INVESTIGATION OF COSMIC RADIATION ON THE ARTIFICIAL SATELLITE LUNA-10

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Abstract

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N. L. GRIGOROV, V. L. MADUEV, N. F. PISARENKO, I. A. SAVENKO

INVESTIGATION OF COSMIC RADIATION ON THE ARTIFICIAL SATELLITE LUNA-10

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The apparatus for investigating cosmic radiation on the first artificial satellite of the Moon, Luna-10, included two identical end-window gas-discharge counters, placed side by side on the upper part of the satellite cone. The axes of the counters were directed parallel to the principal axis of the satellite. To separate cosmic radiation by hardness, the counters had different shielding. The counter intended for recording hard cosmic radiation (galactic cosmic rays and cosmic rays of solar origin) was enclosed on all sides by a copper shield 2.5 $\text{g} \cdot \text{cm}^{-2}$ thick. Through such shielding, protons with energies greater than 50 MeV and electrons with energies greater than 5 MeV could penetrate. These particles were recorded with an efficiency close to unity. The counter intended for recording weakly penetrating cosmic radiation, within a solid angle of about 10 steradians, was covered by exactly the same shielding as the first counter, and on the end side had a thin window 1.2 mg of mica + 0.3 mg of gold per 1 cm^2 thick. The window had a diameter of 0.5 cm, and the solid angle of view was about 2 steradians. Through the window, protons with energies greater than 0.5 MeV and electrons with energies greater than 40 keV could pass.

The global geometrical factor of each of the counters for isotropic hard radiation was 2.6 ± 0.2 cm^2. The counter registering weakly penetrating radiation had a geometrical factor of 0.4 ± 0.1 cm^2 ster. The counters were powered from a common voltage converter. The counting rate of the counters was measured by means of logarithmic circuits of discrete counting. During communication sessions, the mantissa and the characteristic of the number of pulses counted by each counter were transmitted to Earth every 2 min. In the first cycle of a communication session, data were transmitted on the number of pulses counted by each counter during the time that had elapsed since the preceding communication session. The accuracy of the transmission of numbers, determined by the accuracy of transmission of the mantissa, was always better than 3%. The capacity of the logarithmic circuit was $5 \cdot 10^8$ pulses. Information on the operation of the counters was obtained for the period from 31 III to 29 V.

Observations of the integral level of cosmic radiation in free interplanetary space

Fig. 1. Counting rate versus altitude above the lunar surface

Figure 1: Fig. 1. Counting rate versus altitude above the lunar surface

were carried out during the period from 31 III to 3 IV 1966. We have at our disposal data from three sessions, the duration of each of them being about 30 min. The mean counting rate of hard cosmic particles by the shielded counter was 12.2 ± 0.1 sec^{-1}, which corresponds to a flux of 4.7 ± 0.4 cm$^{-2} \cdot$ sec^{-1}.

The value of the flux of primary cosmic radiation indicates that, despite the increase in solar activity that began in 1966, the intensity of the primary radiation continues to retain a rather high value, characteristic of the period of minimum solar activity. The value of the flux given here agrees well with data obtained two months earlier by means of a counter of another type on the space station Luna-9 ([1]).

The satellite Luna-10, on April 3, 1966, entered a selenocentric orbit with an aposelene of 1000 km, a periselene of 350 km, and an inclination angle of 72° to the Moon's axis of rotation. The dependence of the counting rate of the shielded counter on altitude above the lunar surface was obtained. This dependence is shown in Fig. 1.

Fig. 1

The experimentally measured change in the counting rate of the shielded counter between aposelene and periselene is $11 \pm 3°$. Shielding by the Moon, for an albedo equal to zero, should give a change of about 15%.

A contribution to the counting rate of the unshielded counter was made by weakly penetrating cosmic rays of solar origin and by soft radiation in the region of the presumed boundary of the Earth' s magnetospheric tail (see the following article by N. L. Grigorov, V. L. Madyuev, et al. (p. 567)).

Physical Institute named after P. N. Lebedev
Academy of Sciences of the USSR

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Note: Figure translations are in progress. See original paper for figures.