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~~Report No. 27~~
1155-10

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

ST- LPS- PF - 10 528

STUDY OF THE SOFT CORPUSCULAR RADIATION ON
THE AMS "LUNA-10"

by
N. L. Grigorov
V. L. Maduyev
S. L. Mandel'shtam
N. F. Pisarenko
I. A. Savenko
I. P. Tindo

(USSR)

FACILITY FORM 602

N 67 12208

(ACCESSION NUMBER)

(THRU)

5

1

(PAGES)

(CODE)

CR 80174

29

(NASA CR OR TMX OR AD NUMBER)

(CATEGORY)

GPO PRICE \$ _____

CFSTI PRICE(S) \$ _____

Hard copy (HC) 1.00

Microfiche (MF) .50

653 July 85

26 OCTOBER 1966

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THE AMS "LUNA-10"

Doklady A.N. SSSR,
Geofizika
Tom 170, No. 3, 567 -9,
Izdatel'stvo "NAUKA", 1966

by N. L. Grigorov
V. L. Maduyev
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SUMMARY

This note deals with measurements of soft corpuscular radiation from the AMS Luna-10. Description of the instrumentation is given. The conclusion derived uphold the probability of extension in antisolar direction of the Earth's magnetosphere tail over distance to 60 Earth's radii. Comparison is made of the observations obtained here with those of Dolginov, whose paper is part of these series on Luna-10. The registration of soft electrons is evidence that the magnetic field does not form closed lines around the Moon.

Attention is also drawn to the fact that the fluxes of soft electrons registered by Gringauz are directed, while particles of substantially higher energies are quasi-isotropic.

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The instrument package of Luna-10 included gas. ischarge counters SBT-9 and SF, installed outside the satellite body. Their disposition is schematically shown in Fig. 1. The SBT-9 counter has a mica window of 0.2 cm^2 area and 1.2 mg cm^{-2} in thickness. To offset, or decrease the effectiveness with respect to X-ray radiation, it was coated with a layer of gold 0.3 mg cm^{-2} thick. Therefore, this counter could effectively measure (efficiency close to 1) electrons with energies greater than 40 keV, protons with energies greater than 500 keV, and with low efficiency the X-radiation shorter than 10A.

The SF counters have a window of aluminum foil of 0.5 cm^2 area and 2.7 mg cm^{-1} thickness. These counters could register

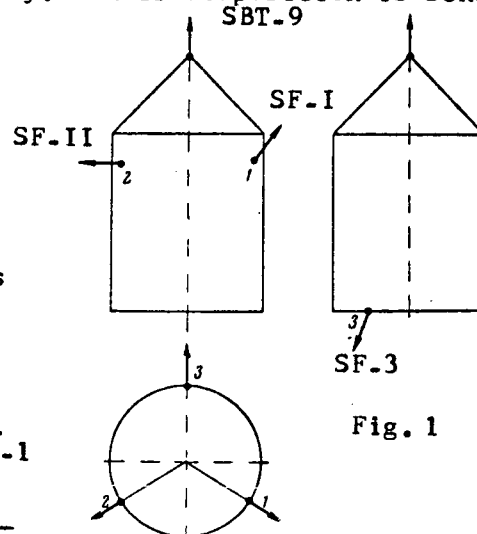


Fig. 1

the X-ray radiation shorter than 14 Å, electrons with energies higher than 50 keV and protons with energies above 800 keV. (Note that these SF-counters were specifically designed for the registration of Moon's X-ray emission; the corresponding material is being processed and will be the object of later publication).

Pulses from the SBT-9 counter were registered by a scaling circuit with a logarithmic scale; those from SF-counters were registered by three independent logarithmic integrators. During measurement sessions the telemetry interrogated the measuring channel outputs once every two minutes.

The readings of the counters are schematically represented in Fig. 2.

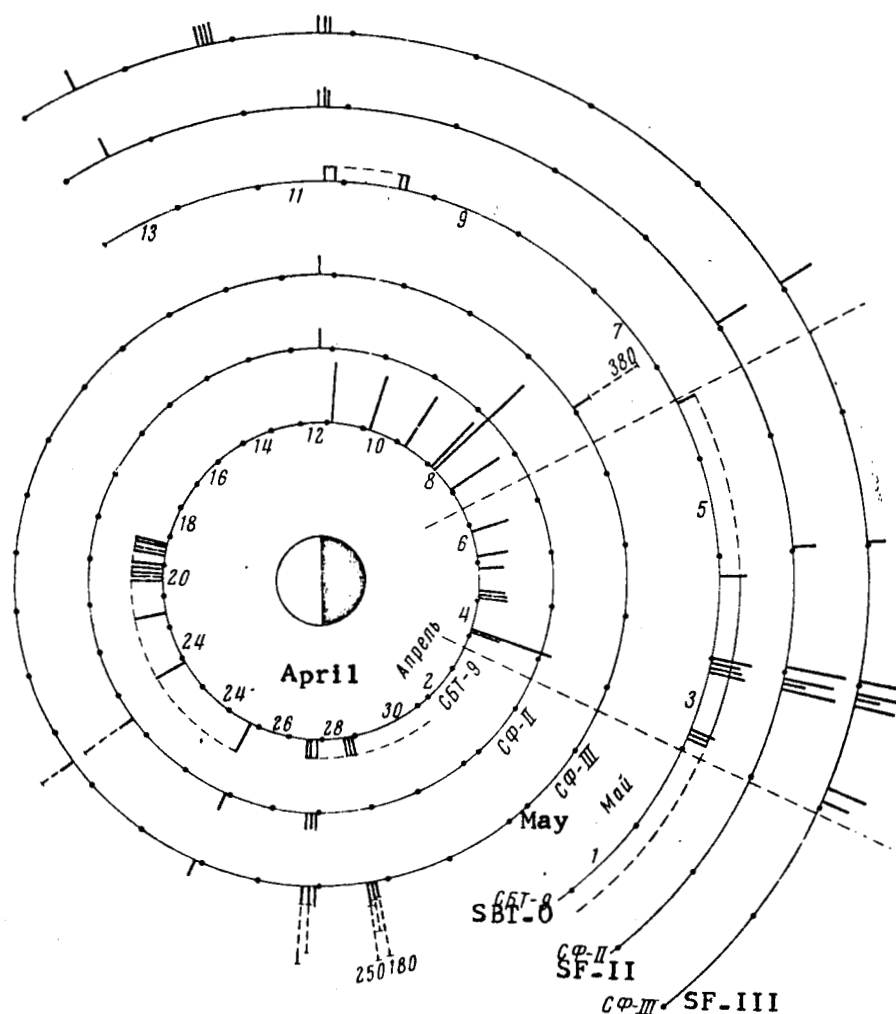


Fig. 2. Readings of the counters for the period from 3 April to 13 May; the length of the strokes is proportional to pulses/sec. Radial dashes indicate the regions of the assumed extension of the magnetosphere tail.

The background of the SBT-9 counter constituted 20-23 pulses in the course of the period from 3 to 23 April, but from 23 April to 12 May, it fell practically to the level of cosmic radiation. We relate the counting rate increase over the cosmic background during the first part of the operational period to the registration of Sun's X-ray radiation. Besides the indicated fluctuations of the background, its increase to 50 pulses $\cdot \text{sec}^{-1}$ was observed during the period from 8 to 13 April; it was apparently due to solar cosmic rays, for at the beginning of April several flares were observed on the Sun.

The SF-counters were switched on only on 8 April. Between 8 April and 2 May they were partially off-scale, giving partially the level of cosmic background. The SF-III counter gave over the extension of this period a modulated signal with maximum near 300 pulses $\cdot \text{sec}^{-1}$, which was due to satellite spinning. At the same time, the signal minimum corresponded to cosmic background (the limits of reading variations of this counter are shown in Fig. 2 by dashes).

The off-scale reading of counters SF-I and SF-II is apparently explained by the fact that Sun's X-ray radiation also hit these counters.

During measurement time, LUNA-10 crossed the assumed extension of the Earth's magnetosphere boundary four times (respectively on 4 April, 8 to 9 April, 2 to 4 May and 7 May). In all those cases the counters detected a clear rise in the counting rate. Particularly interesting are the concomittant measurements by SBT-9 and SF-counters for the period from 2 to 5 May.

Beginning with 2 May, all the counters revealed clearly and simultaneously a notable increase of the counting rate (the SF-I counter remaining off-scale); the signals of all counters are not modulated. The readings of all of them varied entirely synchronously, revealing small decreases and increases, in particular on 5 May, when all counter readings showed a decrease to nearly the level of cosmic background. The counting rate maximum in that period constituted (upon subtracting the cosmic background) $\approx 50 \text{ pulse} \cdot \text{cm}^{-2} \text{ sec}^{-1} \text{ ster.}$ for SBT-9 and $\approx 40 \text{ pulse} \cdot \text{cm}^{-2} \text{ sec}^{-1} \text{ ster.}$ for the SF-counters. After 7 May the readings of all counters decreases to the level of cosmic background.

The increases counter readings on 3 and 8-9 April and also on 2-3 and 7 May may be naturally interpreted as the registration of apparently isotropic in direction fluxes of particles, most probably electrons with energies $E > 40 \text{ kev}$ in the regions of the presumed magnetosphere boundary. These electron fluxes are correlating well with fluxes of softer electrons with $E > 70 \text{ ev}$, measured by K. I. Gringauz ET AL and published in the same journal (ST-LPS-PF-10 529).

These data make quite probable the existence in the antisolar direction of the Earth's magnetosphere tail at the distance up to 60 Earth's radii. It should be noted, however, that the measurement by Sh. Sh. Dolginov ET AL of the magnetic field, which are also published in the current journal (ST-LPS-PF-10 530), apparently fail to give direct indication on the crossing by the Moon of the region of magnetosphere tail, though on 4 May there was observed a small increase in the absolute value of the magnetic field by comparison with the period 7-11 and 18-21 April. It should be also noted that the registration of electrons with energies 40-50 kev and, the more so, of entirely soft electrons, is evidence that the magnetic field does not form closed lines around the Moon.

Attention is also drawn by the fact that the fluxes of low energy electrons ($E > 70$ ev) are directed, while particles of substantially higher energies are quasi-isotropic.

**** THE END ****

Institute of Physics
in the name
of P. N. Lebedev
of the
USSR Academy of Sciences

Manuscript received
on 28 June 1966

Contract No. NAS-5-12487
VOLT TECHNICAL CORPORATION
1145 19th st. NW
D.C. 20036. Tel: 223-6700

Translated by ANDRE L. BRICHANT
on 26 October 1966

DISTRIBUTION

same as ST . LPS . PF . 10 526