# PHYSICS

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Fig. 1

Figure 1: Fig. 1

## Abstract

## Full Text

*PHYSICS*

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# MEASUREMENT OF COSMIC RADIATION ON AN ARTIFICIAL EARTH SATELLITE

This article presents preliminary results obtained with the aid of apparatus placed on the second artificial Earth satellite.

For reliable recording of variations in the intensity of cosmic radiation, two identical instruments were installed on the satellite. The two instruments were completely independent; therefore, the agreement of their readings gives confidence in the proper operation of the apparatus in flight.

Each of the instruments consisted of a charged-particle counter with an effective length of 100 mm and a diameter of 18 mm. On average, the amount of material surrounding the counter was 10 g/cm$^2$. The operating voltage of the counter (400 V) was supplied by means of a semiconductor converter, which was powered by a battery with a voltage of 6.5 V.

**Fig. 1**

Both instruments contained scaling devices, which were made with semiconductor triodes and consumed a power of 0.1 watt each. The entire instrument consumed 0.15 watt. The power reserve ensured continuous operation of the instrument for 200 hours. The weight of the instrument together with its power sources was 2.5 kg. The circuit elements of the instrument were described in ([1]).

During the flight of the satellite over the territory of the Soviet Union on direct orbits (motion from south to north), its altitude above the Earth' s surface remained practically unchanged (225-240 km). During motion on reverse orbits the flight altitude increased monotonically from approximately 350 to 700 km as the latitude decreased from 65° N to 40° N. The ratio of the cosmic-ray intensity on reverse orbits to the intensity on direct orbits at the same geographic points gives the relative increase in intensity due to the difference in altitude (see

Fig. 2. Lines of equal intensity of cosmic radiation (isocosms)

Figure 2: Fig. 2. Lines of equal intensity of cosmic radiation (isocosms)

Fig. 3

Figure 3: Fig. 3

Fig. 1). If the dependence of cosmic-ray intensity on altitude were the same at different latitudes, then Fig. 1 would give this altitude dependence.

The change in the intensity of cosmic rays as a function of altitude beyond the atmosphere may be due to at least three effects: 1) an increase in intensity owing to a decrease in shielding by the Earth; 2) an increase in intensity because of the decrease in the Earth' s magnetic field,

**Fig. 2.** Lines of equal intensity of cosmic radiation (isocosms)

which leads to a decrease in the threshold energy of particles capable of penetrating through the Earth' s magnetic field; 3) a change in the albedo of cosmic radiation. The altitude dependence found can be explained by taking into account only the first two effects.

**Fig. 3**

The measurements of cosmic-ray intensity carried out during the flight of the satellite along many direct orbits make it possible to construct lines of equal intensity of this radiation (isocosms).

Figure 2 presents isocosms for three values of the counting rate: 18, 27, and 36 pulses/sec.

As is seen from Fig. 1, the experimental points lie best on geographic parallels. In the equatorial region Simpson ([2,3]) found that the line of minimum cosmic-ray intensity ( "cosmic equator" ) does not coincide with the geomagnetic equator. In this connection, obtaining data on the distribution of cosmic-ray intensity over the entire globe is of great interest.

The scatter of the points in Fig. 2 exceeds by a factor of 2–3 the scatter that should be expected from statistical errors alone. It is possible that this is connected with variations in cosmic-ray intensity. Analysis of the data obtained shows that significant ⋯

increase in the intensity of cosmic rays. Thus, on November 7, 1957, in the time interval from 4 hr 36 min to 4 hr 49 min (Moscow time), at latitudes above 58°, an increase in the intensity of cosmic radiation by approximately 50% was recorded. This increase was registered simultaneously by two instruments. The change in the intensity of cosmic rays during

**Fig. 4**

Fig. 4

Figure 4: Fig. 4

this "burst," according to the data from both instruments, is shown in Fig. 3 (circles are the data from one instrument, dots from the other instrument). In the same figure, the dotted curve shows the change in the intensity of cosmic radiation as a function of time that would be expected on the basis of the averaged data obtained over all orbits, excluding the orbit on which the "burst" was observed.

More detailed data on the change in intensity during this "burst," corresponding to shorter time intervals, are shown in Fig. 4. Attention is drawn to the fact that during the "burst" large fluctuations of intensity are observed, many times exceeding statistical fluctuations.

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## CITED LITERATURE

1. S. N. Vernov, Yu. I. Logachev, A. E. Chudakov, Yu. G. Shafer, *Uspekhi fiz. nauk*, **63**, 1, 149 (1957).

2. J. A. Simpson, K. B. Fenton, J. Katzman, D. C. Rose, *Phys. Rev.*, **102**, 1648 (1956).

3. Simpson, report at the conference in Varenna.

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