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EARTH'S RADIATION BELTS

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P. V. VAKULOV, E. V. GORCHAKOV, Y. I. LOGACHEV

EARTH'S RADIATION BELTS

Results of Researches on Soviet Satellites and Rockets in 1957—1959

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ABSTRACT

This review paper gives account of the methods of measurements and the principal results of experimental investigations of radiation beyond the limits of the Earth's atmosphere, carried out by a group of Soviet scientists during the period 1957 — 1959 under the leadership of S.N. Vernov and A. E. Chudakov.

The results of the experiments include the data on measurements conducted on board the Soviet 2nd and 3rd A.E.S. and also with the help of the 1st, 2nd and 3rd cosmic rockets.They allowed to obtain the main characteristics of the particles forming the radiation belts, besides corroborating the very existence of these belts. Presented also are data on particle fluxes recorded with various devices beyond the Earth's magnetosphere.

The materials of said experiments were to the greater extent published in various periodicals. Most of the translations were made at NASA or by contractors, namely the entire set of "Artificial Earth's Satellites". Certain papers, to which reference is made in such reviews as the ZhETF or UFN, are cover-to cover translated by the A.I.P. All are available at libraries.

Of great importance is the fact that these measurements were carried out during the period of solar activity maximum, so that the radiation characteristics, given in this review, may be useful for comparison with further experiments, in particular with those carried out in time of solar activity minimum in 1963-1964, and with those to take place during the next solar maximum.

It should be noted that this study covers the period 1957-1959 and refers to literature up to 1961 inclusive. Some subsequent studies have been made, namely by K. I. Gringauz and by Vernov, Savenko et al.. which have been published in 1962 and are available as NASA TT F-8227, 8242, 8279, 8280 etc..

On the whole, this study brings practically nothing new and constitutes mainly a review and an appraisal of what has already been published with the exception, however, that the electronic devices aboard AES are perhaps the object of a more detailed description. In view of the fact that these series will be released as cover-to cover translations in the future, it is felt that the effort of doing it now is not warranted.

However, the Table of Contents, the References and the Appendix, are presented herewith.

Prepared by ANDRE L. BRICHANT

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CONDENSED DATA ON ROCKETS HAVING REGISTERED RADIATIONS IN SPACE IN 1957 - 1959

Designation	Date of launch	Initial Orbit Paramet. *	Oriented flow of scientific information	Brief Informat. on Scient. Apparatus	Annotations
2nd Soviet A.E.S.	3 Nov. 1957	1) 225 km 2) 1670 - 3) 103.76' 4) 65°	Ceased on 10 November 1957	TWO identical gas-discharge counters	
EXPLORER I	1 Feb. 1958	1) 360.5 2) 2530 3) 115 min 4) 33.34°	The 60 Mw transmitter ceased oper. on 28 Feb.58 and that of 10 Mw stopped on 23 May 58.	Gas-discharge counter	
EXPLORER - III	26 March 1958	1) 195km 2) 2810 - 3) 116 min 4) 33.4°	The 60 Mw transmitter ceased oper. on 5 June and the 10 Mw transmitter - on 16 June 58	Gas-discharge counter	There was a magnetic memory device
3rd Soviet A.E.S.	15 MAY 1958	1) 226km 2) 1881 - 3) 105.97' 4) 65°	The main transmitter ceased oper. on 15 June. Information continued by "MAYAK" to 15 August 1958	Inn.scintill, counter with NaJ(Tl) cr.; two outer sc. c. with ZnS; Cerenkov c. with Z ⩾15	There was a magnetic memory device
EXPLORER-IV	26 July 1958	1) 262 km 2) 2220- 3) 110 min 4) 50.29°	The 10 Mw transmitter ceased oper. on 9 Sept. that of 24 Mw - on 6 Oct.58	Two Scintill. and two gas-discharge ctr	
PIONEER I	11 OCT. 1958	Rocket went to 114 000 km	During all the 43-hr flight time	Two gas-disch. counters	Crossed twice radiat. belts near equator. plane
PIONEER-III	6 DEC 1958	Rocket went to 120 000 km	During the entire 37 h flight time	Two gas-disch. counters	Crossed twice radiat.belts near equator. plane

continued../..

continuation

Designation	Date of launch.	Initial Orbit Parameters *	Oriented flow of scientific information	Brief Informat. on scient. apparatus	Annotations
First Soviet cosmic rocket	2 Jan. 1959	Artificial planet passed at 5000 km from the Moon	During the first 24 hrs of flight	Two scintil. and two gas-discharge counters; Cerenkov c. Z 2; Z 15	When drifting from Earth crossed the outer r.belt
PIONEER IV	3 Mar. 1959	Artificial planet	To distance 655 000 km fr. Earth	Two gas-disch.counters	At drifting from Earth crossed the rad.belts near the equat.plane
EXPLORER-VI	7 Aug. 1959	1) 252 km 2) 48 000 km 3) 12h42m. 4) 48°	Ceased on 6 Oct.1959	Scintill. c; telescope from prop. counters; gas disch.c. and ioniz.chamber	Crossed the rad.belts 113 times during lifet.
2nd Soviet cosmic rocket	12 Sep. 1959	Reached the Moon's surface	During the entire near 38-h.fl.time	3 scintill. and 5 gas-disch.ctrs. Cerenkov c. Z ≥ 2, Z ≥ 5 Z ≥ 15	When drift. from Earth crossed the outer r.belt
3rd Soviet cosmic rocket	4 Oct. 1959	Photograph. the conceal. side of the Moon and ent. Earth orbit	During the first 15 days of fl.	Scintill. & 2 gas-disch. counters; Cerenkov coun Z ≥ 2, Z ≥ 14 Z ≥ 28	When drift. from Earth crossed the outer r. belt
EXPLORER VII	13 Oct. 1959	1) 560 km 2) 1095 km 3) 101 min 4) 50.3°	Nearly 15 months	Two gas-disch. counters	-

* 1 — height in perigee· 2 — height in apogee; 3 — revol.period; 4 — inclination angle to equatorial plane.

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