

The Nature of the Particle Beams in the Core
of an Extensive Air Shower

S/056/60/039/002/042/044
B006/B070

$E_{\mu} = 10^{13}$ ev, a value 0.3 per muon is obtained for the probability of electron-positron pair production in the filter of lead+graphite (~10 t-units over the second row of ionization chambers). The number of particles in the avalanche cores recorded in the second row of chambers, (Φ_{ex}) in ΔE , agrees with the number of pair production calculated from muons (Φ_{th}):



| | | | | |
|-------------|----|----------------|----------------------------------|-------------------|
| ΔE | ev | $2 \cdot 10^9$ | $2 \cdot 10^9 - 2 \cdot 10^{10}$ | $2 \cdot 10^{10}$ |
| Φ_{ex} | . | 39 | 7 | 2 |
| Φ_{th} | | 40 | 5 | 3 |

Also the absence of multiplication on the passage of the beam through 0.8 t-units of lead glass agrees with the assumption that a high-energy muon beam is concerned. The authors thank L. G. Smolenskiy and B. A. Zelenov for help in the experiments and S. F. Semenko for help in the calculations. There are 1 table and 5 Soviet references.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of the Moscow State University)

SUBMITTED: June 20, 1960

Card 3/3

81550

S/004/60/000/03/04/03

3.9000

AUTHOR: Vernov, S.N., Corresponding Member

TITLE: What is the Corona of the Earth and What Causes Corpuscular Radiation of the Earth?

PERIODICAL: Znanije-Sila, 1960, No. 3, pp. 37 - 38

TEXT: The author states that the magnetic field of the earth constitutes a "trap" for electrically charged particles, which then form two radiation belts around the earth. The outer belt consists of low-energy electrons, the inner belt of high-energy protons. Experiments showed that the intensity of these particles increases along the magnetic power line. The border of the radiation field formed by these particles is the power line of the magnetic field of the earth. This way our planet influences the surrounding cosmic space and the corona of the earth is actually the result of a corpuscular radiation of the latter. There is no definite explanation as to the cause of corpuscular radiation. It is assumed that radiation is due to neutrons which, when nearing the earth's surface, disintegrate into electrons, protons and neutrons.

ASSOCIATION: AN SSSR (AS USSR)

Card 1/1

VERNOV, S. N., DMITRIYEV, V. A., KHRENOV, B. A., KRISTIANSEN, G. B.,

Ghulam-Sadik, M., Khva, Ly-Don.

"On Mu-Meson Beams in EAS and the Investigation of Mu-Meson
Spectrum."

report submitted for the Intl. Conf. on Cosmic Rays and Earth Storm (IUPAP)
Kyoto, Japan 4-15 Sept. 1961.

VERNOV, S. N., GORCHAKOV, Ye. V., LOGACHEV, Yu. I., NESTEROV, V. E., PISARENKO, N. F.,
SAVENKO, I. A. and SHAVRIN, P. I.

"Investigations of Radiation During Flights of Satellites, Space
Vehicles and Rockets"

Report presented at the International Conference on Cosmic Rays
and Earth Storm, 4-15 Sep 61, Kyoto, Japan.

VERNOV, S.N., KUZ'MIN, A.I., KRIMSKIY, G.F., SHAFER, G.V., SHAFER, YU.G.,

"Cosmic Ray Outbursts on November 12-15, 1960,"

report presented at the Intl. Conference on Cosmic Rays and
Earth Storms, Kyoto, Japan, 4-15 Sept 1961.

VI. KRYLOV, S. I.

- a. On the Problem of the Motion of a Particle in a Gravitational Field
- b. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
S. I. Krylov, Tyurnina, L. O., et al.
- c. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
- d. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
G. E. Grozdovsky, I. M. Kozlov, V. V. Kozlov
- e. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
V. E. Kozlov
- f. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
G. E. Grozdovsky
- g. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
V. E. Kozlov
- h. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
V. E. Kozlov
- i. On the Problem of the Motion of a Particle in a Gravitational Field
U. S. S. R. Academy of Sciences, Institute of Space Research, Moscow, U. S. S. R.
V. E. Kozlov, I. M. Kozlov, N. A. Kozlov, U. S. S. R.

Reports to be presented at the XIIIth International Astronautical Congress,
Washington D. C. 1-7 October 1961

(19)

VERNOV, S.N., otv. red.; DORMAN, L.I., kand. fiziko-matem.nauk, otv. red.;
PODOL'SKIY, A.D., red. izd-va; GOLUB', S.P., tekhn. red.

[Collection of articles] Sbornik statei. Moskva, Izd-vo Akad.
nauk SSSR. No.4. 1961. 258 p. (MIRA 15:6)

1. Akademiya nauk SSSR. Mezhduevdomstvennyy komitet po provedeniyu
Mezhdunarodnogo geofizicheskogo goda. VII razdel programmy MGG.
Kosmicheskiye luchy. 2. Chlen-korrespondent Akademii nauk SSSR (for
Vernov).

(Cosmic rays)

29008

S/020/61/140/004/008/023
B104/B108

3.2420 (1049/442)

AUTHORS: Vernov, S. N., Corresponding Member of the AS USSR, Savenko, I. A., Shavrin, P. I., Nesterov, V. Ye., and Pisarenko, N. F.

TITLE: Outer radiation belt of the Earth at 320 km altitude

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 4, 1961, 787 - 790

TEXT: The second Soviet satellite whose orbit was at an altitude of 307 - 339 km had an automatic storage system which enabled it to measure continuously the radiation intensity in latitudes of $\pm 65^\circ$. The scintillation counter consisted of a $\Phi\Xi\Upsilon$ -16 (FEU-16) photomultiplier and a NaI(Tl) crystal. The energy threshold of this counter was 25 kev. An CTC-5 (STS-5) Geiger counter was also used. Measurements showed that the counting rate of the scintillation counter, from the equator to latitudes of $\pm 40 - 50^\circ$, increased from 3 - 5 pulses/cm².sec to 10 - 12 pulses/cm².sec. In latitudes from $\pm 50^\circ$ to $\pm 65^\circ$, the counting rate increased to 20 - 600 pulses/cm².sec in most cases. The authors assume that this increase in x-ray intensity is caused by particles of the radiation belt of the Earth. To prove this

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Outer radiation belt of the Earth

statement, the relations between the zones of higher intensity of the northern and southern hemispheres are studied. It is shown that the zones of higher intensity on the northern and southern hemispheres are connected by lines of force of the geomagnetic field. The position of the belt of enhanced intensity at 320 km from the Earth is determined by the geomagnetic field. The indications of the two counters were compared to determine composition and energy of the radiation. The authors are convinced that the enhanced intensity recorded is due to electrons of the outer radiation belt, which are slowed down in the casing of the satellite. The authors thank A. Ye. Chudakov, I. P. Ivanenko, and V. Gorchakov for discussions. There are 2 figures, 1 table, and 6 references: 3 Soviet and 3 non-Soviet. The three references to English-language publications read as follows: E. H. Vestine et al., Planet. Space Sci., 1, 285 (1959); J. B. Cladis et al., J. Geophys. Res., 66, 343 (1961); J. A. Welch et al., J. Geophys. Res., 64, 909 (1959).

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: June 7, 1961
Card 2/2

3.2420 (1049, 1482)

29111
S/020/61/140/005/006/022
B125/B138

AUTHORS: Vernov, S. N., Corresponding Member AS USSR, Savenko. I. A.,
Shavrin, P. I., Pisarenko, N. F.

TITLE: Discovery of an inner radiation belt at 320 km altitude in
the region of the South-Atlantic magnetic anomaly

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 5, 1961. 1041-1044

TEXT: The paper reports on the discovery and investigation of the inner radiation belt by the second Soviet satellite. The radiometric apparatus (gas discharge counter ЦТ-5(STS-5) and scintillation counter ФЭУ-16(FEU-16) with NaI(Tl) crystal) carried on the satellite recorded increased radiation intensity above the magnetic anomaly in the South Atlantic. The scintillation counter recorded particles with a threshold of 25 keV and the total release of energy in the crystal. Analysis of the data leads to the following conclusions: The increased radiation intensity revealed to the authors by the flights of the second Soviet satellite at 320 km altitude above the Brazilian magnetic anomaly is attributable to the inner radiation belt. Since no inner radiation belt has been found north of the geomagnetic equator, the reflection points there lie higher than in the anomalous
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B125/B138

Discovery of an inner radiation...

region. At low geomagnetic latitudes, it is the proton component of the inner radiation belt which prevails in the anomalous region. The intensity of x-radiation caused by the deceleration of electrons in the casing of the space ship rises at higher latitudes and the intensity of the proton component decreases. An outer radiation belt appears at magnetic latitudes $>40^\circ$. There is also an intermediate region between the outer and inner radiation belts. In this intermediate region, the bremsstrahlung intensity is only a half or a quarter as much as in the intensity maxima of the inner or outer radiation belt at that altitude. The gap between the inner and outer radiation belts, which is very distinct on the northern hemisphere (measurements made from the third Soviet satellite), is practically absent in the region of the Brazilian anomaly. This fact, together with data on the size of the gap on the northern hemisphere and near the equator, might explain the formation of the inner radiation of the Earth. There are 2 figures, 1 table, and 5 references: 2 Soviet and 3 non-Soviet. The three references to English-language publications read as follows: A. J. Dessler, J. Geophys. Res., 64, No 7, 713 (1959); S. Yoshida, G. H. Ludwig, J. A. Van-Allen, J. Geophys. Res., 65, No 3, 807 (1960); J. A. Van-Allen, L. A. Frank, Nature, 183, 430 (1959); 184, 219 (1959).

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29111

Discovery of an inner radiation....

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B125/B138

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. A. Lomonosova
(Moscow State University imeni M. V. Lomonosov)

SUBMITTED: June 30, 1961

H

Card 3/3

3.2420 (2806,1049,1482)

33306
S/560/61/000/010/004/016
D299/D302

17.2400
AUTHORS:

Vernov, S. N., Savenko, I. A., Shavrin, P. I.,
Nesterov, V. Ye., and Pisarenko, N. F.

TITLE:

Outer radiation belt of the earth at 320 km
altitude

SOURCE:

Akademiya nauk SSSR. Iskusstvennyye sputniki
Zemli. no. 10. Moscow, 1961, 34-39

TEXT: The investigations carried out by means of the 2nd
and 3rd Soviet artificial satellites indicated the existence of
an outer radiation belt, sharply delimited by the high-latitude
region. The scintillation- and Geiger-counters on board the
2nd Soviet Sputnik permitted a detailed study of the outer radi-
ation belt in the vicinity of the earth and its delimitation as
a function of longitude. The autonomous memory-device on board
the Sputnik yielded continuous data on radiation intensity at
altitudes of 306 - 339 km over the entire terrestrial globe for

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latitudes of $\pm 65^\circ$. The scintillation counter consisted of a cylindrical NaJ(Tl)-single crystal and of the photomultiplier $\Phi 3Y-16$ (FEU-16). The Geiger counter was of type CTC-5 (STS-5), which is a halide-counter. A figure shows the radiation intensity recorded by means of the scintillation counter at various points of the globe. It was proved that the sharp increase in counting rate, which could not be explained by the latitude effect, is due to the radiation belts of the earth; this was done by analyzing the connection between the regions of increased intensity in the Northern and Southern Hemispheres, by studying the connection between these regions and the earth's magnetic field, as well as the composition and energy of the radiation. Thus, the zones of increased radiation in the Northern Hemisphere are related to those in the Southern Hemisphere by the lines of force of the geomagnetic field which determines the position of the radiation belt at an altitude of 320 km. In order to determine the composition and to estimate the energy

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of the radiation, the readings of the scintillation- and Geiger-counters were compared. Hence, it was found that the radiation in question is gamma-radiation with energies of the order of 100 - 300 kev. The mean energy of the secondary electrons, arising in the single crystal by interaction with the gamma-radiation, is of the order of 10^5 ev. The clear connection between the zones of increased intensity in the Northern and Southern Hemispheres and the nature of the radiation and its energy are proof that the recorded increase in intensity is due to electrons of the outer radiation belt. In general, no direct relation was observed between the intensity and the strength of the magnetic field. This is apparently due to the short lifetime of electrons of the outer radiation belt at the altitudes under consideration compared to the drift-time around the earth. An estimate of the lifetime of electrons with $E = 300$ kev yielded the value of $10^6 - 10^8$ sec.; hence, the hypothesis of local acceleration of electrons within the geomagnetic field is

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more likely than the neutron hypothesis of electron origin.
[Abstracter's note: The designation "Van Allen Belt" is not used at all in the Russian text.] There are 2 figures, 2 tables and 5 references: 2 Soviet-bloc and 3 non-Soviet-bloc. The references to the English-language publications read as follows: E. H. Vestine, W. L. Sibley, Planet Space Sci., 1, 285, 1959; J. B. Cladis, A. J. Dessler, J. Geophys. Res., 66, 343, 1961; J. A. Welch, W. A. Whitaker, J. Geophys. Res., 64, 909, 1959. X

SUBMITTED: May 23, 1961

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3.2420 (1049, 2806, 1482)

33307

S/560/61/000/010/005/016
D299/D302

17.2400
AUTHORS:

Vernov, S. N., Savenko, I. A., Shavrin, P. I.,
and Pisarenko, N. F.

TITLE:

Observation of inner radiation belt at an
altitude of 320 km in the region of the south-
Atlantic magnetic anomaly

SOURCE:

Akademiya nauk SSSR. *Iskusstvennyye sputniki
Zemli.* no. 10. Moscow, 1961, 40-44

TEXT: In contradistinction to the other zones of increased
radiation-intensity (which form the outer belt), the magnetic
anomaly near the Brazilian coast cannot be related to the outer
radiation belt owing to its geographical position and to the
presence of a large number of penetrating particles in the radi-
ation. A map shows the regions of increased intensity and, in
particular, the points at which the intensity exceeded 3.6

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D299/D302

Observation of inner...

counts $\cdot \text{cm}^{-2} \cdot \text{sec.}^{-1}$; all these points were concentrated in the southern Atlantic. The readings of the Geiger- and scintillation-counters are listed in a table and shown in a figure. Conclusions: (1) The increase in radiation intensity, observed at an altitude of 320 km above the Brazilian magnetic anomaly, is due to an inner radiation belt. This belt is not observed to the north of the geomagnetic equator. (2) At low geomagnetic latitudes, the proton component of the inner belt prevails (in the region of the anomaly). With higher latitudes, the X-ray intensity increases (arising from electron bremsstrahlung on the space-ship hull), whereas the proton component decreases. (3) At magnetic latitudes higher than 40°S , the outer radiation belt appears. (4) A transition region is found between the outer and inner radiation belts, where the intensity of the bremsstrahlung is weaker--by a factor of two and four respectively--than at the maximum of intensity of the internal and external belts. (5) The cut between the inner and outer radia-

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Observation of inner...

tion belts, very clearly observed in the Northern Hemisphere by means of the 3rd Soviet Sputnik, is practically non-existent in the region of the Brazilian anomaly. These facts may shed light on the origin of the outer radiation belt. There are 2 figures, 1 table and 7 references: 3 Soviet-bloc and 4 non-Soviet-bloc. The references to the English-language publications read as follows: A. J. Dessler, J. Geophys. Res., 64, 713, 1959; S. Yoshida, G. H. Ludwig, J. A. Van Allen, J. Geophys. Res., 65, 807, 1960; J. A. Van Allen, L. A. Frank, Nature, 183, 430, 1959; J. A. Van Allen, L. A. Frank, Nature, 184, 219, 1959.

SUBMITTED: May 23, 1961

X

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34350

S/203/51/001/006/002/021
D055/D113

9,6150

3,2420 (1049,1462)

AUTHORS: Vernov, S.N.; Chudakov, A.Ye.; Vakulov, P.V.; Gorchakov, Ye.V.;
Logachev, Yu.I.

TITLE: Radiation measurements in the outer radiation belt on
February 12, 1961, during the rocket flight towards Venus

PERIODICAL: Geomagnetizm i aeronomiya, vol 1, no 6, 1961, 872-874

TEXT: The article deals with data on the Earth's outer radiation belt collected when the Earth-Venus rocket launched on February 12, 1961, was 30,000 - 45,000 km from the Earth's center. The special equipment installed in the hermetic container consisted of a scintillation counter and an etc-5 (STS-5) gas-discharge counter. The distribution of matter around the NaJ(Tl) crystal and the gas-discharge counter is shown in a table. By reducing the dimensions of the crystal and increasing the resolving power of the electronic system of the counter, the radiation intensity in the belt was correctly registered. Fig. 1 shows the overload characteristics for the counting channels of the scintillation (1) and gas-discharge (2) counters.

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Radiation measurements ...

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D055/D113

These channels could register up to 10^6 and 10^5 pulsations/sec. respectively. To penetrate the crystal of the scintillation counter and the working volume of the gas-discharge counter, electrons must have an energy of ≥ 3 Mev, protons - an energy of ≥ 32 Mev and the bremsstrahlung quanta - an energy of ≥ 30 kev. Curves on fig. 2 represent the counting speed of the scintillation counter (1), that of the gas-discharge counter after corrections were made according to the curves in fig. 1 (3) and the energy release in the crystal in relation to the distance from the Earth's center (2). As all three curves were more or less parallel, the mean energy release in the crystal for one reading of the scintillation counter was 130 kev and remained constant between 32,000 and 40,000 km and the mean energy of the bremsstrahlung quanta did not vary with distance. The constancy of the mean-energy release showed that no great changes occurred in the spectrum of electrons of the outer radiation belt. A diagram (fig. 3) shows the paths of the interplanetary rocket (curve 1) and those of another three Soviet rockets (curve 2). A comparison of radiation and ionization data concerning the interplanetary rocket and the space rockets no. 1 and 2, showed that the outer radiation belt was stable for a period of 2 years when no magnetic perturbances were recorded. However, this period was not long enough to

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Radiation measurements ...

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DO55/D113

evaluate solar effects on the outer belt, but could be taken as an indication of the absence of such an effect. The space rocket no 3 was launched during a moderate magnetic storm (the change in the vertical and horizontal components of the terrestrial magnetic field was about 250 and 150 γ respectively). The external side of the belt was not measured, but the total energy release in the crystal during the entire flight coincided with that calculated for the rocket no 1 and was 1.5 times less than that of the rocket no 2, i.e. no changes occurred in the mean state of the outer zone during the flight of the rocket no 3 during a moderate magnetic storm. Since measurements were started a few hours after the beginning of a magnetic storm, the radiation intensity in the belt had not yet decreased. On the other hand, it is also possible that not all magnetic storms cause the radiation intensity of the Earth's outer radiation belt to decrease. There are 4 figures, 1 table and 3 non-Soviet references. The three English-language references are: W.H. Hess, J. Geophys. Res., 1960, 65, no 10, 3107; P. Rothwell, J.E. McIlwain. J. Geophys. Res., 1960, 65, no. 3, 799; R.L. Arnoldy, R.A. Hoffman, J.R. Winckler, J. Geophys. Res., 1960, 65, no 5, 1361.

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Radiation measurements ...

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DOF5/D113

ASSOCIATION: Moskovskiy gosudarstvennyy universitet, Institut yadernoy fiziki (Moscow State University, Institute of Nuclear Physics)

SUBMITTED: September 9, 1961

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Card 4/04

BLOKHIN, Nikolay Nikolayevich; PARIN, Vasiliv Vasil'yevich; GAZENKO, Oleg Georgiyevich, kand.med.nauk; VERNOV, Sergey Nikolayevich; STAROSTENKOVA, M.M., otv.red.; SHISHINA, Yu.G., red.; NAZAROVA, A.S., tekhn.red.

[Medicine and cosmic flight] Meditsina i kosmicheskie polety; sbornik. Moskva, Izd-vo "Znanie," 1961. 30 p. (Vsesoiuznoe obshchestvo po rasprostraneniu politicheskikh i nauchnykh znani. Ser.8, Biologiya i meditsina, no.9)

(MIRA 14:6)

1. Prezident Akademii meditsinskikh nauk SSSR (for Blokhin).
2. Deystvitel'nyy chlen Akademii meditsinskikh nauk SSSR (for Parin).
3. Chlen-korrespondent AN SSSR (for Vernov).

(SPACE MEDICINE)

28590

S/565/61/000/009/004/004
B144/B101

17.2400

AUTHOR: Vernov, S. N., Corresponding Member AS USSR

TITLE: Space radiations

PERIODICAL: Meditsina i kosmicheskiye polety; sbornik, no. 9, 1961, 28-31

TEXT: The paper briefly summarizes the present knowledge of cosmic radiations and their effect on space flight. The existence of cosmic radiation increasing in intensity with rising distance from the earth has been known for some time. Skobel'tsyn showed that this radiation contains scarce particles having energies of more than 10^{18} ev, whereas even with the large particle accelerator at Dubna only $10 \cdot 10^9$ ev can be obtained. The higher the energy, the stronger is the effect on living beings. The radiation belts near the earth, which were recorded by the first artificial satellite and are due to the geomagnetic field, were unexpected. It is presumed that planets, such as Mars and Venus, and other celestial bodies with a magnetic field have radiation belts. The results obtained from the second space rocket have shown that the moon has no magnetic field. These belts form "reefs" endangering space-ships. Their radiation intensity is so strong that space-craft flying through them needs special protection,
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Space radiations

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B144/B101

particularly in long-period flights. Flights on satellites below the radiation belts have proved harmless to organisms. The radiation intensity on orbits, such as that of "Vostok" (apogee 302 km), was determined. The instruments of the third satellite recorded an additional radiation at altitudes of several 100 km, which did not exceed the dose permissible to laboratory workers. Thick walls will protect space vehicles against the "reefs" moving in space. Modern technology permits to determine the radiation intensity within seconds and to avoid imminent danger. Astronauts are endangered by solar eruptions and faculae of varying intensity and their effect on the magnetic fields followed by the formation of some kind of artificial cosmic radiation of solar origin. Its intensity can exceed that of ordinary cosmic radiation by a factor of from 10 to sometimes 10,000. Protection of space-craft against these solar "storms", occurring about once a year, makes it necessary to increase its size a little. Much heavier "storms" burst deep in the Galaxy. It is concluded that astronauts are hardly endangered by constant cosmic radiation, but that combination effects with other factors, such as weightlessness, have to be taken into account. Undoubtedly, radiation can be largely increased in some areas. To protect astronauts against these sporadic dangers, the sun, usually regarded as a very constant celestial body, has to be closely observed.

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VERNOV, Sz.N. [Vernov, S.N.]

Cosmic rays and the universe. Pt. 2. Term tud kozl 5 no.6:270-273
Je '61.

27183

S/056/61/041/002/004/028
B102/B205

3.2410

AUTHORS: Vernov, S. N., Solov'yeva, V. I., Khrenov, B. A.,
Christiansen, G. B.

X

TITLE: Fluctuations of the muon flux in extensive atmospheric showers

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41,
no. 2(8), 1961, 340 - 353

TEXT: The study of fluctuations of the muon flux in extensive atmospheric showers is very interesting, since the fluctuations accompanying the formation of avalanches of high-energy nuclear-active particles in the atmosphere, as well as the applicability of the various models of shower formation can be estimated from their character. This article gives a detailed presentation of the results of an investigation of muon-flux fluctuations in extensive atmospheric showers, which were carried out with a special device for comprehensive studies of such showers, made available by Moskovskiy gosudarstvennyy universitet (Moscow State University). First, the authors give a detailed description of the experi-

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Fluctuations of the muon flux...

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V

mental arrangement which used numerous Geiger-Müller counters in hodoscopic arrangement. Fig. 2 shows a muon detector. Detectors of this type, used for measurements on the earth surface, had a total area of 4.75 m^2 ; at a depth of 20 m water equivalent, it was 3.2 m^2 , and at 40 m water equivalent, 6.3 m^2 . The arrangement was designed in such a way that six-fold coincidences could be recorded. Showers with $N > 10^5$, in which the numbers of muons with $E > 4 \cdot 10^8 \text{ ev}$ were determined, were examined more closely. In order to eliminate the nuclear-active effect, only the records of those detectors were taken into account, which were more than 50 m away from the shower axis. The arrangement made it possible to measure the total number of shower particles and the number of muons in the shower simultaneously. The showers investigated were grouped as follows:

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Fluctuations of the muon flux...

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B102/B205

A - Detectors on the earth surface

$$\begin{cases} N = (2 - 5) \cdot 10^6 \\ N = (5 - 10) \cdot 10^6, \\ N \geq 10^7 \end{cases}$$

Detectors

$$\begin{cases} N = (2 - 4) \cdot 10^6 \\ N \geq 4 \cdot 10^6 \end{cases}$$

Detectors B

$$\begin{cases} N = (1 - 2) \cdot 10^6 \\ N = (2 - 4) \cdot 10^6, \\ N \geq 4 \cdot 10^6 \end{cases}$$

✓

The distribution of events with respect to the ratios q/p (q - number of recorded muons, p - average number of muons to be expected) for the groups (A: $N \geq 5 \cdot 10^6$; B: $N \geq 4 \cdot 10^6$; C: $N \geq 4 \cdot 10^6$) is given in a table. Conclusions: The slight fluctuations of the muon flux in showers with a given number of particles, which were observed experimentally, contradict the conception of the development of extensive air showers proposed by T. E. Cranshaw, and A. M. Hillas in a report delivered at the International Conference on Cosmic Particles. The fact that the experimentally

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B102/B205

Fluctuations of the muon flux...

observed fluctuations of the muon flux do not exceed the theoretically predicted fluctuations (theory takes into account only fluctuations at the altitude at which the primary shower-producing particle undergoes its first interaction) corroborates theory. Calculations show that in the case of a shower developing without fluctuation, the form of distribution with respect to the muon number n_μ in a shower with a given number of particles is highly sensitive to the quantity $\epsilon = (\Lambda + B)/\lambda - \gamma - 1$. Since Λ and γ are known, the value of λ can be estimated from the form of distribution with respect to n_μ (λ is the interaction mean free path of the ultrahigh-energy particles releasing the showers. In order to obtain the exact distribution of muon fluxes, it is necessary to improve the experimental conditions. The authors thank I. P. Ivanenko for a discussion, and K. I. Solov'yev, V. Sokolov, Ye. Shein, V. Putintsev, I. Vasil'chikov, V. Nazarov, G. Degtyareva, N. Proshina, and I. Massal'skaya, co-workers of MGU, for assistance. There are 4 figures, 4 tables, and 8 references: 7 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut yadernoy fiziki Moskovskogo gosudarstvennogo universiteta (Institute of Nuclear Physics of Moscow State Uni-

Card 4/5

Fluctuations of the muon flux...

17383

S/056/61/041/002/004/028
B102/B205

versity)

March 13, 1961

SUBMITTED: Legend to the Table: (1), (3), (6): Experimental distributions;
(2), (4), (7): distribution to be expected from the formula

$$\sum_{q=0}^{p/3} W(q), \quad (\text{для } q/p = 0 \div 1/3),$$

(2)

$$\sum_{q=p/3}^{2p/3} W(q) \quad (\text{для } q/p = 1/3 \div 2/3), \text{ и т. д.}$$

(8): distribution to be expected from the factor given in column 5 and from the statistical fluctuations. The last line but one gives q/p of all events.

Card 5/5

PISARENKO, N. F., SAVENKO, I. A., CHUDAKOV, A. Ye., SHAVRIN, P. I.,
VERNOV, S. N., GORCHAKOV, E. V., LOGACHEV, Yu. I., NESTEROV, V. E.

"Investigations of Radiation During Flights of Satellites, Space
Vehicles, and Rockets:"

Soviet Papers Presented at Plenary Meetings of Committee on Space Research
(COSPAR) and third International Space Symposium, Washington, D. C.,
23 Apr - 9 May 62.

VERNOV, S. N.
~~VARNOV, S. N.~~

"Radiation Belts"

Report to be presented at the Varenna Summer School, Varenna, Italy,
12-13 June 1962

VERNOV, Sergey N., LOGACHEV, Yu. I., GORCHAKOV, Ye. V., SAVENKO, I. A.,
CHUDAKOV, Alek Ye. and NESTEROV, V. Ye.

"The earth's radiation belt"

report to be submitted to the 13th Intl. Astronautical Congress, IAF,
Varna, Bulgaria, 23-29 Sep 1962.

41906

S/560/62/000/013/002/009

I046/I242

AUTHORS: Vernov, S.N., Savenko, I.A., Shavrin, F.I.,
Nesterov, V.E., and Pisarenko, N.F.

TITLE: Radiation belts of the earth at altitudes from
180 to 250 km

SOURCE: Akademiya nauk SSSR. Iskusstvennyye sputniki
Zemli. no.13. Moscow, 1962, 67-74

TEXT: Assuming identical altitude dependence of the
radiation intensity in the northern and the southern hemispheres,
it is shown from measurements made on the third orbital space ship
on December 1, 1960 (orbital data: perigee 187 km, apogee 265 km,
inclination 65°) that the radiation intensity in the outer belt
decreases by a factor of 2 between $h = 235$ km and $h = 185$ km.

Card 1/2

S/560/62/000/013/002/009
I046/I242

Radiation belts of the earth...

Comparison with the findings of the second orbital spaceship shows that in the high radiation-intensity region in the Southern Atlantic the bremsstrahlung intensity has increased with the 100 km decrease in altitude and the entire region appears to have shifted to the north-west. This anomalous behavior may be due to either the magnetic storm of November 30 and December 1, 1960, or to some new phenomenon on the inner boundary of the radiation belts. The average bremsstrahlung energy for the outer-belt electrons is $E_e \approx 2 \cdot 10^5$ eV; the corresponding electron flux is $2 \cdot 10^5$ particles $\text{cm}^{-2} \text{sec}^{-1}$. The radiation over the Brazilian magnetic anomaly is due to the protons of the inner radiation belt; the particle count in this region (Geiger counters) drops from 10 particles $\text{cm}^{-2} \text{sec}^{-1}$ at $h=320$ km (orbital ship II) to 2 particles $\text{cm}^{-2} \text{sec}^{-1}$ at $h=220$ km (orbital ship III). There are 6 figures and 2 tables.

SUBMITTED: September 12, 1961
Card 2/2

31550

S/048/62/026/005/014/022
B102/B104

3,2410 (2205, 2705, 2805)

AUTHORS:

Vernov, S. N., Khristiansen, G. B., Belyayeva, I. F.,
Dmitriyev, V. A., Kulikov, G. V., Nechin, Yu. A.,
Solov'yeva, V. I., and Khrenov, B. A.

TITLE:

The primary cosmic-ray component at superhigh energies and
some peculiarities of its interaction with nuclei of air
atoms

PERIODICAL:

Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya,
v. 26, no. 5, 1962, 651-657

TEXT: The paper is a report on experiments with the Moscow University
large apparatus (area $4 \cdot 10^4 \text{ m}^2$) for comprehensive studies of extensive
air showers induced by high-energy cosmic particles. The charged-particle
detectors (Geiger counters in hodoscope arrangement) cover an area of
 110 m^2 , the muon detectors (2-3 counter layers shielded with lead and iron,
in hodoscope arrangement) more than 12 m^2 , 6.3 m^2 of which are under

Card 1/4

S/048/62/026/005/014/022
B102/B104

The primary cosmic-ray component ...

40 m water equivalent. The nuclear-active-particle detectors form a system of 128 ionization chambers (8 m^2) shielded by lead and graphite filters. The number of muons produced in charged-pion decay was estimated (the pions were assumed to be formed in gamma-quantum

photoeffect on nuclei of air atoms): $N_{\mu}^n(E) \leq \sigma_0 E_0 / 1.8(1-\alpha)E$, $\alpha \leq 0.5$, $\sigma_0 < 10^{-3}$; for $E_0 \approx 10^{16}$ ev and $E_{\mu} = 10^{10}$ ev ($\alpha = 0.5$), $N_{\mu}^n(10^{10}) \leq 10^3$.

The number N_{μ}^n of muons in nuclear showers was measured. For showers with $N = 7 \cdot 10^6$ a mean number of $8 \cdot 10^4$ muons with $E \geq 10^{10}$ ev is to be expected. The spatial muon flux distribution was determined for these two types of showers (ϕ_{μ}^n and ϕ_{μ}^{π}). In the case of a simple model of air shower production (Suppl. Nuovo Cimento, 2, 649, 1958), an analysis of the experimental data yields $N = k_e E_0 \exp(-x + x_m + x_0) / \Lambda$; E_0 is the energy of the primary particle, x_0 is the depth of its first interaction, $x_m = B \log E_0$ (x - depth of observation), N is the total number of

Card 2/4

S/048/62/026/005/014/022
B102/B104

The primary cosmic-ray component ...

shower particles; the number of muons $N_{\mu} = k_{\mu} E_0^{\alpha}$; $\Lambda = 200 \text{ g/cm}^2$,
 $B = 30 \text{ g/cm}^2$ and $\alpha = 0.8 \pm 0.1$. If the primary energy spectrum has the
 shape $A E_0^{-(\gamma+1)} dE_0$, at fixed N the N_{μ} distribution has the shape
 $\frac{1}{N_{\mu}} \left(\frac{\Lambda+B}{\Lambda} - \gamma - 1 \right) dN_{\mu}$, Λ being the mean free path with respect to inter-
 action. Comparison between experiment and theory yields $\lambda = (85 \pm 5) \text{ g/cm}^2$,
 as an upper limit. For charged muons their energies (E_{μ}) and numbers
 (n_{μ}) were measured and calculated for several altitudes H ; W is the
 probability for a charged pion produced at H decays without interacting
 with an air nucleus. The results indicate that in $\sim 3\%$ of all cases
 nuclear interaction is accompanied by a production of narrow beams of
 great numbers of charged pions. There are 8 figures.

Card 3/4

The primary cosmic-ray component ...

S/048/62/026/005/014/022
B102/B104

| Величина | $H = 100 \text{ м}$ | $H = 250 \text{ м}$ | $H = 500 \text{ м}$ | $H = 3 \cdot 10^3 \text{ м}$ | $H = 10^4 \text{ м}$ | $H = 5 \cdot 10^4 \text{ м}$ | $H = 10^6 \text{ м}$ | $H = 1,7 \cdot 10^6 \text{ м}$ |
|-------------------------|---------------------|---------------------|---------------------|------------------------------|----------------------|------------------------------|----------------------|--------------------------------|
| $E_{\pi}, \text{ эв}$ | $1,4 \cdot 10^{10}$ | $1,8 \cdot 10^{10}$ | $3,3 \cdot 10^{10}$ | $9,3 \cdot 10^{10}$ | $3,3 \cdot 10^{11}$ | $6,3 \cdot 10^{11}$ | $1,2 \cdot 10^{12}$ | $1,7 \cdot 10^{12}$ |
| $n_{\pi} = \frac{3}{W}$ | 30 | 15 | 20 | 25 | 75 | 100 | 100 | 90 |
| $n_{\pi_{\text{теор}}}$ | 9 | 8 | 10 | 16 | 25 | 32 | 36 | 40 |

4

Card 4/4

S/048/62/026/005/016/022
B108/B102

3.2410

AUTHORS: Vernov, S. N., Dmitriyev, V. A., Khristiansen, G. B., and
Gulyam Sadyk Mukhibi

TITLE: Study of the high-energy muon spectrum at a depth of
40 m water equivalent

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26,
no. 5, 1962, 661-667

TEXT: The underground muon spectrum was studied with an array of
ionization chambers (overall area, 1.75 m^2) with 48 Geiger-Müller counters
(1.6 m^2) operating at energies from 10^{10} to 10^{13} ev. The muon spectrum
was determined from the spectrum of showers induced by high-energy muons
in the ionization chambers. The spectrum of the showers recorded, each
of which involved ≥ 200 relativistic particles, could be approximated by
an exponential law with the index $\gamma = -1.9 \pm 0.2$. In the case of showers
with ≥ 2000 particles, $\gamma = -1.8 \pm 0.4$. The strongest showers involved
more than 30,000 particles. The data obtained show that the muon-energy

Card 1/2

Study of the high-energy...

S/048/62/026/005/016/022
B108/B102

spectrum is uniform throughout the range of 10^{11} to 10^{13} ev. The constant exponent γ in this range is indicative of a more complex nature of muon production in the atmosphere than has hitherto been assumed. The production of muons by K-mesons, which would increase the exponent γ , is also considered. There are 3 figures.

8

Card 2/2

28957
S/048/62/026/006/013/020
B125/B102

3.2420
AUTHORS:

Vakulov, P. V., Vernov, S. N., Gorchakov, Ye. V., Logachev, Yu. I., Nesterov, V. Ye., Nikolayev, A. G., Pisarenko, N. F., Savenko, I. A., Chudakov, A. Ye., and Shavrin, P. I.

TITLE:

Radiation studies during the flights of satellites, spaceships and rockets

PERIODICAL:

Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 6, 1962, 758-781

TEXT: This report deals with radiation measurement made by the second and the third Soviet spaceship, by the rocket launched toward the Venus on February 12, 1961, and by the third Soviet earth satellite (August 15, 1958). The spaceships were equipped with scintillation counters, gas discharge counters and elements for storing data through 24 hours. The northern and southern zones of increased radiation intensity are undoubtedly linked by the lines of force of the geomagnetic field. The increased radiation intensity is due to electrons of the outer radiation belt, slowed down in the jacket of the spaceship. The

Card 1/3

Radiation studies during the flights ...

S/O48/62/026/006/013/020
B125/B102

boundaries of this belt were determined more accurately by the lower orbiting Soviet spaceship. At 16 hours after the chromosphere flare of June 17, 1958 had vanished but still a few hours before the magnetic storm, charged particle intensity increased. The electron spectrum of the outer radiation belt does not change much at an altitude of 32,000-40,000 km, nor did the magnetic storm which occurred during the flight of the third Soviet spaceship have any substantial effect on the outer radiation belt. Except for a few percent, the proton intensity of the inner radiation belt remained constant during the three weeks' flight of the third Soviet satellite. The increased radiation intensity over the Brazilian anomaly, observed on board of the second spaceship at an altitude of 320 km, was due to the inner radiation belt. In this anomaly, the proton component of the inner radiation belt is predominant at small geomagnetic latitudes. The portion of X-rays increases with increasing latitude. A zone of lower bremsstrahlung intensity separates the outer from the inner radiation belt. This zone is practically absent in the region of the Brazilian anomaly. The equator of cosmic rays, determined by the second and the third Soviet spaceship resembles remotely a sine curve running between 11° of northern and 11° of southern latitude.

Card 2/3

Radiation studies during the flights ...

S/048/62/026/006/013/020
B125/B102

Between 60° western and 60° eastern longitude the equator of cosmic radiation lies north of the theoretical sine curve. The general trend of the lines of equal cosmic radiation intensity corresponds in general to the distribution of magnetic rigidity. There are 16 figures and 2 tables.

ASSOCIATION: Nauchno-issledovatel'skiy institut yadernoy fiziki
Moskovskogo gos. universiteta im. M. V. Lomonosova
(Scientific Research Institute of Nuclear Physics of the
Moscow State University imeni M. V. Lomonosov).
Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR
(Physics Institute imeni P. N. Lebedev of the Academy of
Sciences USSR)

Card 3/3

h2155

S/203/62/002/001/003/019
I023/I223

3.2100 (also 3002)

AUTHORS: Vernov, S.N., Savenko, I.A., Shavrin, P.I., Nesterov, V.Ye.
and Pisarenko, N.F.

TITLE: Earth's radiation belts at 180-250km height

PERIODICAL: Geomagnetizm i Aeronomiya, v.2, no.1, 1962, 41-47

TEXT: The distribution of cosmic rays and radiation belts at the height of 307-339km were obtained by the second Soviet cosmic satellite. The third cosmic space-ship, launched on December 1, 1960 with a perigee of 180km, apogee of 250km and an inclination of 65° measured the intensity and geographical position of the radiation belts in the height range 180-250km. The apparatus consisted of a NaI(Tl) crystal (a cylinder of 14mm height and 30mm diameter) with a photomultiplier and a gas counter. The crystal counted all particles above 25kev and measured the total energy dissipation in it. The counting rates increase from the equator to higher latitudes: of the counter from 0.8 to 3.2 $\frac{\text{counts}}{\text{cm}^2 \cdot \text{sec}}$.

Card 1/3

S/203/62/002/001/003/019
I023/I223

Earth's radiation belts...

of the photomultiplier from 3 to 12 $\frac{\text{counts}}{\text{cm}^2 \cdot \text{sec}}$, and the energy dis-
sipation increased from 7.5×10^6 to $3.7 \times 10^7 \frac{\text{ev}}{\text{cm}^2 \cdot \text{sec}}$. When passing
radiation belts the counting rate increased considerably. Graphs
based on data from space-ship 2 and 3 are given. The geographical
distribution of the radiation intensity as measured by the
scinillation counter is also presented in a graphical form. The
radiation intensity in the outer belt as measured by space-ship 2
is on the average 2.2 times higher in the southern hemisphere
(average height 330km) than in the northern (average height 320km).
The same ratio as measured by space-ship 3 is 4.4 (average height
in southern hemisphere - 235km, in the northern - 185km). There
were variations in the geographical distribution of the belts
between the two flights. The proton flux decreased between the
two flights. There are 6 figures and 2 tables.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M.V.

Card 2/3

S/203/62/002/001/003/019
I023/I223

Earth's radiation belts...

Lomonosova, Institut yadernoy fiziki (Moscow State
University im. M.V. Lomonosov, Institute of Nuclear
Physics)

SUBMITTED: August 28, 1961

Card 3/3

VERNOV, S. M.[Viernov, S. M.]; CHUDAKOV, O. Ye.[Chudakov, O. IE.]

Investigation of cosmic rays and the terrestrial corpuscular
radiation by means of rockets and satellites. Dos. such. fiz.
no.6:17-33 '62. (MIRA 16:1)

(Spaceships) (Cosmic rays)

VERNOV, S.N.

Introductory note. Izv.AN SSSR.Ser.fiz. 26 no.5:546-548 Ap
62. (MIRA 15:5)
(Cosmic rays) (Particles (Nuclear physics))

24.4600

37549

S/048/62/026/005/013/022

B102/B104

AUTHORS: Vernov, Yu. S., and Sisakyan, I. N.

TITLE: The problem of gamma quantum and muon emission in high-energy multiple production

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 5, 1962, 642-650

TEXT: Ye. L. Feynberg (Izv. AN SSSR, Ser. fiz. 26, 5, 622) has shown that at very high energies in multiple particle production gamma quanta, muons or even electron pairs can be emitted. This effect is now theoretically studied on the basis of approximate models. Owing to the difficulties arising in strong-interaction procedure the problem cannot be solved exactly, but the radiation intensities can be estimated in perturbation-theoretical approximation. The total number of γ -quanta emitted is calculated for a meson-nucleon plasma which radiates as a black or gray body, on the basis of Landau's hydrodynamic theory.

Approximately $N_{\gamma} \approx 30Ae^2 (T_0/\mu)^{4/3} \sqrt{\ln(T_0/\mu)}$ is obtained. The angular

Card 1/2

The problem of gamma quantum ...

S/048/62/026/005/013/022
B102/B104

distribution is determined for an isotropically emitting volume element, terms of higher order than μ/T_0 being ignored. Numerical estimates for the total energy and the total number of γ -quanta emitted are given. Finally, the intensity of the electromagnetic emission is estimated with the help of perturbation theory. The results are only illustrative and give the possible order of magnitude of the effect. For $E_L \sim 10^{15}$ ev, $N_{\gamma} \sim N_{\pi}$ and $N_{\mu} \sim 10^{-3} N_{\pi}$. There are 5 figures.

Card 2/2

24600

35562
8/056/62/042/003/018/049
B102/B138

AUTHORS: Vernov, S. N., Li Don Khva, Khrenov, B. A., Khristiansen, G. B.

TITLE: Muon beams in extensive air showers

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 3, 1962, 758 - 769

TEXT: The underground measurements of cosmic-particle distributions described in Ref. 1 (ZhETF, 37, 1252, 1959) have been continued. The spatial muon distributions have been measured at a depth of 40 m water-equivalent by means of Geiger counters in hodoscope circuit. The total area covered by the counters was 1.2 m². The spatial muon distribution was characterized by the distance D between the muon tracks in dependence on M (number of recording counters in the middle row), N (number of particles in the shower) and R (distance from the shower axis on the earth's surface). The showers recorded were divided into two groups: R < 30m (N = 5 · 10⁴ - 10⁶), and R > 50m (N = 10⁶ - 2 · 10⁷). The meson track distribution determined was analyzed
Card 1/2

10

15

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30

DORMAN, Leyb Isaakovich; VERNOV, S.N., prof., otv. red.; ALEKSEYEV,
D.M., red.izd-va; LAUT, V.G., tekhn. red.

[Variations of cosmic rays and space exploration] Variatsii
kosmicheskikh luchei i issledovanie kosmosa. Moskva, Izd-
vo Akad. nauk SSSR, 1963. 1026 p. (MIRA 16:7)

1. Chlen-korrespondent AN SSSR (for Vernov).
(Cosmic rays) (Outer space—Exploration)

VERNOV, S.N.

VERNOV, S.N., GORCHAROV, YE.V., LOGACHEV, YU.I.
CHARAKHCHYAN, A.N., CHARAKHCHYAN, T.N., CHUDAKOV, A. YE.

Cosmic rays in the stratosphere and their correlation with solar activity.

Report to be submitted for Space Research Committee on COSPAR 6th plenary meeting Warsaw, Poland 11 June 63-

VERNOV, S.N.

"Trapped radiation."

Report submitted to the Symposium on Results of the IOY-IGC (Intl.
Geophysical Year) Los Angeles, California 12-16 Aug 1963

L 17445-63

EWTEL /RDS AFPTC /ASD /ASD-2

ACCESSION NR: AP002306

9/0030/63/100/100/0040/0013

AUTHORS: Petrov, B. N. (Academician); ~~Vernov, S. M.~~ (Corr. member,
of Sciences USSR); Liberson, L. Y. Candidate of Technical Sciences

TITLE: Applications of Mossbauer effect.

SOURCE: AN SSSR. Vestnik, no. 7, 1963, 40-43

TOPIC TAGS: radiation, recoil, resonance, Doppler shift, crystal lattice

ABSTRACT: Recently Mossbauer discovered a new aspect of emission and scattering of gamma rays by nuclei in solids. A certain fraction of these rays of the nuclei of the solid is emitted without individual nuclear recoil. Instead, the recoil momentum is delivered to the crystal lattice as a whole, resulting in negligible Doppler shift. The most significant effect of this Mossbauer radiation is the extremely precise resonance line in the emission or absorption spectrum. For example, the 14.4-kev gamma ray without recoil by 0.1-microsecond Fe^{57} in metallic iron has been the most precisely defined electromagnetic frequency yet discovered. The longer the half-life of a nucleus, the sharper becomes the resonance curve. A whole series of unique applications can be foreseen for the applications of this principle. In physics, this effect may be useful in obtaining a better insight into crystal lattice vibrations, metallic superconductivity, and relativistic effects. In chemistry, Card 1/2

L 17445-63
ACCESSION NP: AP3004306

one may study molecular structures, the hyperfine splitting due to quadrupole-magnetic field interactions, and isomer chemistry. Finally, in automation the Mossbauer effect could be useful in controlling very small relative movements and complex chemical reactions and in constructing devices to obtain and process information.

ASSOCIATION: none

SUBMITTED: 00

DATE ACQ: 15Aug63

ENCL: 00

SUB CODE: PH

NO REF SOV: 000

OTHER: 000

Card 2/2

VERNOV, S.N.; SAVENKO, I.A.; SHAVRIN, P.I.; TVERSKAYA, L.V.

Structure of the earth's radiation belts at an altitude of
320 km. Geomag. i aer. 3 no.5:812-815 S-O '63. (MIRA 16:11)

Institut yadernoy fiziki Moskovskogo gosudarstvennogo universi-
teta.

VERNOV, S., laureat Leninskoy premii

Mysteries of the near and far space. Av. i kosm. 46 no.6:24-32
Je '63. (MIRA 16:8)

1. Chlen-korrespondent AN SSSR.
(Outer space--Exploration)

VERNOY, S. M.; KHRISTIANSEN, G. B.; ABROSIMOV, A. M.; KHRENOV, DMITRIYEV, V. A.
SOLOVYEVA, V. I.; SOLOVYEV, K.I.; BELYAYEVA, M.F.; NECHIN, Yu. A.; VEDENEYEV, O.N.;
KULIKOV, G. V.; FOMIN, Yu. A.

Summary of the new data on EAS structure obtained with the aid of the complex
equipment of Moscow State University.

Report submitted for the 8th Intl. Conf. on Cosmic Rays (IUPAP) Jaipur, India,
2-14 Dec 1963

VERNOV, S. N.; SAVENKO, I. A.; TVERSKAYA, L. V.; TVERSKOY, B. A.; SHAVRIN, P. I.;

"About the fast electron intensity asymmetry in conjugated points at low altitudes." (USSR)

Report submitted for the COSPAR Fifth International Space Science Symposium, Florence
Italy, 8-20 May 1964.

VERNOV, S.N.; SAVENKO, I.A.; TVERSKAYA, L. V.; SHAVERIN, P. I.; TVERSKOY, B. A.;

"About the fast electron intensity asymmetry in conjugated points at low altitudes"(USSR)

Report submitted for the COSPAR Fifth International Space Science Symposium, Florence,
Italy, 8-20 May 1964.

VERNOV, S. N.; CHUDAKOV, A. Ye.;

"Investigation of radiation at altitudes of 250-800 km during flight of Cosmos 17."(USSR)

Report submitted for the COSPAR Fifth International Space Science Symposium, Florence, Italy, 8-20 May 1964.

VERNOV, S. N.; NESTEROV, V. Ye.; PISARENKO, M. F.; SAVENKO, I. A.; SAVUN, O.I.;
SHAVRIN, P. I.; SHARVINA, K. N.;

"A Study of the Earth's radiation belts in the region of the Brazilian magnetic anomaly at altitudes of 235 to 345 kms. (USSR)."

Report submitted for the COSPAR Fifth International Space Science Symposium, Florence, Italy, 8-20 May 1964.

VERNOV, S. N., SAVENKO, I. A., SHAVRIN, P. I., NESTEROV, V. E., PISAFENKO, N. F.,
and BASILOVA, R. N. (Acad. Sci. USSR)

"A Study of Cosmic Rays at Altitudes of 200 to 400 Km"

Report presented at the COSPAR, 5th Intl Space Science Symposium, Florence,
Italy, 8-20 May 1964

ESD(51/52) 7/82
ACCESSION NR: AP5002107

Shayria, P. I.:

Conference on ...

... v. 23, no. 12,

Some data on the ... below 400 kb are presented.

magnetically quiet days. ...
density was also noted within the radiation belts. ...

tribution in the inner zone ...
with energies exceeding 2 mev within the ... of Cosmos-4

ACCESSION NR: AF5002100

... A. Ye: Vakuiov, P. V. Gorchakov,
... Y. I. Lyubimov,
... Terobvakaya,

... at the end
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... at Moscow, 4-10-1960

... 18, 1960

... measurement
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C&ED 215

EXHIBIT 100-10000

EXHIBIT 100-10000

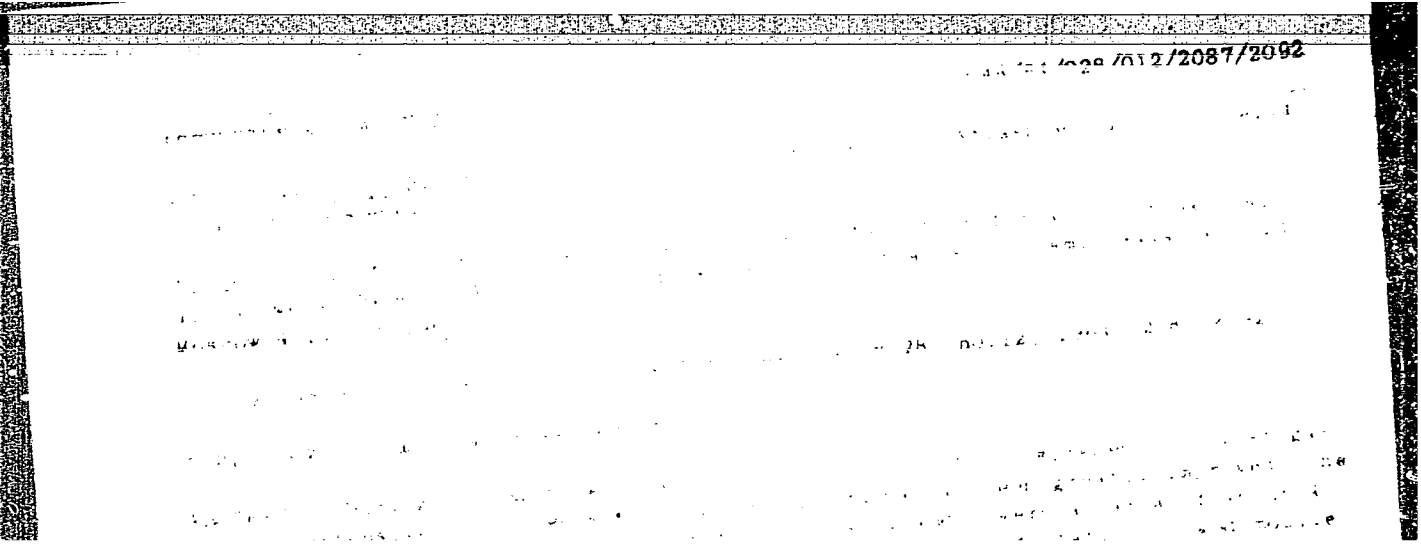
particle energies
values and 4 formulae:

4.1

ENCLOSURE 01

20078301

[Faint, mostly illegible text follows, possibly including a list or table of items.]



1/3

figures.

ASSOCIATION: none

ENCL: 01

SUBMITTED

DATE: 3

SUB CODE: AA

2/3

VERNOV, S.H.; CHUDAKOV, A.Ye.; GORCHAKOV, Ye.V.; LOGACHEV, Yu.I.; NESTEROV,
V.Ye.; SAVENKO, I.A.; SHAVRIN, P.I.

Radiation belts of the earth. Geofiz. biul. no.14:96-108 '64.
(MIRA 18:4)

ACCESSION NR: AP4026240

S/0293/64/002/001/0136/0146

AUTHOR: Vernov, S. N.; Savenko, I. A.; Shavrin, P. I.; Nesterov, V. Ye.;
Pisarenko, N. F.; Tel'tsov, M. V.; Pervaya, T. I.; Yerofeyeva, V. N.

TITLE: Some results of radiometric measurements at heights of 200—400 km during
1960-1963

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 1, 1964, 136-146

TOPIC TAGS: artificial satellite, radiation dose, radiation belt, cosmic radia-
tion, cosmic ray, solar activity cycle, artificial radiation belt, space flight,
astronaut

ABSTRACT: Measurements made by 15 satellites and spaceships (the second and third
spaceships, satellites of the "Cosmos" series, and "Vostok" spaceships) during the
period from August 1960 through June 1963 at heights of 175-405 km were used to
determine the daily values of the radiation dose for various flight trajectories;
these doses were 10-55 mrad/day and are not dangerous for astronauts when the
shielding of the ship is denser than 3-5 g/cm². At the time of measurements in
April 1962 and June 1963 it was found that there was an increase by a factor of 1.2
in the intensity of cosmic radiation in the high latitudes where the magnetic rigi-
dity does not exceed 5.4 Bev. There was no increase of intensity in the equatorial

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latitudes (magnetic rigidity greater than 5.4 Bev). These facts confirm the assumption of a genetic relationship between excess cosmic radiation recorded at heights of 200-400 km and primary cosmic radiation. Using mirror points at heights of about 350-370 km, it was possible to determine the lifetime of the particles of the artificial radiation belt as approximately 3 months. For orbits of 210-369 km the dose caused by the artificial radiation belt 20 days after its formation was almost 3 times as large as the dose caused by cosmic radiation in the natural belts. The dependence of the mean daily intensity caused by the radiation belts on height was determined. In an orbit of 207-407 km this intensity was 5.6 times as large as in an orbit of 209-301 km. The contribution to the dose by the radiation belts for satellites with an apogee of 400 km becomes equal to the dose caused by cosmic radiation. A table in the original article lists the characteristics of the radio-metric apparatus carried aboard the "Cosmos" satellites; another table lists the 15 satellites and spaceships and the absorbed dose measured by each. "The authors express thanks to S. F. Papkov, Yu. V. Trigubov, O. I. Savun, A. F. Tupikin, and L. A. Smirnov for participation in developing the apparatus and making the experiments and to Prof. N. L. Grikorov for participation in discussion of the results." Orig. art. has: 2 figures, 2 tables, and 9 formulas.

ASSOCIATION: none

Card 2 / 3

ACCESSION NR: AP4026240

SUBMITTED: 29Jul63

SUB CODE: AA

ATD PRESS: 3053

NO REF SOV: 011

ENCL: 00

OTHER: 002

Card 3/3

ACCESSION NR: AP4034800

S/0293/64/002/002/0280/0288

AUTHOR: Baslova, R. N.; Varnov, S. N.; Nesterov, V. Ye.; Pisarenko, N. F.;
Savenko, I. A.; Shavrin, P. I.

TITLE: Investigation of cosmic radiation at heights of 200-350 km by the satellites
"Kosmos 4" and "Kosmos 7"

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 2, 1964, 280-288

TOPIC TAGS: artificial satellite, cosmic radiation, cosmic ray equator, cosmic
rays, radiation counter, inner radiation belt, radiation belt

ABSTRACT: As the result of an analysis of the counting rate of STS-5 counters
carried aboard the satellites "Kosmos 4" and "Kosmos 7", it was possible to find 13
additional points on the cosmic ray equator. A study of the geographic distribu-
tion of the counting rate of the STS-5 counters also made it possible to discover a
relationship between the radiation registered by these counters and primary cosmic
rays. The regular longitude variation of the STS-5 counting rates in the neighbor-
hood of the equator, the relationship of the counting rate to the magnetic rigidity
cutoff of the point of measurement and the reasonable latitude variation are all
properties of the radiation registered by these counters which can be related to

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ACCESSION NR: AP4034800

primary cosmic rays. It would be difficult to explain these facts by assuming that the registered particles had diffused from the inner radiation belt. Fig. 1 of the Enclosure shows the geographic position of the points of minimum radiation registered by the counters. "The authors wish to thank Ye. A. Voronina, L. V. Drozdova and N. M. Trishkina for computation and drafting work". Orig. art. has: 5 formulas, 5 figures and 2 tables.

ASSOCIATION: None

SUBMITTED: 19Nov63

DATE ACQ: 20May64

ENCL: 01

SUB CODE: AA, SV

NO REF SOV: 005

OTHER: 006

Card 2/3

ACCESSION NR: AP4034800

ENCLOSURE: 01

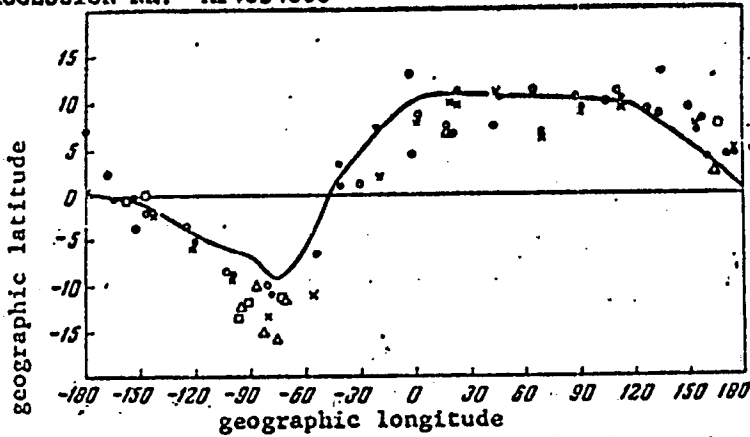


Fig. 1. Geographic positions of points of minimum radiation registered by the STS-5 radiation counters. Open circles denote the minimum counting rate of the STS-5 counter according to data from the second satellite-ship; the crosses denote the minimum counting rate of the STS-5 counter according to data from the third satellite-ship; the filled circles denote the minimum photomultiplier current according to data from the third satellite-ship; the triangles denote the minimum counting rate of the STS-5 counter according to data from the satellite "Kosmos-4"; the squares denote the minimum counting rate of the STS-5 counter according to data from the satellite "Kosmos-7"; the solid line is the cosmic ray equator as fixed by Kellogg.

ACCESSION NR: AP4034801

S/0293/64/002/002/0289/0295

AUTHOR: Vernov, S. N.; Yerofeyeva, V. N.; Nesterov, V. Ye.; Savenko, I. A.; Shavrin, P. I.

TITLE: Geographic position of the maxima of particle intensity in the outer radiation belt at low heights

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 2, 1964, 289-295

TOPIC TAGS: upper atmosphere, radiation belt, outer radiation belt, aurora, radiation intensity maximum

ABSTRACT: As a result of investigations by the second and third Soviet space-ships, the position of the maxima of intensity of particles in the outer radiation belt has been established experimentally at all longitudes. The experimentally determined intensity maxima in the outer radiation belt are situated at different longitudes approximately along the drift paths of the mirror points. However, in two ranges of longitude (from -150 to -110° and from -50 to -10°) in the northern hemisphere and in magnetically conjugate regions there is a displacement of the position of the intensity maxima in the direction of greater values L. In the first of the mentioned regions the position of the maxima of

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ACCESSION NR: AP4034801

frequency of occurrence of auroras also is displaced in the direction of larger L. As a result of investigations made on the satellite "Kosmos-4" it has been found that in a broad range of longitudes there is a displacement of the intensity maximum in the outer radiation belt on magnetically quiet days in the direction of greater latitudes than is the case on magnetically disturbed days. Fig. 1 of the Enclosure shows the geographic position of the maxima of intensity of particles in the outer radiation belt at low heights. The authors thank M. V. Tal'tsov and N. P. Pisarenko for participation in the experiment, L. V. Drozdova and O. P. Gorskaya for assistance in finalizing the data and V. Gess who furnished the maps of drift paths at various heights". Orig. art. has: 5 figures and 1 table.

ASSOCIATION: None

SUBMITTED: 19Nov63

DATE ACQ: 20May64

ENCL: 02

SUB CODE: AA

NO REF SOV: 006

OTHER: 005

Card 2/4

ACCESSION NR: AP4034801

ENCLOSURE: 01

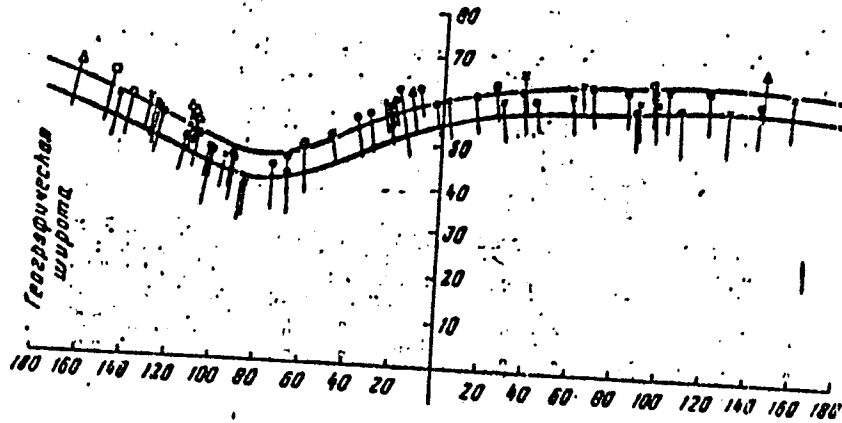


Fig. 1. Geographic position of the maxima of intensity of particles in the outer radiation belt at low heights. The filled circles and squares denote experimentally determined points of the maxima found from flights of the second and third

Card 3/4

ACCESSION NR: AP4034801

ENCLOSURE: 02

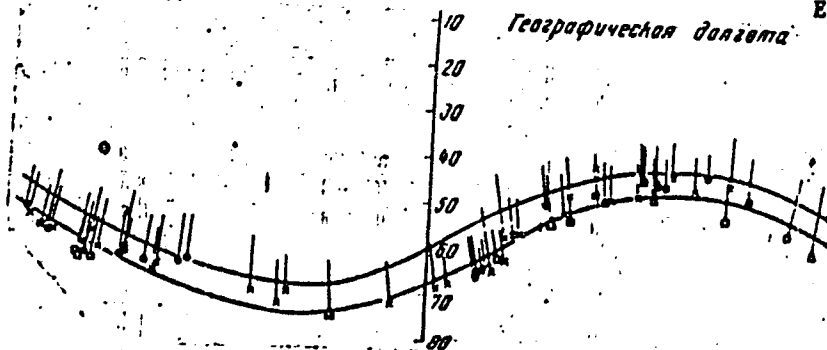


Fig. 1 (cont.) spaceships respectively; the crosses denote magnetically conjugate points for maxima measured on spaceships; the open squares denote experimentally determined points of the maxima obtained during the flight of the satellite "Kosmos-4"; the triangles denote magnetically conjugate points for maxima measured on the satellite "Kosmos-4"; the lines denote the drift paths of mirror points (at lesser latitudes for $L = 3$ and at greater latitudes for $L = 4$).

vertical: geographic latitude; horizontal: geographic longitude

Card 4/4

ACCESSION NR: AP4041571

S/0293/64/002/003/0485/0491

AUTHOR: Vernov, S. N.; Nesterov, V. Ye.; Savenko, I. A.; Shavrin, P. I.; Sharvina, K. N.

TITLE: Geographical intensity distribution of radiation in the region of Brazilian magnetic anomaly at the height of 300 km

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 3, 1964, 485-491

TOPIC TAGS: artificial satellite, geomagnetic anomaly, Geiger counter; oscillation counter, isoline, nuclear burst, artificial radiation belt, radiation intensity, inner belt

ABSTRACT: Data from Cosmos 4, Cosmos 7, and Cosmos 15, which passed through the region of the Brazilian geomagnetic anomaly at the heights of 235-340 Km, have been studied. Charged particles were counted by Geiger and oscillation counters. The results of processing are presented graphically by isolines, and the numerical values are given in a table. The numbers of the table show a difference between the two measurements. The data from Cosmos 4 were obtained before a nuclear burst in the atmosphere, and the data of Cosmos 15 were obtained

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ACCESSION NR: AP4041571

after the burst. The difference is created by an artificial radiation belt caused by the burst. The radiation of the artificial belt consists of electrons with energies of about 1—7 Mev, which have been recorded in the region of the Brazilian anomaly. The radiation intensity in the inner belt and in the artificial belt is approximately equal. Orig. art. has: 3 figures and 3 tables.

ASSOCIATION: none

SUBMITTED: 14Jan64

ATD PRESS: 3056

ENCL: 00

SUB CODE: AA

NO REF SOV: 004

OTHER: 002

Card 2/2

ACCESSION NR: AP4041572

S/0293/64/002/003/0492/0497

AUTHOR: Vernov, S. N.; Nesterov, V. Ye.; Pisarenko, N. F.; Savenko, I. A.; Savun, O. I.; Shavrin, P. I.; Sharvina, K. N.

TITLE: Investigation of terrestrial radiation belts in the region of the Brazilian magnetic anomaly at heights of 235 to 345 km

SOURCE: Kosmicheskiye issledovaniya, v. 2, no. 3, 1964, 492-497

TOPIC TAGS: magnetic anomaly, anomaly region, inner radiation belt, magnetic level, Geiger counter, electron lifetime, artificial radiation belt

ABSTRACT: A large region of high radiation intensity at the height of 300 km was detected by the second space probe at the Brazilian great negative geomagnetic anomaly. The intense radiation is caused by the sinking inner radiation belt at that height in the anomaly region; the intensity of the magnetic field at the height mentioned is less than 0.22 gs. The comparison of the counter speeds of Cosmos 4 with those of the second probe showed a more rapid decrease in the intensity of the magnetic field when the measurements were

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ACCESSION NR: AP4041572

carried out by Cosmos 4 at magnetic levels 1.2, 1.3, and 1.45. This comparison shows an increase of protons of the energy 25 Mev in the period between the launching of these space probes. Four times more particles were counted during the Cosmos-4 flight in 1962 than in 1960 during the flight of the second space probe. The lifetime of electrons in the artificial radiation belt is different for individual levels and the intensity of the magnetic field. Orig. art. has: 3 figures and 1 table.

ASSOCIATION: none

SUBMITTED: 14Jan64

ATD PRESS: 3064

ENCL: 00

SUB CODE: AA

NO REF SOV: 004

OTHER: 008

Card 2/2

L 2044-65

FSP(R)/PSS-5/EWT(1)/PS(8) EDIA(2) TRIG/PROB(1)

IL/SW/NS
AUTHOR: Vernov, S. Il.; Chudakov, A. Ye.; Vukulov, P. V.; Gorchakov, Ye. V.; Lopachev, V.

Investigation of...
radiation...
AD-IRA...
TABLE...

L 7044-65

ACCESSION NUMBER

slow and smooth variations in cosmic-ray intensity connected with
changes of the magnetic situation in the solar system were recorded.
The particle fluxes in the radiation belts recorded by
are given. The

ASSOCIATION: none

SUBMITTED: 1984

AID PRESC. 1104

EN-1

SUB CODE: 2A, 1V

16 2

L 1887-66 EWT(1)/EWT(m)/FCC 'T/EWA(h) LJP(c) GS/GW

ACCESSION NR: AT5022828

UR/0000/65/000/000/0103/0110

AUTHOR: Vernov, S. N.; Solov'yeva, V. I.; Khrenov, B. A.; Khristiansen, G. B. 37
36
24

TITLE: Primary cosmic radiation in the ultrahigh energy range and extensive air showers 19

SOURCE: Vsesoyuznoye soveshchaniye po kosmofizicheskomu napravleniyu issledovaniy kosmicheskikh luchey. Ist, Yakutsk, 1962. Kosmicheskiye luchy i problemy kosmofiziki (Cosmic rays and problems in cosmophysics); trudy soveshaniya. Novosibirsk, Redizdat Sib. otd. AN SSSR, 1965, 103-110

TOPIC TAGS: extensive air shower, mu meson, primary cosmic ray, cosmic radiation energy, astrophysic instrument 12

ABSTRACT: The device used at the MGU for studying extensive air showers (EAS) has yielded extensive experimental data pertaining to ultrahigh-energy primary cosmic radiation. The present report cites cumulative experimental data for 1960-1961. The device consists of 18 points (arranged in a circle of 120 m radius) at which detectors of charged particle densities and mu-mesons are located (Fig. 1 of the Enclosure). A very valuable feature of the device is its ability to record high-energy mu-meson fluxes in an individual shower. The energy spectrum of primary cosmic radiation obtained is discussed. The Card 1/3

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ACCESSION NR: AT5022828

experimental data are used to determine the probability that pure electron-photon showers comprise a fraction α of the total number of recorded showers γ :

$$P(\alpha\gamma) \sim \sum_{n_1} \sum_{m=0}^{n_1} \frac{(\exp(-\alpha n_1)) (n_1)^m}{m!} (1 - \alpha \frac{\mu_1^y}{\mu_1^n})^m$$

where n_1 is the number of EAS with a density of mu-mesons μ_1^n ; μ_1^y is the density of mu-mesons in pure electron-photon showers with the same number of particles N as in the observed EAS. Calculation shows that $\alpha < 2 \times 10^{-3}$ with 90% probability. The upper limit for the fraction of primary γ quanta with energy of $\sim 10^{16}$ ev is from 4×10^{-4} to 10^{-4} . In conclusion, the isotropy of primary cosmic radiation of the highest energy that can be recorded by the device is discussed. Orig. art. has: 2 figures and 2 tables.

ASSOCIATION: Nauchno-issledovatel'skiy institut yadernoy fiziki MGU
 (Scientific Research Institute of Nuclear Physics, MGU)

SUBMITTED: 29Oct64

ENCL: 01

SUB CODE: AA

NO REF SOV: 006

OTHER: 006

Card 2/3

L 1887-66

ACCESSION NR: AT5022828

ENCLOSURE: 01

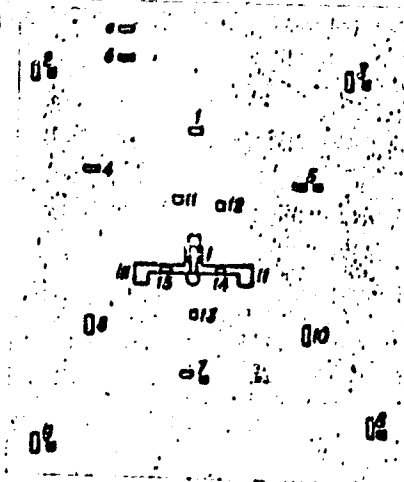


Figure 1. Diagram of cosmic ray and air shower recording device.

a - detectors of charged particle density; b - mu-meson detectors
($E \geq 6 \times 10^6$)

mlr
Card 3/3

L 1278-66 ENT(1)/FCC/EWA(h) GS/GW
ACCESSION NR: AT5023598

UR/0000/65/000/000/0277/0284

AUTHOR: Vernov, S. H.

TITLE: The present state and future potential of emission from terrestrial radiation belts

SOURCE: Vsesoyuznaya konferentsiya po fizike kosmicheskogo prostranstva. Moscow, 1965. Issledovaniya kosmicheskogo prostranstva (Space research); trudy konferentsii. Moscow, Izd-vo Nauka, 1965, 277-284

TOPIC TAGS: radiation belt, earth planet

ABSTRACT: The author reports on the present state of our knowledge concerning the radiation belts surrounding our planet. This information may be useful for a theoretical explanation of the acceleration mechanism responsible for these radiation belts. Orig. art. has: 10 figures.

[14]

ASSOCIATION: none

SUBMITTED: 02Sep65

ENCL: 00

SUB CODE: ES

NO REF SOV: 001

OTHER: 002

ATD PRESS: 4/02

Card 1/1 *mlr*