STUDY OF SOFT CORPUSCULAR RADIATION

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N. L. GRIGOROV, V. L. MADUEV, S. L. MANDELSHTAM, N. F. PISARENKO,
I. A. SAVENKO, I. P. TINDO

STUDY OF SOFT CORPUSCULAR RADIATION

ON THE LUNA-10 LUNAR SATELLITE

(Presented by Academician B. P. Konstantinov, 5 VII 1966)

The instrumentation on the first artificial satellite of the Moon, "Luna-10," included SBT-9 and SF gas-discharge counters mounted on the outside of the satellite. The arrangement of the counters is shown schematically in Fig. 1. The SBT-9 counter had a mica window with an area of 0.2 cm^2 and a thickness of 1.2 $mg \cdot cm^{-2}$; to reduce its effectiveness for soft solar X-radiation, a layer of gold 0.3 $mg \cdot cm^{-2}$ thick was deposited on the mica. Thus this counter could, with an efficiency close to 1, register electrons with energies greater than 40 keV, protons with energies greater than 500 keV, and, with low efficiency, X-radiation shorter than 10 Å.

The SF counters had windows made of aluminum foil with an area of 0.5 cm^2 and a thickness of 2.7 $mg \cdot cm^{-2}$. The counters could register X-radiation shorter than 14 Å, electrons with energies greater than 50 keV, and protons with energies greater than 800 keV.*

Pulses from the SBT-9 counter were registered by a counting circuit with a logarithmic scale; pulses from the SF counters were registered by three independent logarithmic integrators. During measurement sessions the telemetry system interrogated the outputs of the measuring channels once every 2 min.

The counter readings are shown schematically in Fig. 2.

The background of the SBT-9 counter during the period from 3 to 23 IV amounted to 20–23 pulses, and from 23 IV to 12 V this background fell practically to the level of cosmic radiation. We associate the excess of the counting rate over the cosmic background in the first half of the operating period with the registration of solar X-radiation. In addition to the indicated background fluctuations, during the period from 8 to 13 IV an increase of the background

Fig. 1. Schematic representation of the arrangement of the counters

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Fig. 2. Counter readings in the period from 3 IV to 13 V; the length of the strokes is proportional to the number of pulses per second. The radial dashed line shows the boundaries of the region of the presumed continuation of the magnetosphere tail

Figure 2: Fig. 2. Counter readings in the period from 3 IV to 13 V; the length of the strokes is proportional to the number of pulses per second. The radial dashed line shows the boundaries of the region of the presumed continuation of the magnetosphere tail

up to 50 pulses $\cdot$ sec^{-1} was observed, apparently caused by solar cosmic rays, since at the beginning of April several flares were observed on the Sun.

The SF counters were switched on only on 8 IV. During the period from 8 IV to 2 V the SF-I and SF-II counters were partly, apparently, blinded, partly

Fig. 1. Schematic representation of the arrangement of the counters

* The SF counters were intended for detecting X-radiation from the Moon; the corresponding materials are being processed and will be published later.

gave the level of the cosmic background. During this period the SF-III counter gave a signal modulated because of the satellite' s rotation, with a maximum of about 300 pulses $\cdot$ sec^{-1}, and the minimum of the signal corresponded to the cosmic background (the limits of variation of the readings of this counter are shown in Fig. 2 by the dashed line). The off-scale readings of the SF-I and SF-II counters, apparently,

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are explained by the fact that solar X-ray radiation also entered these counters.

During the measurements the Luna-10 satellite crossed four times (4 IV, 8-9 IV, 2-4 V, and 7 V) the boundaries of the region of the presumed continuation of the Earth' s magnetosphere tail. In all these cases the counters detected a distinct increase in the counting rate. Of particular interest are the joint measurements with the SBT-9 and SF counters in the period from 2 to 5 V.

Beginning on 2 V, all the counters simultaneously detected a clearly noticeable increase in the counting rate (the SF-I counter remained off scale); the signals of all counters were not modulated. The readings of all the counters changed quite synchronously, revealing small decreases—

decrease and increase in the counting rates; in particular, on 5 V the readings of all the counters decreased almost to the level of the cosmic-ray background. The maximum counting rate in this period was (after subtraction of the cosmic-ray background) ≈ 50 pulses $\cdot$ cm^{-2} $\cdot$ sec^{-1} $\cdot$ ster^{-1} for the SBT-9 counter and ≈ 40 pulses $\cdot$ cm^{-2} $\cdot$ sec^{-1} $\cdot$ ster^{-1} for the SF counters. After 7 V the readings of all the counters decreased to the level of the cosmic-ray background.

The elevated readings of the counters on 3 and 8–9 IV, and also on 2–3 and 7 V, should naturally be interpreted as the registration, apparently, of particle fluxes isotropic in direction—most probably electrons with energies $E \geqslant 40$ keV—in the regions of the presumed boundary of the magnetosphere. These electron fluxes correlate well with the fluxes of softer electrons with energy $E > 70$ eV according to the measurements of K. I. Gringauz et al., published in the present issue of the journal.

These data make very probable the existence, in the antisolar direction, of the Earth' s magnetospheric tail at distances of up to 60 Earth radii. It should be noted, however, that measurements of the magnetic field by Sh. Sh. Dolginov et al., published in the present issue of the journal, apparently do not give direct indications that the Moon crossed the region of the magnetospheric tail, although on 4 V a small increase in the magnitude of the magnetic field was observed in comparison with the periods 7–11 and 18–21 IV. It should also be noted that the registration of electrons with energy 40–50 keV and, still more, of very soft electrons indicates that the magnetic field does not form closed lines around the Moon.

It is noteworthy that the fluxes of low-energy electrons ($E > 70$ eV) recorded by K. I. Gringauz are directed, whereas particles of substantially higher energies are quasi-isotropic.

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.