, Vol. 2, Aug. 1964.

Presentation of thermochemical equilibrium values of electron concentration as a function of temperature and density corresponding to five models of the Martian atmosphere. The models consist of different percentages of carbon dioxide, argon, and nitrogen. It is shown that at

a given temperature and density the electron concentration on Mars will be less than that on Earth and that this is most evident at low temperatures and high densities.

Sinton, W. M., "Infrared Observations of Venus," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963 (Contract No. AF 19(606)-5874).

Presentation of IR observations of Venus made since 1958 with the 42-in. Lowell reflector. The spectra presented may be used to evaluate the dependence of the Venus albedo on wavelength. The calculations are tabulated.

Sinton, W. M., "Optics and the Atmospheres of the Planets," Applied Optics, Vol. 3, Feb. 1964.

General discussion of some of the experiments that have been performed in the observation of atmospheres of planets using the light waves emanating from the planets and collected by the telescopes. The methods are examined for determining the nature of an atmosphere containing particles from the wavelength dependence of scattered intensity when combined with the wavelength dependence of the polarization properties of the atmosphere. Some results of measurements of planetary temperatures are discussed, together with those of spectrographic observations. A table containing gases found spectrographically on the planets is included.

Smith, B. A. and Bains, W. E., "Observations of the Optically Thin Scattering Layer in the Atmosphere of Venus," Repr. from Astron. J., Vol. 69, No. 2, Mar. 1964 (Grant NsG-142-61).

Photographic observations were made during the inferior conjunctions of 1959, 1961, and 1962. A composite of heights published by Edson and those obtained by the authors (at elongation angles less than 10°) suggests a summetry about an axis nearly perpendicular to the orbital plane. Symmetry about any axis other than the orbital radius vector can be produced only by rotation. These observations tend to conflict with the current concept of synchronous rotation of Venus.

Smith, B. A. and Tombaugh, C. W., "Observations of the Red Spot on Jupiter," Repr. from Publ. Astron. Soc. Pacific, Vol. 75, No. 446, Oct. 1963 (Grant NsG-142-61).

Photographic observations of the Red Spot on Jupiter were made on 33 dates between June 1962 and January 1963. In addition, photometric measurements were made on selected plates of the brightness, in blue light, of the Red Spot and South Equatorial Belt Zone with respect to the Equatorial Zone.

Sobolev, V. V., "Study of the Venus Atmosphere. I," Astronomicheskii Thurnal, Vol. 41, Jan.-Feb. 1964 (In Russian).

Sonett, C. P., "A Summary Review of the Scientific Findings of the Martiner Venus Mission," Space Science Reviews, Vol. 2, Dec. 1963.

Descriptive review of the scientific findings of Mariner 2, limited to the interplanetary particles and fields measurements and Venus encounter data. Three planetary scans were made. Experimenters concluded that the scanned area in each case was an unbroken cloud cover with no apparent pattern of convective instability.

Spinrad, H., "A Search for Water Vapor and Trace Constituents in the Venus Atmosphere," Repr. from Icarus, Vol. 1, No. 3, Oct. 1962.

An unsuccessful spectroscopic search for water vapor and other gases in the Venus atmosphere is described. The resulting upper limit on the Cytherean water vapor-atmosphere mixing ratio down to a level of high temperature and pressure is about 10^{-5}.

Spinrad, H., "Spectroscopic Research on the Major Planets," Repr. from Applied Optics, Vol. 3, Feb. 1964 (NASA Contract NAS7-100) (NASA CR-53574; JPL-TR-32-550).

Recent results in planetary spectroscopy of Jupiter, Saturn, Uranus, and Neptune are summarized. Some methods of analysis for atmospheric composition and thermal and kinematic characteristics are described.

Spinrad, H., and Richardson, E. H., "High Dispersion Spectra of the Outer Planets. II. A New Upper Limit for the Water Vapor Content of the Martian Atmosphere," Repr. from Icarus, Vol. 2, June. 1963 (NASA Contract NAS7-100) (NASA CR-53004; JPL-TR-32-462).

A very high dispersion Spectrogram of Mars has been searched unsuccessfully for Martian H_2O lines near λ7200. From this data, an upper limit has been derived for the integrated Martian water vapor abundance of approximately 3.5×10^{-3} gm/cm^2 (35μ).

Stibbs, D. W. N., "Scattering Functions for Planetary Atmospheres," Société Royale des Sciences de Liège, Mémoires, Cinquième Série, Tome 7, 1963; Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium. Liège, Belgium, July 9-12, 1962. University of Liège and USAF. Institut d'Astrophysique, Liège, Belgium, 1963.

Calculation of H-functions for the greenhouse effect and fluorescent scattering in planetary atmospheres. The complete results of the calculations are shown in a figure.

V,
E. ATMOSPHERES (CONT.)

Suess, H. E., "Remarks Concerning the Chemical Composition of the Atmosphere of Venus," Zeitschrift für Naturforschung, Vol. 19a, Jan. 1964 (Grant No. NsG-322.

Survey of our present knowledge of the Venus atmosphere. Some observations are noted which indicate that the main constituent of this dense atmosphere may be neon.

Sytinskaia, N. N., "Some Features of the Martian Polar Caps and the Hypothesis That They Arise from Photographic Irradiation," Astronomicheskii Thurnal, Vol. 40, July-Aug. 1963; Soviet Astronomy, Vol. 7, Jan-Feb. 1964 (Translation).

Teifel', V. G., "Photometric Properties of the Jupiter Red Spot," Astronomicheskii Thurnal, Vol. 41, May-June 1964 (In Russian).

Thornton, D. D. and Welch, W. J., "8.35 MM Radio Emission from Jupiter," Icarus, Vol. 2, Oct. 1963 (Contract No. Nonr 222(54); NSF Grant No. G-16741).

Presentation of the results of a number of observations of the 8.35-mm radio emission from Jupiter made following the planet's opposition at the end of August, 1962. A disk temperature of $144 \pm 23^{\circ}$ is found. It is shown that the 8-mm brightness temperature of Jupiter should correspond closely to the temperature at the level of the visible cloud cover. The results are compared with the emission temperature predicted by a model atmosphere proposed by Kuiper.

Trafton, L. M., "The Thermal Opacity in the Major Planets," letter in Astrophysical Journal, Vol. 140, 3, October 1, 1964.

A Jupiter model atmosphere can probably be constructed with only a solar radiation energy source.

_____, "A Study of the Meteorology of Mars and Venus," Quarterly Progress Report No. 4, 6 Oct. 1963-5 Feb. 1964 (NASA Contract NASw-704).

Computations of the radiative equilibrium distribution of temperature between the cloud-base and the surface of Venus were completed, and the results are presented. A preliminary version of the average annual radiation budget at the top of the Martian atmosphere is presented.

V. PLANETARY ENVIRONMENT

F. SURFACE CHARACTERISTICS

Barabashov, N., "Investigation of Various Formations on Mars," Astron. Zh. (USSR), Vol. 29, No. 5, 1952, (AD-602194), (Translation).

Among the basic results of Martian observations discussed in this report are these: (1) The various regions of the Martian seas have different albedos. The seas contain greenish and bluish regions, as well as reddish and yellow ones. (2) Certain dark areas observed are moist regions of the Martian continent. Their color does not vary with the meridian altitude of the Sun. (3) The color changes, with the meridian altitude of the Sun, in a large number of areas in the seas, viz., the region becomes red with decreasing altitude and becomes blue with increasing altitude. (4) The increase in greenness and the color variations of the Martian continent and seas do not contradict the hypothesis that vegetation develops in these regions. (5) There are regions on the Martian continent whose albedo reaches 0.448 in red, 0.190 in yellow, and 0.193 in green. (6) The polar caps of Mars are reddish. The atmospheric portion of the polar cap is probably identical with the bright areas of the eastern and western limbs of the disc of Mars, which gives the impression of four polar caps located at the ends of two mutually perpendicular diameters on the planetary disc. This indicates that there is very little moisture on Mars. (7) The atmosphere of Mars often becomes turbid, apparently because of fine ice crystals at great heights in the atmosphere.

Barath, F., "Symposium on Radar and Radiometric Observations of Venus During the 1962 Conjunction," Astron. Journal, Vol. 69, No. 1, February 1964 (Contract NAS7-100).

The antenna feed system employed during the 1962 Venus radar experiment permitted the remote automatic selection of the sense of circularity independently for both transmitting and receiving. Although the spectrum is extremely noisy, it appears that the depolarized echo-scattering law lies somewhere between Lambert and Lommel-Seeliger scattering, characteristic of a rough surface. The matched component has a very pronounced specular spike expected from a smooth reflector.

Barrett, A., Lilley, E., "Mariner-2 Microwave Observations of Venus," in Sky and Telescope, Vol. 25, April 1963.

Description of the techniques and equipment used in the observations of Venus by Mariner 2 (1962 Alpha Rho 1). Various microwave radiometer measurements are discussed. Preliminary results indicate a Venus surface temperature of approximately 700°K, a value in keeping with previous radio measurements. It leads to a concept of Venus' surface as being extremely hot, dry, and hostile to terrestrial forms of life.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Bellier, M., Dupré, M., Wlérick, G., Rösch, J., Arsac, J., "Photometry of Jupiter and Saturn, Starting From Plates Obtained with an Electronic Camera," in Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, 1963, (In French).

Considerations on the analysis of electronic photographs of Jupiter and Saturn. Friefly reviewed are the advantages to planetary study offered by the Lallemand system of electronic photography: (1) plates can be made with exposures short enough to avoid blurring by atmospheric turbulence; (2) shady portions are as well recorded as bright portions, making the plates highly suitable for accurate photometry; and (3) large amounts of information can be shown in fine detail.

Carpenter, R., Goldstein, R., "Radar Observations of Mercury," in Science, Vol. 142, October 18, 1963, (Contract No. NAS 7-100).

Review of radar observations of Mercury during its conjunction in May 1963. The planet was illuminated with 100 kw at a wavelength of 12.5 cm. Three types of signal processing were used: (1) the receiver was used in the configuration of a Dicke radiometer, and the total power of the echo was measured; (2) the power of the echo was analyzed into its frequency components by means of an autocorrelation function appraoch; and (3) a spectrometer was used to analyze the signal selected by a range-rate gate. The data obtained provide a confirmation of the astronomical unit reported by Muhleman, based on radar observations of Venus during the conjunctions of 1961 and 1962.

Chebotarev, G., "A New Determination of the Mass of Mercury," in Probl. of Cosmogony, Vol. 1, 25 May 1964,

The corrected value for the mass of Mercury, according to E. Rabe who used the motion of the minor planet Eros in his determination, is $1:m_1 = 6{,}120{,}000 \pm 43{,}000$. However, only the first significant figure was reliably determined. Therefore, the problem of further determinations of the mass of Mercury, as before, remains an acute question of theoretical astronomy. Also, various methods for determining planetary mass are discussed.

Dollfus, A., "Measurement of the Diameter of Mercury During Its Passage Before the Sun on on November 7, 1960; Results of Collective Observations Required by the International Astronomical Union," in Icarus, Vol. 2, October 1963, (In French).

Presentation of the results of several measurements of the diameter of Mercury during the passage of the planet before the solar disk on November 7, 1960. Several methods of measurement using a double-image micrometer and a photometric technique are described. On the basis of five different determinations, the mean value of 6"67' of 1 AU is obtained with an accuracy of 1%. The radius of the planet is found to be 2,420 km, and its density 5.45.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Draper, A., Adamcik, J., Gibson, E., "Comparison of the Spectra of Mars and a Goethite-Hematite Mixture in the 1 to 2 Micron Region," in Icarus, Vol. 3, May 1964.

Discussion of the reflectance spectrum of a mixture of goethite (hydrated iron oxide) and hematite. The spectrum generally agrees with the spectrum of the bright areas of Mars in the 1- to 2-μ region. The procedure of preparation of goethite is described in detail. Both components are physically mixed in proportions possibly close to the composition of the surface soil of the bright areas of Mars. An iron oxide composition appears to constitute a considerable portion of the Martian surface.

Ebisawa, S., "Some Problems in Mars Mapping," Kyoto, University, Institute of Astrophysics and Kwasan Observatory, Contributions, No. 129, 1963.

Review of areography. Results of observations so far made disclose great differences. The establishment of Mars mapping and the preparation of coordinates lists on a new homogeneous system with high accuracy are discussed. With respect to this problem, current researches at Pic-du-Midi and Harvard College Observatories are outlined, and a new interpretation of some anomalous secular variations of soil actually observed on the Martian surface is proposed. The program of modern areographic study planned in Japan is presented.

Goldstein, R., Gillmore, W., "Radar Observations of Mars," in Science, Vol. 141, September 20, 1963, (Contract No. NAS 7-100).

Brief review of radar measurements of Mars, made from January 31 to March 2, 1963. Two types of experiments were performed. In one, the total power of the echo was measured by means of radiometer techniques. In the other, the autocorrelation appraoch was used to analyze this power into its frequency spectrum. The results of these experiments are considered.

Gol'nev, V., Lipovka, N., Pariyskiy, Y., "Observation of Jupiter's Radio Emission in the 6.5 cm Wave in Pulkovo," Dokl. Akad. Nauk. SSSR, Ser. Astron. (Moscow), Vol. 157, (Contract NAS5-3760), (Translation)

The following results were obtained from observations of Jupiter's radio emission at the 6.5-cm wavelength: (1) The flux from Jupiter is equal to $8.15 \pm 0.8 \times 10^{-26} w/m^2 mc$ at a distance of 4 au, which corresponds to a disk brightness temperature of $324^{o} \pm 30^{o}K$. (2) Comparison of the observations with computed values of radiation-pattern widening for various models of radioemitting regions of Jupiter indicate an absolute blackbody temperature of $128^{o}K$. (3) The residual emission polarization after accounting for blackbody emission was found to be less than 18%. (4) No correlation between Jupiter's radio emission flux and solar activity was indicated.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Hodge, P., "Interactions of the Planet Mercury with Interplanetary Material," in Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, July 9-12, 1962, University of Liege and USAF, 1963.

Evaluation of the rate of erosion of Mercury's surface due to meteoritic encounters, assuming that Mercury has no appreciable atmosphere. There is some evidence that a small atmosphere on the bright side is detected by polarization measures. The erosion rate on this side would be unaffected by an atmosphere of less than about 0.1-mb pressure, which is approximately the pressure at the level at which meteoroids are decelerated by the Earth's atmosphere. An atmosphere of 10^{-4} times the Earth's is the maximum allowable if Mercury's sunward surface is extensively eroded meteoritically. Dollfus' value of 3×10^{-3} Earth atmospheres is so great that most meteoroids would never reach Mercury's sunward surface.

Kellogg, W., "Mars," International Science and Technology, February 1964.

Discussion of Mars as a planet in the solar system likely to support life similar to the terrestrial kind. Changes in color and polarization of Mars' dark areas that coincide with seasonal waxing and waning of the white (ice?) polar caps, persistence of the dark areas through the years, and recent discovery in them of spectral evidence of organic molecules suggest that all of Mars is not as barren of life as its red dusty deserts of limonite seem to be. The Martian atmosphere seems singularly lacking in oxygen (perhaps 0.1% by volume) and water vapor. The brilliantly white polar caps are the most pronounced features of the Martian disk. It may be sublimed deposit of water in the form of hoarfrost, plus, possibly, a little CO_2, but recent suggestion that it is nitrogen tetroxide--N_2O_4 - has merit. The possibility of life and the geological evidence for life on Mars are examined.

Kopal, Z., "Radiative Transport of Heat in Lunar and Planetary Interiors," Icarus, Vol. 3, May 1964.

Presentation and solution of the problem of the radiative transfer of energy in solid globes of planetary size with the radiative loss into space taken into account. The time-dependent partial differential equation of radiative transfer is presented in terms of spherical polar coordinates. A method of solving this equation to an arbitrary order of accuracy is developed, with either the emissivity or temperature as the dependent variable. The problem of the radiative transfer of energy in planetary interiors, with the radiative loss at the boundary, is solved analytically for a homogeneous globe with a constant absorption coefficient. If the emissivity is considered the dependent variable, the problem can be rendered linear by suitable substitution, and then solved in terms of Fourier series arising by the inversion of a certain finite Fourier sine transform of the emissivity.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Korol'kov, D., Pariyskiy, Y., Timofeeva, G., Khaikin, S., "Radio Astronomical Observations of Venus with High Resolving Power," Dokl. Akad. Nauk SSSR (Moscow), Vol. 149, No. 1, 1963, (Translation).

The purpose of these investigations was to evaluate the nature of the distribution of radio brightness, by using high resolving power and high precision of the coordinate measurements with a variable probile antenna. The results of measurements of the effective dimensions of Venus are shown. An attempt to determine the phase variations of radio temperature with displacement of the center of gravity of radio emission led to a negative result. The observations agree best with the model of a hot surface and a cold atmosphere.

Kotel'nikov, V., Dubrovin, V., Dubinskii, B., Kislik, M., Kuznetsov, B., Petrov, G., Rabotiagov, A., Rzhiga, O., Shakhovskoi, A., "USSR Radar Probing of the Planet Mars," Adadeniia Nauk SSSR, Doklady, Vol. 151, August 1, 1963, (In Russian).

Discussion of radar probes of the planet Mars in the opposition period of February 1963, during which it was about 100 million km from the Earth. Data concerning the transmission and reception of the radar signals, at a frequency of 700 Mc, are described. Presented are the spectrum of the received signal at a filter band of 4 cps, and graphs showing the stored energy of the reflected signal.

Kotel'nikov, V., "Radar Probes of the Planet Mercury," Dokl. Akad. Nauk SSSR (Moscow), Vol. 147, No. 6, December 21, 1962, (Translation).

In June 1962, the U.S.S.R. carried out a radar survey of the planet Mercury. The measurements were made at Mercury's perigee. The distance to Mercury during the measurements was 83 to 88 million km, twice that of the radar survery of Venus in 1961. The materials obtained in 53 sessions, over the period from 10 through 15 June 1962, were treated. The average spectrum of signals reflected by Mercury during that period, the distribution of probabilities for values of the reflection coefficient with respect to energy in the 4-cycle and 12-cycle frequency bands, and the accumulation of difference energy for various values of the astronomical unit are presented.

Kuzmin, A., Kutuza, B., Losovski, B., Salomonovich, A., Vetukhnovskaia, I., "Measurements of Microwave Spectrum of the Venus Night Side," in Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Ed. by M. Florkin and A. Dollfus, Interscience Publishers, 1964.

Presentation of the results of Venus emission measurements at 8mm, 1.6 cm, and 3.3 cm. The observations were performed near the inferior conjunction of 1962. The brightness temperatures, averaged over the visible disk of the planet, are said to be equal, respectively to $386 \pm 30^{\circ}K$, $534 \pm 60^{\circ}K$, and $575 \pm 20^{\circ}K$. The microwave spectrum of Venus in the range of wavelengths from 4 mm to 40 cm is constructed with the aid of data from other observers.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Lipskii, L., "Results of Observations of Mars," Priroda (Moscow), Vol. 46, No. 4, 1957, (Contract AF 19(628)-3880), (Translation).

Preliminary results of observations made during the opposition of Mars in September 1956 are discussed. Included in these observations are the following: (1) an investigation of the optical properties of the vegetation of the various climatic zones; (2) brightness; (3) the polar cap; (4) the seas; (5) a comparison between the color of the seas and that of the continents; (6) water in the atmosphere and on the surface; and (7) the polarization of light reflected by various portions of the surface.

Menzel, D., Young, A., De Vaucouleurs, G., Finsen, W., Leighton, R., Research Directed Toward the Production of a Map of the Visible Features of Mars, Contract AF 19(604)-7461; April 1964.

Areocentric coordinates of about 150 Martian surface features are determined from photographs taken at the 1954 and 1956 oppositions. The data lead to the tentative conclusion that the flattening of the solid surface of the planet is about twice the dynamical value. The coordinates of a large number of clouds and other temporary features are also given.

Mourao, R., "A Search for Periodicity in the Thickness of Jupiter's N. E. B.," in Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liege, Belgium, July 9-12, 1962, University of Liege and USAF, 1963.

Analysis of periodicity occurring in the North Equatorial Belt (N. E. B.) of Jupiter. A table presents values obtained for the northern and southern parts of the N. E. B. and their difference, or thickness of belt; bibliographical references are included. Periodograms suggesting the existence of a period of 4.5 yr are shown. A graphic representation is provided of the N. E. B. thickness variation for a period of 4.5 yr, with mean values.

Murray, B., Wildey, R., Westphal, J., "Observations of Jupiter and the Galilean Satellites at 10 Microns," Astrophysical Journal 139, April 1, 1964.

The 9-14 μ brightness temperature of 128-2.3°K is confirmed and has no significant structural variations over the surface. Polar and equatorial brightness temperatures within 1°K were observed. One or two of the Galilean satellites may be hotter than Plackian equilibrium with the sun would indicate.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Ohring, G., Tang, W., DeSanto, G., "Theoretical Estimates of the Average Surface Temperature on Mars," J. Atmospheric Science, Vol. 19, No. 6, November 1962, (Contract NASw-704).

Estimates of the average surface temperature on Mars are derived from radiative equilibrium considerations. A minimum possible surface temperature is estimated by computing the radiative equilibrium temperature that the Martian surface would have if the planet had no atmosphere. An estimate of the maximum possible value of the average surface temperature is obtained by computing the surface temperature that would result from a maximum greenhouse model. The computations indicate that the average surface temperature is in the range 219° to 233°K. Comparisons of the theoretical computations with indications of surface temperature obtained from thermal emission observations are found to be in reasonable agreement.

Öpik, E., "Venus and the Mariner," Irish Astron. Journal, Vol. 6, No. 2, June 1963, (NASA Grant NsG-58-60).

Observations relating to the surface conditions on Venus, which were obtained radiometrically (by radiation measurements, not by radio) during the Mariner II 35 minutes of fly-by, are discussed. Generally, the Mariner II microwave results agree with, or rather support, the "aeolospheric" model of a windswept planetary desert, heated by wind friction (and some trickle of internal heat) and screened by the dust-laden atmosphere. The sunlit side indicated a temperature of 400°K as opposed to 460°K for the dark side. A constant surface trade wind must be blowing from the dark hemisphere towards the sunlit side. Sand and dust are transported by the wind in one direction, and very little is returned to the dark hemisphere by the upper current at or above cloudtop.

Rea, D., Belsky, T., Calvin, M., "Interpretation of the 3- to 4-Micron Infrared Spectrum of Mars," Science, Vol. 141, No. 3584, 6 September 1963, (NASA Grant NsG-101-61).

Infrared reflection spectra were recorded for a large number of inorganic and organic samples to interpret the 3 μ to 4 μ spectrum of Mars. Martian reflection spectra obtained by Sinton favored the conclusion that carbohydrates were present because the spectra closely resembled those of organic molecules. Colthup did not interpret the bands in the same manner; the great difference between absorption and reflection spectra makes widely varied interpretation possible. The most minute investigation of the spectra cannot give definite answers at this time.

V,
F. SURFACE CHARACTERISTICS (cont'd)

Robinson, J., "Photographic Observations of Mars at New Mexico State University in 1960-61," in Icarus, Vol. 2, December 1963, Grant No. NsG-142-61; Contract No. AF 19(604)-5570.

Description of the results of observations of Mars. It is stated that routine three-color photography of Mars at the 1960-61 apprach revealed the presence of a number of canals at this season, as well as the continued existence of the large dark area near the Thoth. Blue clearings were asymmetrically distributed about opposition, although the strongest degree of clearing apparently occurred at opposition. Blue cloud activity reached a maximum concurrently with the maximum extent of the polar haze caps in blue and ultraviolet, shortly after Martian vernal equinox. A persistent blue cloud streak paralleling the Gigas canal was found to rotate with the surface.

Rzhiga, O., "Radar Observations of Venus in the Soviet Union in 1962," in Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Ed. by M. Florkin and A. Dollfus, Interscience Publishers, 1964.

Description of radar echo observations of Venus made in the Soviet Union during the period of inferior conjunction of Venus in 1962. The reflection coefficient of Venus measured from the energy of reflected signals in a band of 20 cps changed during 2 months of observations within the limits of 12-18%. The rotation period of Venus was determined from the change of the width of the spectrum of the reflected signal according to days and due to the Doppler effect caused by the rotation of Venus. The distance distribution of the energy of the reflected signal is taken into account. It is noted that experimental results have shown that, if the rotation axis of Venus is perpendicular to the plane of the ecliptic, then the retrograde rotation is most probable - i.e., the rotation in the direction opposite to the motion of Venus around the Sun, with the period of about 300 days.

Schocken, K., The Thermal Environment of the Terrestrial Planets (Supplement 3), 2 March 1964, (NASA TM X-53016).

As determined by the microwave radiometer, the surface temperature of Venus averages approximately 427°C on both light and dark sides of the planet. The surface pressure is estimated as equal to about 20 bars. A new density model of the upper atmosphere of the Earth from 200 to 800 km is presented. Some physical parameters of the Moon, which are generally those of average silicate rock, are summarized. If it is assumed that the solar wind has remained unchanged over the period of the Moon's existence, then the Moon has lost a layer approximately 17 cm thick in $4.5 \cdot 10^9$ years. A series of model atmospheres for Mars has been developed in order to derive upper and lower probable limits for the variation of pressure and density in the upper atmosphere. On the assumption that ordinary meteoritic densities are of the order of 5g cm^{-3}, mean space densities of meteoritic material at the Earth's distance from the Sun are found to be of the order of 10^{-21} to 10^{-23}g cm^{-3}.

V,
F. SURFACE CHARACTERISTICS (cont'd)

Shachovskoi, A., "Radar Observations of the Planet Mars in the Soviet Union," in Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963. Ed. by M. Florkin and A. Dollfus, Interscience Publ., 1964.
Presentation of results of radar observations of Mars during the opposition of February 1963. It is stated that the narrow-band spectrum received from the fast rotating planet indicates that the surface of Mars has plane areas not less than a few km^2. The observed area corresponds to the Northern Hemisphere of Mars, its areographic latitude being 14 to 15°, and its areographic longitude 320 to 360° and 0 to 140°. It is noted that, according to the known astronomical maps of Mars shown, this area corresponds to the lighter parts of its surface, conventionally called continents. The results of the radar measurements are said to show that individual areas of the observed surface of the planet Mars have a higher coefficient of reflection than the surface of the Moon.

Sharonov, V., "Dust Covers on the Surface of Planets and Satellites," in Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963, Ed. by M. Florkin and A. Dollfus, Interscience Publishers, 1964.
Consideration of the problem of the existence of extensive dust covers on the Moon, Mars, and other planets. It is stated that photometric observations of the Moon give a reflectivity diagram that is sharply elongated towards the Sun. Since a powdery material cannot possess such a diagram, the exitence of an extensive dust cover on the Moon is said to be unlikely. The hypothesis is expressed that the lunar surface throughout consists not of dust, but of a slag-like material, as recently confirmed from the analysis of radio-astronomical observations. The surface of Mercury should resemble that of the Moon. As to Mars, it is noted that photometric data indicate that the reflectivity is nearly orthotropic. The orange of reddish dust mist or fog observed in the planet's atmosphere is said to warrant the supposition that the surface of the planet is mostly covered with dust which, on account of its color, consists in all probability of powdery limonite or ochre.

Sharonov, V., "The Nature of the Mars Surface and Atmosphere According to Photometric and Colorimetric Data," in Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liege Belgium, Jul. 9-12, 1962, Univ. of Liege & USAF 1963 (French)
Conclusions on the nature of the surface and atmosphere of Mars derived from visual and photographic observations. The data on the albedo and color of objects on the Earth and on Mars are tabulated. The photometric observations show that the light reflection from the soil of bright regions occurs in accordance with the Lambert law. The simplest explanation is that the external layer of the Mars surface consists of powder or powders colored orange by limonite.

V,

F. SURFACE CHARACTERISTICS (cont'd)

Smith, B., A Photographic Optical Semidiameter of Venus, 5 November 1963, (NASA Grant NsG-142-61)

Measurements of the optical diameter of Venus are generally free from the usual systematic errors when such measurements are made of the illuminated crescent at phase angles approaching 180°. Fifty-four photographic images obtained within a few days of inferior conjunction in November 1962 have been measured across the diameter connecting the geometric cusps. An optical semidiameter of 8".486±0".004 (p.e.) at unit distance is found, and is in some disagreement with visual observations. A radius of 6,050 km for the solid globe of Venus and a resulting mean density of 5.25 g cm^{-3} is inferred.

Steinhoff, E., "Use of Extraterrestrial Resources for Mars Basing," Presented at the Symposium on the Exploration of Mars, Denver, 6-7 June 1963.

Use of regeneration techniques to recover water and oxygen, and hydroponic gardening to grow food can reduce the logistics requirements to a small fraction of the original value and so reduce the cost of resupply. A further drastic reduction of space transportation costs can be achieved by using lunar and planetary resources for the local production of water, which together with its decomposition products represents over 90% of all the logistic needs of humans and which can also satisfy rocket propulsion needs for spacecraft if used in its dissociated state and liquefied form as LH_2 and LO_2. An advanced technology program is evolved in broad terms outlining areas of applied research and advanced development. Basides water, other locally produced chemical compounds suitable as fuels for spacecraft and extraterrestrial surface and flight vehicles or as nutrients for the local production of food and for the photosynthetic regeneration of oxygen are discussed.

Thomson, J., "Planetary Radar," Royal Astronomical Society, Quarterly Journal, Vol. 4, December 1963.

Discussion confined to radar studies of the planets, lunar, and solar radar being excluded. Methods are described for measuring the rotation of the target, and for mapping its surface. The probable strength of echoes is discussed; present techniques allow the three inner planets to be detected. Necessary computational and electronic techniques are discussed. Observations of Venus have resulted in a much more precise measurement of the astronomical unit, which is in conflict with the generally accepted value, and the rotation period has been measured as 250 to 300 days, the rotation being retrograde. A start has been made with the mapping of planetary surfaces of Mercury and Mars.

V,
F. SURFACE CHARACTERISTICS (cont'd)

Tikhov, G., "Concerning N.A. Kozyrev's Article 'Explanation of the Color of Mars by the Spectral Properties of its Atmosphere'," Izv, Krymsk. Astrofiz, Observ. (Moscow), No. 16, 1956 (Contract AF 19(628)-3880) (Translation)

In this paper, the author substantiated his reasons for believing that Kozyrev's conclusion that the red color of Mars is determined solely by the properties of its atmosphere is incorrect.

Tombaugh, C., Planetary and Lunar Research in the Photographic Infrared, Visible and Ultraviolet, Final Report, 1 April 1961- 31 March 1964, (Grant DA-ARO(D)-31-124-G41)

The markings and phenomena that are observable on the disks of Venus, Mars, and Jupiter vary from day to day, and in some features, from hour to hour. A vigorous daily patrol of photographic observations was conducted using a 12-in. Fecker reflecting telescope. Spectroscopic plates with a wide range of color sensitivites and degrees of contrast were used, as well as about a dozen different color filters to isolate photographs to particular spectral regions. Observations of Saturn and of sections of the Moon were also made.

Troitskii, V., "To the Radio Emission Theory of Venus and Mars," Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), Vol. 7, No. 2, 1964, (Contract NAS5-2078) (Translation).

The phase dependence of radio emission of Venus' and Mars' surfaces is considered in the assumption of existence of a given periodical temperature regime of the surface. As a result of experimental data on phase dependence of Venus' radio emission and location data on the reflection factor, the period of Venus' proper rotation was estimated to be near 2 to 10 days at reverse rotation.

deVaucouleurs, G., The Physical Ephemeris of Mars, Rand Corp., (NASA Contract NASr-21(04)), January 1964.

A revision of the physical ephemeris of Mars is one of the first steps toward a reasonably accurate Martian map. The complexities in determining true values are pointed out, and a set of values is found that serves as the basis for computing the new ephemeris.

deVaucouleurs, G.,"Precision Mapping of Mars," Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liege Belgium, July 9-12, 1962. University of Liege and USAF, 1963.

Description of the Mars Map Project. The sources of the areographic coordinates for the three cycles of oppositions from 1909 to 1954 are described, together with the areographic coordinates and map for 1958. Discussed are the systematic and accidental errors, the origin (zero point) of longitudes, the coordinates of the pole, the ellipticity of the globe, the rotation period, the phase effect, timing and other errors, and the measurement of composite photographs.

V,
F. SURFACE CHARACTERISTICS (cont'd)

Walter, L., "Petrology of Venus - Further Deductions," Science, Vol. 143, March 13, 1964.

Brief summary of recent investigations of Venusian petrology. The possible existence of pools of carbonate lava on the surface of Venus is discussed, based on the physicochemical condition assumed by Mueller. It is noted that the carbon dioxide pressure of the atmosphere of Venus may be controlled by one or more of several decarbonation reactions. One of these is the formation of carbonate-rich liquids. The pressure-temperature equilibrium conditions of these reactions are in the range of those proposed for the Venusian surface. Also considered is the existence of carbonate melts on the surface.

Wells, R., A Re-evaluation of W. H. Wright's Plates of the 1924 and 1926 Opposition of Mars, (Grant NsG-101-61) 22 July 1964.

Micrometric and microphotometric measurements were made of Wright's plates. The data obtained were reduced by the IBM-7090 computer and then compared with Wright's results. It was found that the problems arising in the photographic determination of planetary diameters fall into two categories - problems associated with the optical system and tracking, and problems concerning the photographic plates (the photographic emulsion).

Younkin, R., "Spectral Energy Distributions of the Major Planets," in Physics of Planets; Proceedings of the Eleventh International Astrophysical Symposium, Liege Belgium, July 9-12, 1962, University of Liege and USAF, 1963 (Contract No. NAS 7-100).

Consideration of preliminary results of color photometry measurements of the major planets, made to determine, in a general way, the nature of the energy distribution curves of the planets. The procedure for obtaining and recording the spectral scans is presented, and the instrumentation is shown in a block diagram. Data reduction procedures are outlined, and spectral energy distribution plots are presented and analyzed for Jupiter, Saturn, Uranus, and Neptune. In general, the curves reduced are seen to repeat quite well.

DISTRIBUTION

R-RP
Dr. Stuhlinger (5)

R-SA
Dr. Kuettner

R-FP
Dr. Ruppe (2)

R-AERO
Mr. J. R. Scoggins
Mr. O. H. Vaughan (25)
Mr. W. T. Roberts
Mr. H. C. Euler
Mr. O. E. Smith
Mr. R. E. Smith

Office of Advanced Research and Technology
NASA Headquarters
Washington, D. C.
Attn: Mr. R. Rhode
Mr. M. Ames
Mr. W. J. Underwood (2)

NASA
Langley Research Center
Hampton, Virginia
Attn: Mr. R. Hord
Mr. H. B. Tolefson

NASA
Goddard Space Flight Center
Greenbelt, Maryland
Attn: Mr. D. C. Kennard, Jr.

NASA
Jet Propulsion Laboratory
4800 Oak Grove Dr.
Pasadena, California
Attn: Mr. Conway Snyder

NASA
Manned Spacecraft Center
Houston 1, Texas
Attn: Mr. P. Burbank

Scientific and Technical
Information Facility (2)
Attn: NASA Representative
(S-AK/RKT)
P.O. Box 5700
Bethesda, Maryland

NASA
Ames Research Center
Moffett Field, Calif.
Attn: Mr. M. Hood

Office of Manned Space Flight
Director Space Medicine, Code MM
Hq. NASA
Washington, D. C.