National Aeronautics and Space Administration
Goddard Space Flight Center
Contract No.NAS-5-12487

ST—LPS—RWR—10626

INVESTIGATION OF REFLECTIONS BY THE MOON'S SURFACE OF METER RADIOWAVES

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16 JUNE 1967

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Doklady A.N.SSSR,
Geofizika
Tom 174, No.3, 583-4,
Izd-vo "NAUKA", 1967

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SUMMARY

This note describes the results of measurements of the reflection and scattering of radiowaves with $\lambda \approx 1.7$ m performed in September 1966 on the AMS "LUNA-11". The investigation of the dependence of the reflection factor on the sliding angle permitted to obtain data on lunar rocks' dielectric constant. A more extended report is to be presented elsewhere.

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Analysis of radiowave reflection and scattering was conducted earlier by way of Moon's location; these investigations permitted to determine the effective diameter and angular spectrum of radiowave inverse scattering [1]. The Moon's artificial satellites offer a new possibility of investigating another characteristic of the lunar surface; at the same time, the determination has been also possible of the dependence of the reflection factor η on the angle of sliding ψ.

During the reception on Earth of radiowaves emitted by a Moon's satellite, two field components are observed, which correspond to the direct and the reflected ray. Because of difference in the Doppler frequency shift of these components their separate registration is possible, and consequently also the determination of the dependence $\eta(\psi)$.

Measurement of the reflection and scattering of meter radiowaves $\lambda \approx 1{,}7$ м emitted by AMS "LUNA-11" was conducted by us from 30 August to 27 September 1966. This satellite had an orbit inclined by 27° to the lunar equatorial plane, and a revolution period close to 3 hours [2]. The near-equatorial orbit allowed us to conduct measurements of reflection factors as the angle of sliding varied from 0 to 80°. Altogether 65 reliable measurements of the reflection factor could be completed. These measurements were incorporated into groups, of which everyone included values of the reflection factor for close angles of sliding , the averaging of the results of measurements within a group providing

(*) ISSLEDOVANIYE OTRAZHENIY METROVYKH RADIOVOLN POVERKHNOST'YU LUNY

the final value of the reflection factor. The maximum reflected signals were measured, i. e., those corresponding to horizontal polarization of radiowaves. During the conducting of measurements the distance from the satellite to the region essential for reflection was included within the range 500 – 1200 km.

The obtained dependence of the reflection factor on the angle of sliding is shown in Fig.1. At $\psi = 90°$ the reflection factor is plotted according to data on the location of the Moon [1]. It follows from Fig.1 that the reflection factor is little dependent on the angle of sliding when $\psi = 40 \div 90°$; thus, for $\psi = 40°$ we have $\eta = 0{,}40$, and for $\psi = 75°$ we have $\eta = 0.30$. As the angle of sliding decreases from 15 to 0°, there is observed a rapid increase of the reflection factor; at $\psi = 7°$, $\eta = 0.69$.

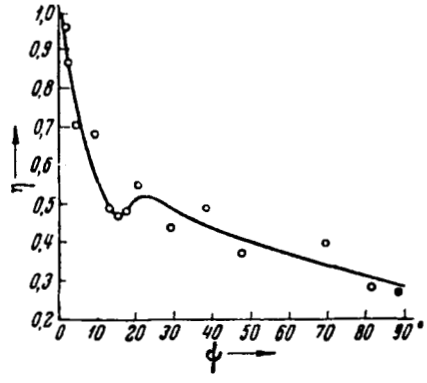

Fig.1

We also conducted a preliminary analysis of the spectrum of the reflected and scattered field. This analysis has shown that what is mainly observed is the mirror component of the field with a frequency bandwidth of no less than 20 cps; the diffusion component encompassing a larger frequency band is registered irregularly.

The investigation of the dependence of the reflection factor on the angle of sliding allows us to obtain data on dielectric constant of lunar rocks. Comparison of the curve of Fig.1 with the theoretical dependence $\eta(\psi)$ for a plane surface shows that $\varepsilon \approx 3$. Note that the thus appraised value of the dielectric constant is the average for the region of depths essential at reflection of meter radiowaves. Below the superficial formations with $\varepsilon \approx 3$, there are apparently located formations with a higher value of the dielectric constant.

It is necessary to underscore that the results of measurements might have been influenced by the roughness and curvature of the lunar surface. A more developed description of the results of study of reflection and scattering of radiowaves by the surface of the Moon will be given elsewhere.

The authors express their gratitude to Prof. M. A. Kolosov for his help in the performance of this work and the discussion of the results obtained.

**** THE END ****

Institute of Radioengineering
and Electronics of the USSR
Academy of Sciences

Manuscript received on

3 December 1966

Contract No.NAS-5-12487
VOLT TECHNICAL CORPORATION
WASHINGTON D.C. 20036.

Translated by ANDRE L. BRICHANT

on 16 June 1967

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