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ELECTRONS WITH ENERGY $E_e \geq 100$ MeV AT ALTITUDES OF 500 km IN THE EQUATORIAL REGION[1])

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Fluxes of electrons with an energy above 100 MeV on the low altitude satellite Intercosmos-17 near the equator are analysed. In the Brazil magnetic anomaly there are obtained fluxes of electrons up to $14\,800 \pm 500$ m^{-2}s^{-1}ster^{-1}. The pitch-angle distribution of quasitrapped electrons as well as a rough estimation of the dependence of the flux on B for the interval $L = 1.08$—1.42 are presented.

АНАЛИЗ ПОТОКОВ ЭЛЕКТРОНОВ С ЭНЕРГИЕЙ $E_e \geq 100$ МэВ В ЭКВАТОРИАЛЬНОЙ ОБЛАСТИ НА ВЫСОТЕ 500 км

В работе приводятся результаты анализа потоков высокоэнергичных электронов ($E > 100$ МэВ и $E > 300$ МэВ) вблизи экватора при помощи низкоорбитального искусственного спутника Земли «Интеркосмос-17». Телеметрическая запись с временным разрешением 0,3 с позволила получить относительно высокие потоки таких электронов в области бразильской магнитной аномалии.

I. INTRODUCTION

The existence of the radiation belt of the Earth consisting of high energy electrons was proposed in [1]. The measurements provided on the satellites Cosmos 490 and Salyut 6 proved this assumption [2, 4—7]. More recent papers on this subject [5, 7] report the registration of an enhanced flux of high energy electrons in the region of the Brazil magnetic anomaly.

Our report continues the investigations [2—4, 6, 7], analysing the set of experimental data obtained from measurements of the apparatus SEZ-10 placed on board of the Intercosmos-17 satelite. A more detailed description of the apparatus SEZ-10 and of the system of registration is presented in [3].

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II. EXPERIMENTAL RESULTS

Intercosmos-17 (launched in September 1977) was a satellite with a nearly circular orbit ($h \sim 500$ km) and an inclination of 83.5° with respect to the equatorial plane. The apparatus SEZ-10 registered high energy electrons ($E_e >$ 100 MeV) and the axis of its telescope was oriented in the horizontal plane perpendicularly to the orbital plane. The orientation of the detector enabled to measure the fluxes of particles with high pitch angles in the low latitude region.

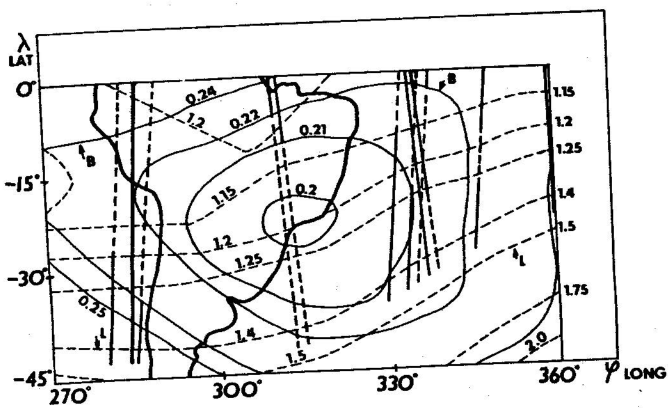

Fig. 1. Fragments of several orbits of Intercosmos-17 (straight lines) with detection of high energy electrons ($E_e > 100$ MeV) in the region of the Brazil magnetic anomaly. The parts of orbits where saturation in the basic telemetry regime occurred are shown by dashed straight lines. Several north → south as well as south → north passes differing in the detector orientation with respect to **B** are shown. One of the passages with a higher counting rate interval in the "faster" telemetry regime is given also (thicker line). Measurements are from October 27, 1977, December 9, 1977, December 13, 1977, February 18, 1978.

For analysis we have chosen several fragments of the satelite's trajectory where $L < 1.45$, with the purpose to trace the fluxes of electrons in the region of the Brazil magnetic anomaly. The basic telemetry regime enabled to register fluxes only up to 6 imp s^{-1}. The geometrical factor of the detector is 7 cm^{2}ster. There are, however, several passages of the satellite during which the telemetry regime has a 15 times higher temporal resolution and makes it possible to extend the counting rate interval. Such passages at the edge of the Brazil magnetic anomaly together with passages where saturation occurs in the basic telemetry regime are shown in Fig. 1.

From the point of view of the dynamics of particles in the radiation belt there are usually quoted stable trapped and quasitrapped particles. The quasitrapped

particles are detected on a given L above a certain B_m, that means the mirror point of the particle in the azimuthal drift falls into the atmosphere so that the full 2π azimuthal motion for the given particle is not possible. Although we discuss here only 30 passages in the low latitude region ($\lambda \in (-45, +10°)$), we have enough statistics for the quasitrapping region. For this purpose we took all measurements in $L = 1.08$—1.42 and $B > 2400$ nT and arrange them according to the angle between the axis of the detector and the local $\boldsymbol{B}(\alpha)$.

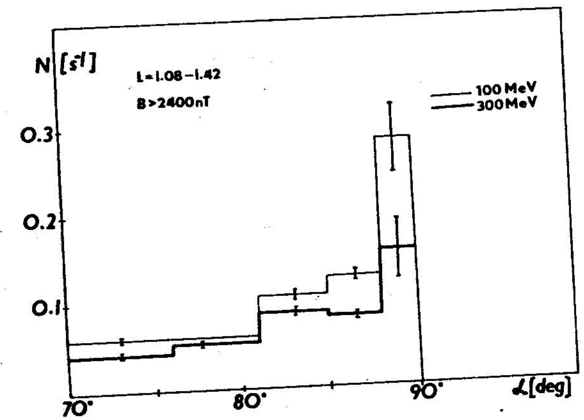

Fig. 2. The counting rate of quasitrapped electrons for $E_e > 100$ MeV (thin line) and for $E_e > 300$ MeV (thick line) for several intervals of the angle α between the axis of the telescope and local $\boldsymbol{B}$.

Fig. 2 shows the dependence of the electron counting rate on the angle α for two energies $E_e \geq 100$ MeV (thin line) and $E \geq 300$ MeV (thick line) for $B > 2400$ nT. It can be seen that electrons in the quasitrapping region have a narrow pitch angle distribution.

Further we have obtained the dependence of the electron counting rate on B. Because of low statistics we take the whole interval $L = 1.08$—1.42 and so it should be presented only as a rough estimation of the height profile of the electron flux. The results are shown in Table 1. From the table we can see that below $B = 2200$ nT the only reliable data can be obtained in a "faster" telemetry regime, while the basic regime is suitable for obtaining the flux on a B higher than 2400 nT.

III. DISCUSSION AND CONCLUSIONS

The high energy electron flux measurements in the low latitude portion of several orbits of the satellite Intercosmos-17 enable to obtain these characteristics:

1. The dependence of the quasitrapped electron flux on the angle between the

axis of the detector and $\boldsymbol{B}$ is pronounced for quasitrapped electrons with energies $E_e > 100$ MeV and $E_e > 300$ MeV, respectively. For electrons with $E_e > 100$ MeV, the ratio of the flux near $\alpha = 90°$ to the flux at $\alpha \simeq 70°$ is ~ 4.

2. The estimation of the "height" profile, i.e. the dependence of the electron flux on B for the interval $L = 1.08$—1.42. The extension of this profile to a lower B performed by a "faster" telemetry regime gave relatively high fluxes of electrons, $J = 10.4\ s^{-1}$ for $E_e > 100$ MeV and $J = 5.8\ s^{-1}$ $E_e > 300$ MeV for $L = 1.16$ $B =$ 2100 nT.

Table 1

The counting rates of electrons with energies $E_e \geq 100$ MeV and $E_e > 300$ MeV for the interval $L = 1.08$—1.42 at different intervals of B. The measurements denoted by brackets were obtained in a "fast" telemetry regime (see text). Only cases when $\alpha = 90 \pm 5°$ are taken

B (10^{-4} T)	$E \geq 100$ (MeV s^{-1})	$E_e \geq 300$ (MeV s^{-1})
0.21—0.22	(10.4 ± 0.9)	(5.8 ± 0.6)
0.22—0.23	(1.5 ± 0.6) 1.1 ± 0.2	(0.7 ± 0.4) 0.6 ± 0.3
0.23—0.24	0.3 ± 0.15	0.1 ± 0.05
>0.24	0.15 ± 0.04	

These characteristics support the idea that the source of high-energy electrons trapped in the radiation belt is connected with high-energy protons in the inner radiation belt, which may produce electrons in nuclear collisions with the residual atmosphere. For evaluating this idea it is necessary to make a more detailed examination of the measurements by the apparatus SEZ-10, to obtain for instance "height" profiles in several L-intervals, evaluate energy spectra of electrons and to compare electron fluxes with the characteristics of protons of high energies. The authors would like to thank Dr. S. N. Kuznetsov for his evaluable discussions about the results presented here.

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