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21(1) PHASE I BOOK EXPLOITATION HUN/1911

International Conference on Cosmic Radiation. Budapest, 1956.

International Conference on Cosmic Radiation Organized by the Hungarian Academy of Sciences. Budapest, 1957. 187 p. 200 copies printed.

Sponsoring Agency: Magyar Tudomanyos Akademia

Eds.: E. Fenyves, and A. Somogyi

PURPOSE: This report is intended for geophysicists concerned with cosmic radiation.

COVERAGE: This report contains the papers read at the six plenary sessions of the conference. Some of the problems dealt with include nuclear emulsions, extensive air showers and the program of cosmic ray measurements planned for the International Geophysical Year. Most of the reports are followed by references. Soviet scientists in the field of cosmic radiation who attended the conference are: E.L. Andronikashvili, N.A. Dobrotin, I.I. Gurevich, S.I. Nikolskiy and S.N. Vernov. The articles are written in English, German and Russian without parallel translations.

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THIRD SESSION

EXTENSIVE AIR SHOWERS

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FIFTH SESSION

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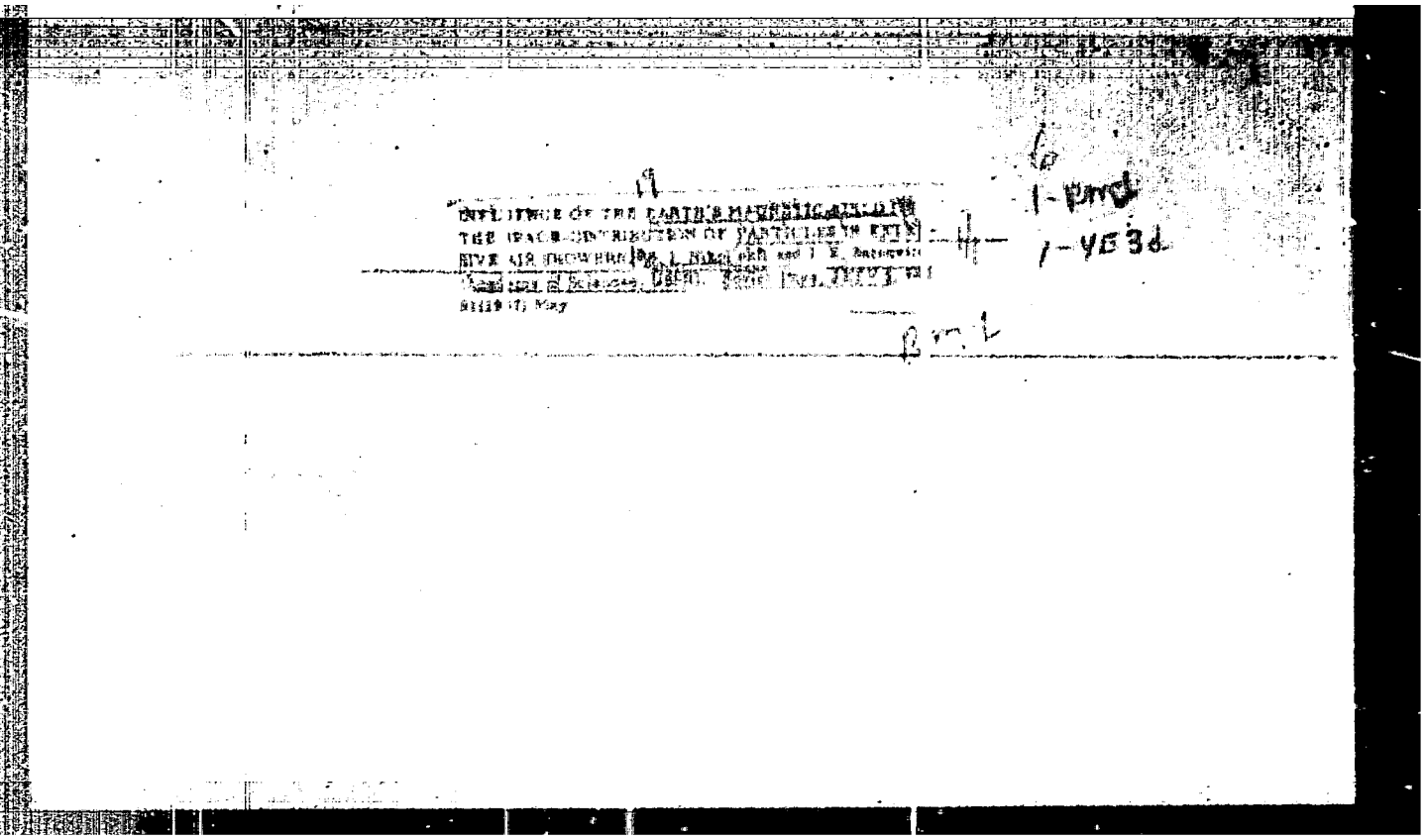

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3751
SPATIAL DISTRIBUTION OF THE PARTICLES OF EXTENSIVE AIR SHOWERS PRODUCED BY PRIMARY COSMIC RAYS OF VARIOUS ENERGIES. G. P. Dobrovol'skii, [illegible], [illegible], and V. [illegible] [illegible] (Academy of Sciences, USSR). Soviet Phys. JETP 5, 799-801(1957) July.

The spatial distribution of charged particles in the central region of extensive air showers produced by primary cosmic ray particles of various energies was experimentally investigated. It has been found that, within the limits of experimental error, the spatial distribution is independent of the energy of the primary particle producing the shower in the energy region of 10^{4} to 10^{6} ev. (auth)

[illegible]

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Distr: 4E3c/AE3d

[illegible]

ENERGY SPECTRUM OF μ MESONS IN EXTENSIVE ATMOSPHERIC COSMIC RAY SHOWERS. O. I. Dovzhenko, B. A. Nelepo, and S. I. Nikol'skii (Academy of Sciences USSR). Soviet Phys. JETP 5, [illegible] (19[illegible]) Oct.

The energy spectrum of μ mesons in extensive atmospheric showers of varying primary energy was studied in the energy range from 0.3 to 2.5 Bev. The measurements were carried out at mountain altitudes. It was found that in the aforementioned energy range the energy spectrum of μ mesons is independent of the energy of the primary particle which initiated the shower. The mean μ meson energy decreases with the distance from the shower axis. (auth)

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

AUTHOR DOVZHENKO O.I., NELEPO B.A., NIKOL'SKIY S.I. PA - 2957

TITLE The Energy Spectrum of Myons in the Broad Atmospheric Showers of Cosmic Rays.
(Energeticheskiy spektr Myonov v shirokikh atmosfericheskikh livnyakh kosmicheskikh luchey.- Russian)

PERIODICAL Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 32, Nr 3, pp 463 - 466 (USSR).

Received: 6/1957 Reviewed: 7/1957

ABSTRACT The authors carried out experiments for the determination of the shape of the energy spectrum of myons at three different distances from the axis of a broad atmospheric shower in the Pamir (3860 m sea level) in the fall of 1954. Besides, they compared the spectra of myons in showers with different primary, energies. The energy of the myons was determined from their absorption in lead and in the ground. The general scheme of the experimental order and the section of the pit dug into the ground are shown in form of drawings. The control system consisted of three groups of GEIGER-MÜLLER counters which were located above the detectors of the penetrating particles as well as at a distance of 100 and 500 m from them. Above the detectors of the penetrating particles many hodoscopic counters for the investigation of the electron-photon components of the showers

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PA - 2957

The Energy Spectrum of Myons in the Broad Atmospheric Showers of Cosmic Rays.

of the broad atmospheric shower.
(2 Illustrations and 2 tables)

ASSOCIATION: Physical Institute "P.N. LEBEDEV" of the Academy of Science of the U.S.S.R.
PRESENTED BY: -
SUBMITTED: 3.11. 1956.
AVAILABLE: Library of Congress.

CARD 3/3

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

56-5-47/55

AUTHOR: NIKOL'SKIY, S.I., SELEZNEV, V.M.

TITLE: The Spatial Distribution of Electron- Photon-Components on the Periphery of Broad Atmospheric Cosmic Showers. (Raspredeleniye elektronno-fotonnoy komponenty na periferii shirokikh atmosfernykh livney kosmicheskogo izlucheniya, Russian)

PERIODICAL: Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 32, Nr 5, pp 1250 - 1252 (U.S.S.R.)

ABSTRACT: A large number of counting tubes which were established at different distances from one another (of up to 1000 m) in an altitude of 3860 m, were used to measure the current density of all charged particles of the shower. The counters were screened by means of a thin Al-foil and by wood.

From the formula $\rho(r) = \frac{1}{\sigma} \ln \frac{n}{m-n}$ the current density of the particles at the distance r from the axis of the shower can be computed, where n denotes the number of counting tubes which had responded, m- the total number of counting tubes, and σ the surface of a counting tube. Three groups of broad showers with accurately determinable axis were investigated. The first group comprised such showers as contained from 5.10^4 to 1.10^5 charged particles. The energy of the primary particles causing these showers can be assumed to be $1,6.10^{14}$ eV. For the 2nd and 3rd group the corresponding figures are:

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

56-6-8/56

AUTHOR: VAVILOV, Yu.N., ZEVSTIGNEYEV, Yu.F., NIKOL'SKIY, S.I.

TITLE: Investigation of the Penetrating Component of Extensive Cosmic Ray Air Showers (-Russian)
(Issledovaniye proniknyushchey komponenty shirokikh atmosfericheskikh livney kosmicheskogo izlucheniya -Russian)

PERIODICAL: Zhurnal Eksperim. i Teoret.Fiziki,1957,Vol 32,Nr 6,pp 1319-1327 (U.S.S.R.)

ABSTRACT: The present paper investigates the spatial distribution of myons in broad atmospheric showers,which are caused by primary particles with different energy.These measurements were carried out in an altitude of 3860 m (Pamir) in the summer and fall of 1954.
Experimental order: The spatial distribution of the charged particles was investigated by the method of the individual investigation of the showers by means of numerous counters (which were connected with a hodoscopic device).The general scheme of the experimental order is illustrated by means of a drawing.
The spatial distribution of Myons in the showers: The density of the myon flux in the showers investigated did not suffice for measuring them in an individual shower if detectors with the usual surface area are used.The mean value of the density of the myon flux in the showers with assumed number of particles was determined by counting the myon passages through the detector.The varying influence exercised by the angle of emission of the pions upon the spatial distribution of the soff and the penetrating component of the broad atmo-

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KRASIL'NIKOV, D.D.; NIKOL'SKIY, S.I.

Continuous recorder of extensive atmospheric showers of cosmic rays.
Nauch. soob. IAFAN SSSR no.1:66-71 '54. (MIRA 17:1)

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KOVAL'SKAYA, A.I.; KRASIL'NIKOV, D.D.; NIKOL'SKIY, S.I.

Preliminary results on barometric and temperature effects caused by extensive atmospheric showers near the sea level. Trudy IPGI Sbor. fiz. no.2:88-92 '58. (MIRA 11:7)
(Cosmic rays) (Atmospheric temperature) (Atmospheric pressure)

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

Nikol'skiy S. I.

AUTHORS: Zatsepin, G. T., Krugovykh, V. V. 56-2-4/51
Murzina, Ye. A., Nikol'skiy, S. I.

TITLE: The Study of High-Energy Nuclear-Active Particles by Means of an Ionization Chamber (Nablyudeniye yaderno-aktivnykh chastits vysokoy energii pri pomoshchi ionizatsionnykh kamer)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958. Vol 34, Nr 2, pp 298-300 (USSR)

ABSTRACT: In autumn 1955 the authors investigated at an altitude of 3860 m above sea level nuclear-active particles of high energy ($E > 10^{11}$ eV). The apparatus used for these measurements consisted of 6 impulse-ionization chambers which were mounted below a lead layer of variable thickness. The ionization chambers consisted of brass cylinders. An electronic device made possible the registration of the intensity of the ionization impulse in each of the 6 chambers. Beside the ionization chambers there was a system of 972 hodoscopic counters with a total surface of ~ 10 m^2. The distribution of frequencies of the ionization bursts as

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a function of their intensity (below different filters) it shown in a diagram. The integral spectra of the bursts with N > 2000 relativistic particles can be expressed by an exponential law:

$$V\ (\geqslant N) = A/N^{\gamma}$$

Here the exponent γ is the same with all three spectra (20, 50 and 80 cm thick lead layers); it is on the average $\gamma = 1,5 \pm 0,16$. The absolute frequencies of the ionization bursts below 20 cm and 50 cm of lead coincide within the range of error, limits. The range for the absorption of the nuclear active component in air is $\sim 120\ g.cm^{-2}$. This value is obtained in different ways. In the analysis of the correlation of ionization bursts with atmospheric showers the cases observed were divided into two groups:
1.- Ionization bursts which are accompanied by an atmospheric shower of small density. 2.- Ionization bursts which are accompanied by a broad atmospheric shower of more than 10^3 particles. The result of this analysis is shown in a

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diagram as follows: With increasing intensity of the ionization burst also the probability of air escort increases (vozdushnoye soprozhdeniye). In 2% of the cases the authors observed bursts which can be explained by a simultaneous entrance into the detector of at least two nuclear active particles of high energy. The authors investigated the showers with a number of particles from 7.10^4 to 7.10^5. The distribution of the frequency of the ionization bursts produced by the nuclear-active particles of the wide atmospheric shower with respect to their density is shown in a diagram. The frequency of bursts decreases with increasing thickness of the lead layer. The distribution with respect to the density of the showers accompanying wide atmospheric showers can be represented by the exponential function with the exponent $\gamma = 0,9 \pm 0,2$. The spectrum of the nuclear active component in a wide atmospheric shower of $\sim 10^5$ particles can be represented in the interval of energies of from 5.10^{11} to 10^{13} eV in the form $E^{-0,9 \pm 0,2}$. But the real spectrum can be different from the one given here because of the simultaneous entrance of

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The Study of High-Energy Nuclear-Active Particles by Means of an Ionization Chamber 56-2-4/51

several nuclear-active particles on the surface of the detector.
There are 3 figures, 1 table, and 1 reference, 1 of which are Slavic.

ASSOCIATION: Institute of Physics imeni P. N. Lebedev AS USSR (Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSR)

SUBMITTED: July 20, 1957

AVAILABLE: Library of Congress

1. Ionization chambers-Performance 2. Ionization chambers-Characteristics 3. Particles-Study and teaching

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

AUTHORS: Danilova, T. V., Dovzhenko, O. I., Nikol'skiy, S. I., Rakobol'skaya, I. V. SOV/56-34-3-2/55

TITLE: Cloud Chamber Investigation of the Electron-Photon Component of Extensive Atmospheric Showers Near the Axis of the Shower at an Altitude of 3860 m by Means of Vil'son Camera (Issledovaniye elektronno-fotonnoy komponenty shirokikh atmosfernykh livney vblizi osi livnya na vysote 3860 m s pomoshch'yu kamery Vil'sona)

PERIODICAL: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958, Vol. 34, Nr 3, pp. 541-547 (USSR)

ABSTRACT: The present work is a continuation of a paper by I. A. Ivanovskaya and others (Ref 1), and it investigates the energy spectra of the electron-photon component in extensive atmospheric showers. The measurements were carried out on the Pamir by means of a rectangular cloud-chamber and with 1000 counters (connected to a hodoscopic device) in autumn 1955. Seven lead plates of different thickness were mounted within this cloud chamber. The cases of passage of an extensive atmospheric shower were separated by means of a system of

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SOV/56-34-3-2/55

Cloud Chamber Investigation of ...e Electron-Photon Component of Extensive Atmospheric Showers Near the Axis of the Shower at an Altitude of 3860 m by Means of Vil'son Camera

coincidence and anticoincidence pulses in some groups of counters. The registered distribution of the showers on the number of particles is shown in a diagram. The position of the shower axis and the total number of particles within the shower were determined from the spatial distribution of the charged particles. The energy of the electrons and photons which caused the shower in the lead pla es inside the chamber was determined by means of the comparison of the total number of particles within the shower with the number of particles computed from the cascade curves for lead. In order to compare the experimental results with the predictions of electromagnetic cascade theory the authors computed the integral energy spectra of the electrons. The results of these spectra coincide with one another in the case of an energy of 10^9 eV for the distances of from 2 to 4 m from the axis. These and also other mentioned experimental results make possible the following final conclusions: Near the axis of an extensive atmospheric shower deficiency of electrons and photons with high energies is

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Cloud Chamber Investigation of the Electron-Photon Component of Extensive Atmospheric Showers Near the Axis of the Shower at an Altitude of 3860 m by Means of Vil'son Camera

observed. This obviously is connected with a flow of photons of low energy near the axis as well as with the fact that in the production of the electron-photon component of the shower nuclear-active particles with an energy of from 10^{10}-10^{12} eV play a part. The spectrum of the electron-photon component in extensive atmospheric showers caused by primary particles with an energy of $\leq 2.10^{14}$ eV remains unchanged with a change of the observational altitude. This can be explained by the equilibrium of the electronphoton component of extensive atmospheric showers with nuclear-active particles of high energy as well as by the predominant registration of extensive atmospheric showers (which formed at a certain absolute altitude above the pbservation level in the depth of the atmosphere).
There are 8 figures, 3 tables, and 8 references, 6 of which are Soviet

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SOV/56-34-3-2/55

Cloud Chamber Investigation of the Electron-Photon Component of Extensive Atmospheric Showers Near the Axis of the Shower at an Altitude of 3860 m by Means of Vil'son Camera

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physical Institute imeni P. N. Lebedev AS USSR)

SUBMITTED: July 16, 1957

Card 4/4

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

AUTHORS: Dovzhenko, O. I., Kozhevnikov, O. A. SOV/56-34-6-37/51
Nikol'skiy, S. I., Rakobol'skaya, I. V.

TITLE: The Energy Spectrum of the Nuclear-Active Particles in the Extensive Air Showers (Energeticheskiy spektr yaderno-aktivnykh chastits v shirokikh atmosfernykh livnyakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 6, pp. 1637-1638 (USSR)

ABSTRACT: As a supplement of their previous paper (Ref 1) the authors investigated (at an altitude of 3860 m) the above mentioned energy spectrum. The nuclear-active particles were separated from the total particle flow in the extensive air shower according to the generation of an electron nuclear shower in lead plates which were located within a great rectangular cloud chamber. The total thickness of the lead plates was ~100 g/cm^2. A criterion is given for the separation of the cases with electron-nuclear showers from the cases with electromagnetic showers. The experiments were carried out in 2 different ways. In the first one there was no absorber above the cloud chamber, but in the second way - ~100 g/cm^2 Al. A sketch of the experimental apparatus is given, it registrat-

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The Energy Spectrum of the Nuclear-Active Particles in the Extensive Air Showers

ed the extensive air showers with total particle numbers from 10^4 to 10^6. As a result of the measurements carried out for 52 nuclear interactions the authors obtained the integral energy spectra of the nuclear-active particles in the energy interval 2 - 50 BeV for distances from 0 - 9 m from the axis of the extensive air shower. As the form of the energy spectrum was identical for both of the above-mentioned experimental variants their results were averaged. The integral energy spectrum of the nuclear-active particles obtained for the energy region 10 - 50 BeV may be approximated by an exponential function of the type E^{-k} with $k = 0,95 \pm 0,25$. By comparison of the observed number of the nuclear-active particles with the density of the electron flow in the showers recorded by the authors' apparatus, it was possible to estimate the share of the nuclear-active particles with >2 BeV in the total flow of the charged particles in the extensive air showers located within distances of 0 - 9 m from the axis. This share amounts to $(1,3 \pm 0,3)$ %, which is in good agreement with previous results obtained by means of a hodoscopic detector. There are 2 figures and 6 references, 6 of which are Soviet.

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SOV/56-34-6-37/51

The Energy Spectrum of the Nuclear-Active Particles in the Extensive Air Showers

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev, AS USSR)

SUBMITTED: February 26, 1958

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APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R0011372

"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

21(0)

AUTHORS: Nikol'skiy, S. I., Pomanskiy, A. A. SOV/56-35-3-9/51

TITLE: Investigation of Extensive Atmospheric Showers of Cosmic Radiation Under Dense Substances (Issledovaniye shirokikh atmosfernykh livney kosmicheskogo izlucheniya pod plotnym veshchestvom)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 3, pp 618 - 630 (USSR)

ABSTRACT: The present paper deals with investigations of the absorption of atmospheric shower particles in an absorber with a low atomic number in an altitude of 3860 m above sea-level (Pamir Plateau, 1955). Measurements were carried out by means of a special arrangement of ionization chambers and groups of hodoscope counters (Fig 1). For the description see reference 4. The results obtained by measurements appear to prove that in extensive air showers with particle numbers of $10^4 < N < 10^5$ there is, on the average, equilibrium between the nuclear active and electron-photon components

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of the shower. This is in contradiction to the hypothesis according to which the formation of extensive showers is assumed to be a result of acts of nuclear interaction with total dissipation of the energy of primary particles; it also indicates the comparatively insignificant part played by fluctuations. The energy of the nuclear active component of a shower with $N < 10^5$ in the lowermost third of the atmosphere exceeds the energy of the electron-photon component by the 1,7-fold of its amount. A considerable part of this energy ($\sim$60%) is used for the production of myons and neutrinos. The variation of the absorption coefficient of an extensive air shower as well as the change of the structure of the shower core in transition from showers with $N < 10^5$ to showers with $N > 10^5$ agrees with the assumption (Ref 14) that the character of the elementary act of nuclear interaction is modified at an energy of $E_o \sim 5.10^{14}$ eV. The measured data obtained seem to show that the absorption of shower particles increases at transition to $N > 10^5$. Measurements were

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

Investigation of Extensive Atmospheric Showers of Cosmic SOV/56-35-3-9/61
Radiation Under Dense Substances

carried out with the participation of a large group of collaborators of the Fizicheskiy institut AN SSSR (Physics Institute AS USSR) as well as diplomated students of the Fizicheskiy fakul'tet MGU (Faculty of Physics of Moscow State University). The authors thank Professor S.N.Vernov, Professor N.A.Dobrotin, and Professor G.T.Zatsepin for discussing results. There are 7 figures, 3 tables, and 14 references, 11 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im.P.N.Lebedeva, Akademii nauk SSSR (Physics Institute imeni P.N.Lebedev of the Academy of Sciences USSR)

SUBMITTED: April 10, 1958

Card 3/3

APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R0011372

"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

SOV/56-35-5-44/56

21(7)

AUTHORS: Murzina, Ye. A., Nikol'skiy, S. I., Yakovlev, V. I.

TITLE: The Observation of Nuclear-Active Particles of Cosmic Radiation With an Energy of $\geq 10^{13}$ eV (Nablyudeniye yaderno-aktivnykh chastits kosmicheskogo izlucheniya s energiyey $\geq 10^{13}$ eV)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 5, pp 1299-1300 (USSR)

ABSTRACT: In the Fall of 1957 the current intensity of nuclear-active high-energy cosmic radiation particles was measured in an altitude of 3860 m above sea level. The detector of nuclear-active particles consisted of 7 ionization chambers which were surrounded by lead. The arrangement of the ionization chambers is shown by a schematical drawing. An analysis of measuring results shows the following: Nuclear-active particles having an energy of more than 2.10^{12} eV are accompanied in 91 $\pm$ 3 cases by extensive atmospheric showers of more than 3.10^3 particles. In the case of $\geq 1.5.10^{13}$ eV nuclear-active particles this percentage is 93 $\pm$ 4%. Thus, the percentage of high-energy particles accompanied by showers depends only to a small extent on the energy of nuclear-active particles.

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SOV/56-35-5-44/56

The Observation of Nuclear-Active Particles of Cosmic Radiation With an Energy of $\geq 10^{13}$ eV

A diagram shows the integral energy spectrum of nuclear-active particles observed in an altitude of 3860 m above sea level. The energy spectrum may be represented in the form $F(>E) \sim 1/E^{1.53 \pm 0.07}$ in the energy interval of between 10^{12} and 10^{13} eV, which is in agreement with the energy spectrum of the primary cosmic radiation of corresponding energy. Much fewer particles with $> 3.10^{13}$ eV were, by the way, found than might have been expected. The authors thank Professor N. A. Dobrotin and G. T. Zatsepin for useful discussions of the results obtained. There are 2 figures and 3 references, 2 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: July 10, 1958

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

20-11[illegible]-17/59

AUTHORS: Dovzhenko, O. , Zatsepin, V. , Murzina, Ye. , Nikol'skiy, S., Rakobol'skaya, I. , Tukish, Ye.

TITLE: Investigation of Extensive Atmospheric Showers of Cosmic Radiation (Issledovaniye shirokikh atmosfernykh livney kosmicheskogo izlucheniya)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 118, Nr 5, pp.899-902 (USSR)

ABSTRACT: In autumn 1955 the energetic characteristics of extensive atmospheric showers were investigated at an altitude of 3860 m above the sea level. The lay-out of the experimental equipment is illustrated in a diagram. Extensive atmospheric showers caused by primary particles with an energy of from 2.10^{13}-10^{16} eV were separated by fourfold discharges in two groups of counters (with a mutual distance of two meters). A number of about 4.10^4 extensive atmospheric showers were recorded. A great number of counters was employed in these measurements. The energy spectrum of the myons at a distance

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Investigation of Extensive Atmospheric Showers of Cosmic Radiation

fluence of the neutral pions with energies above 10^{10} eV on the electron-photon component of the shower is assumed. Filters of various thickness of different materials were mounted above the ionization chambers. This permitted to measure the energy flow, which is carried by the electron-photon component of the shower at various distances from the shower axis and also the determination of the energy of the nuclear-active shower particles. The energy of the particle with the highest energy in the core of the extensive atmospheric showers with less than 10^5 particles amounts to 10 % in the mean of the energy of the electron-photon component of the shower at the observation altitude. The remaining nuclear-active particles in the shower are distributed according to the law $\sim 1/E^n$, E denoting the energy of the nuclear active particles and $n = 0,9 \pm 0,2$ holding. The cores of the extensive atmospheric showers with a number of particles exceeding 10^{15} are very complicated. There are 3 figures, and 6 references, 6 of which are Soviet.

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NIKOLSKIY, S. I.

DIFFERENT CHARACTERISTICS OF EXTENSIVE AIR SHOWERS AS FUNCTIONS OF THE TOTAL OF SHOWER PARTICLES

S.I. Nikolskiy, A.A. Pomanskiy

1. Using composite apparatus, a general description of which was given at the cosmic-ray conference at Varenna, a study was made (at 3760 m altitude) of the absorption of the total particle flux of extensive air showers in a dense material close to air in its mean atomic number.

The number of particles under the absorber was measured by means of ionization chambers. Showers were registered with the total number of particles from 10^4 to 10^6.

2. An analysis has been made of the absorption of the flux of shower particles in showers with different number of particles. Experimental data indicate that particle flux in showers with the number of particles from 10^5 to 5×10^5 is absorbed in a dense material more intensively that particle flux in a shower with a smaller number of particle . This more rapid absorption of particle flux in showers with the total number of particles ranging from 10^5 to 5×10^5 may be due to the relatively small number of nuclear-active particles in showers with the number of particles lying in this range. This was noted in earlier experiments.

reportpresented at the International Cosmic Ray Conference, Moscow, 6-11 July 1959.

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3. A number of other shower characteristics are considered. The spatial distribution both of all the charged particles and the electrons in the shower is found to only slightly sensitive to the number of particles in the shower. According to the cascade theory and the nuclear-cascade scheme of the development of extensive air showers one might expect that with an increase in the number of particles in the shower, the function of spatial destribution would manifest a peak (parameter S would diminish).

Experimental data point to the opposite. The spatial distribution and energy spectrum of -mesons are independent of the number of particles in the shower within the range of the total number of particles 10^4 - 10^6. However, a comparison of different investigations shows that the dependence of the number of mu-mesons in the shower of the total number of particles varies slightly when passing from showers with the number of particles to a larger shower.

4. The experimental data are compared with calculations of nuclear-cascade avalanches caused b primary nucleons of energy 10^{12} - 10^{16} ev.

Report presented at the International Cosmic Ray Conference, Moscow, 6-11 July 59

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NIKOLSKY, S. I.

ENERGY SPECTRA OF THE ELECTRON-PHOTON COMPONENT IN EXTENSIVE AIR SHOWERS NEAR THE SHOWER AXIS

S.I. Nikolsky, S.I. Dovzhenko, I.V. Rakobolskaya

1. The study was carried out in 1957-1958 at sea level with a cloud chamber triggered by a system of counters.
2. The triggering counter system made it possible to select air showers, the axes of which fell near the cloud chamber. In addition, during the study, the system was altered so as to register most effectively showers with a given number of particles: $\overline{N} = 8 \times 10^3$; $\overline{N} = 1.2 \times 10^4$; $\overline{N} = 3 \times 10^4$. The position of the shower axis and the number of particles in it were determined from the readings of the hodoscope counters. A total of 4500 showers were registered.
3. The rectangular cloud chamber (60 x 60 cm) with a depth of 30 cm had 6 plates of lead making a total thickness of 120 g/cm^2. When an electron or photon entered the chamber, a cascade shower was observed produced by these particles in the lead sheets. The energy of the electrons and photons was determined from the total number of particles registered between the lead sheets in the cascade showers.
4. As a result of these measurements we have obtained the integral energy spectra of a sum of electrons and photons foreach of the shower groups; the fraction of high-energy electrons and photons ($\geq 10^9$ ev) in the total number

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of electrons of all energies in the 0-3 metre distance range from the shower axis was also determined. A comparison of experimental data with calculations based on cascade theory shows that energy spectra near the shower axis (0-3 m) are depleted in the high-energy region (10^9 - 10^{10} ev).

Report presented at the International Cosmic Ray Conference, Moscow, 6-11 July 1959

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NIKOLSKY, S. I.

THE SPECTRUM OF EXTENSIVE AIR SHOWERS ACCORDING TO THE NUMBER OF PARTICLES; THE COEFFICIENT OF ABSORTION OF EXTENSIVE AIR SHOWERS
G.V.Kulikov, M.M. Nesterova, S.I. Nikolsky, G.B. Khristiansen, A.E.Chudakov

1. Utilizing the method of correlated hodoscopes, which permits determining the position of the axis and the number of particles in a shower, we have obtained data on shower spectra level and at sea level.
2. At 3860 m above sea level and the interval of particle-number variation in the shower from 3×10^4 to 10^7. thespectrum is well approximated by power law $N \sim \chi$, where $\chi = 1.6 \pm 0.1$. At sea level there is a greater probability that the spectrum will be irregular in the range $10^6 < N < 10^7$ (for $N < 10^6$ $\chi = 2.1 \pm 0.3$ and for $N > 10^7$ $\chi = 1.5 \pm 0.2$.
3. The shower absorption coefficient obtained from a comparsion of absolute number of showers with a number of particles greater than that given at mountain altitudes and at sea level, amounts to $\lambda = 1/(180-20)$ g/cm^2.

Report presented at the International Cosmic Ray Conference, Moscow, 6-11 July 1959

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31522
S/627/60/002/000/004/027
D299/D304

3,2410 (1559, 2205, 1705)

AUTHORS: Kulikov, G. V., Nesterova, N. M., Nikol'skiy, S. I., Solov"yeva, V. I., Khristiansen, G. B., and Chudakov, A.Ye.

TITLE: Number spectrum of extensive air showers at altitudes of 200 and 3860 m above sea level

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye atmosfernyye livni i kaskadnyye protsessy, 87-91

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TEXT: Number spectra of extensive air showers were investigated in detail at the Physics Institute of the AS USSR and at Moscow State University. The spectra were investigated at an altitude of 3860 m and at sea level. Those at sea level were studied over a range N = $= 4 \cdot 10^3$ to $3 \cdot 10^7$. For showers with small N (10^3 to $5 \cdot 10^4$), the statistical method was used. The apparatus incorporated hodoscoped Geiger-Müller counters, whose disposition is shown in a figure. The experiments yielded the number of anti-coincidences n per unit time

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D299/D304

Number spectrum of ...

for counters of different σ; (σ varied between 0.4 and $1.65 \cdot 10^{-2} m^2$). By comparing the measurements and the calculations, the integral spectrum of the showers was obtained: $F(>N) = 2.5 \cdot 10^{-3} N^{-(1.45 \pm 0.03)}$ $cm^{-2} sec^{-1}$, with $N = 4 \cdot 10^3$ to 10^5. For large N, the spectrum was obtained by individual study of the showers, at sea level. For this purpose, the majority of the counters were disposed in a circle. The position of the axis and the number of particles in each shower were determined by means of the electronic computer "Strela". Thereupon the integral spectrum was found for $N = 8 \cdot 10^4$ to $8 \cdot 10^5$, viz.

$$F(>N,0) = (1,95 \pm 0,14) \cdot 10^{-10} \left(\frac{N}{10^5}\right)^{-1,5 \pm 0,1} cm^{-2} sec^{-1} sterad^{-1}$$

Both series of measurements coincide in the range $N \approx 10^5$. In order to determine the absolute number of extensive air showers in the

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D299/D304

Number spectrum of ...

range $N \geq 10^7$, the apparatus was divided into 4 groups of counters. Further, extensive air showers were studied at an altitude of 3860 m. The apparatus was controlled by photomultipliers, recording the Cherenkov radiation [Abstractor's note: See article on p. 47, this Trudy.]. The shower axis and the number of particles were determined by means of a simulator. Showers with $N = 2 \cdot 10^4$ to 10^7 were investigated. From the obtained results, the integral spectrum of showers with $N = 2.5 \cdot 10^4$ to $1.3 \cdot 10^7$ was constructed, viz.

$$P(>N,0) = (4,6 \pm 1,4) \cdot 10^{-11} \left(\frac{N}{10^6}\right)^{-(1,60 \pm 0,15)} \text{cm}^{-2}\text{sec}^{-1}\text{sterad}^{-1}$$

The absorption length λ of showers was also determined; for showers with $N\ 10^5$, $\lambda = 156 \pm 22$ gm/cm^2. There are 4 figures and 2 Soviet-bloc references.

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31522
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D299/D304

Number spectrum of ...

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute im. P. N. Lebedev AS USSR); Nauchno-issledovatels'kiy institut yadernoy fiziki MGU (Scientific Research Institute of Nuclear Physics Moscow State University)

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

31528
S/627/60/002/000/010/027
D299/D304

3,24/0(1559, 2205, 2805)

AUTHORS: Dovzhenko, O. I., Nikols'kiy, S. I., and Rakobol'skaya, I. V.

TITLE: Study of electron-photon component of extensive air showers near the shower axis

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye atmosfernyye livni i kaskadnyye protsessy, 132-138

TEXT: The electron-photon component was investigated by a cloud chamber containing lead plates; thereby, cascade showers were created by the electrons and photons on passage through the chamber. In contradistinction to other investigations, the energy of the electrons and photons was not determined by the overall sum of particles in the entire cascade shower, but by the number of particles in the upper 5 sections of the chamber, in the region of the shower maximum. The present investigation was carried out in the fall of 1955 at an altitude of 3860 m (at Pamir Mountain), and during 1957-

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D299/D304

Study of electron-photon ...

1958 at sea level (at Moscow). Two different methods of shower selection were used. In 70% of the cases the axes of the extensive air showers passed at a distance of 0 to 3 m from the cloud chamber. The total number of particles was determined by means of a hodoscope. In the Pamir investigations, 300 showers were recorded with number of particles per shower $\bar{N} = 10^5$. At Moscow, 2370 showers with $\bar{N} = 8 \cdot 10^3$ were registered. 1830 showers with $\bar{N} = 1.2 \cdot 10^4$, and 436 showers with $\bar{N} = 3 \cdot 10^4$. As a result of the experiments, the integral energy-spectra of the electron-photon component were obtained. From these spectra, the fraction of high-energy electrons and photons (with respect to the total number of particles in a shower) was determined. The results obtained for showers of various number of particles agree with each other within the limits of experimental error. No increase was observed in the high-energy electron and photon fraction with increasing number of particles. A comparison of experimental results with the predictions of cascade shower theory showed that the experimental spectra in the vicinity

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Study of electron-photon ...

of the shower axis, are deficient in high-energy electrons. Subsequently, the energy spectra of electrons were computed for showers in which the electron-photon component is in equilibrium with the nuclearactive component. The integral energy spectrum was constructed for distances of 0 to 3 m. from the shower axis. A considerable discrepancy was found between the theoretical and experimental curves. This may be due to the fact that the theoretical calculations did not properly take into account the initial conditions of creation and development of the electron-photon component. Further, the lateral distribution of high-energy electrons and photons in the core region was found (at distances of 0 to 0.3 m from the shower axis). If certain conditions were simultaneously fulfilled, then the core was considered to pass through the cloud chamber. For electrons and photons with energies $\geqslant 10^9$ ev., the density distribution of the particles can be expressed by $\rho(\geqslant 10^9) \sim r^{-n}$, where $n = 1.2 \pm 0.3$. From data obtained at the Pamir Mountain, it follows that $n = 1.6 \pm 0.3$ at distances of 1 to 7 m. A figure shows the distribution of electrons and photons, obtained at Moscow and the

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Study of electron-photon ...

Pamir Mountain, respectively. The energy spectra of electrons and photons were constructed on the basis of 12 cases when the core passed through the chamber (for distances of 0 to 0.3 m from the axis). The mean energy per charged particle in the region of the axis was approximately $3 \cdot 10^9$ ev., and at 0.3 to 3 m from the axis - approx. $4 \cdot 10^8$ ev. The obtained values for the mean energy and the mean density are in good agreement with the results of T. Kameda et al. (Ref. 7: This Trudy, p. 56). There are 2 figures, 1 table and 8 references: 6 Soviet-bloc and 2 non-Soviet-bloc (including one translation). The reference to the English-language publication reads as follows: W. Hazen. Phys. Rev., 85, 455, 1952.

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11529
S/627/60/002/000/011/027
D299/D305

3.2410 (2205, 2705, 2905)

AUTHORS: Nikol'skiy, S. I., and Tukish, Ye. I.

TITLE: Distribution of energy flux of electron-photon and nuclearactive component of extensive air showers at an altitude of 3860 m above sea level

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye atmosfernyye livni i kaskadnyye protsessy, 139-143

TEXT: The investigations were carried out at the Pamir Mountain (3860 m). The apparatus was described in detail in publications of the earlier International Conference on Cosmic Radiation (Ref. 1: Dobrotin et al., Nuovo Cim. Suppl., 8, 612, 1958). The density of the energy flow was determined by 12 ionization chambers placed under lead absorbers of various thickness. In some of the experiments, the absorbers were removed. The apparatus permitted determining the density distribution of the energy flow at distances of 0.2 to 30 m.

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Distribution of energy flux ...

from the shower axis (for showers with numbers of particles from $2 \cdot 10^5$ to $4 \cdot 10^5$) and at distances of 0.2 to 20 m from the shower axis (for showers with number of particles from $6 \cdot 10^4$ to $12 \cdot 10^4$). The density of particle flow was defined as the sum of the integrals

$$\rho_E = \beta \int_0^{53} N(t)dt + \beta \int_{53}^{\infty} N(t = 53)e^{-\frac{t}{95}} dt$$

where $\beta = 6.4 \cdot 10^6$ ev. is the critical energy for electrons in lead, t - the absorber depth, and N(t) - the particle-flow density at depth t. A figure shows the density distribution of particle-flow in showers with $\bar{N} = 3 \cdot 10^5$ and $\bar{N} = 10^5$ particles. The obtained distributions are independent of the number of particles in the show-

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Distribution of energy-flux

er, and have the form: $\rho_E \sim r^{-1.8}$ for $0.5 < r < 8$ m, and $\rho_E \sim 1/r^2$ for $8 < r < 30$ m. For small depth t, the contribution by π^0-mesons to the total ionization is small. Hence it is assumed that to a depth t=5 cm Pb, the ionization is entirely due to the electron-photon component. The energy-flow density of the nuclearactive component was determined as the difference between the density of of the total energy flow and the density of the electron-photon component. The energy of the nuclearactive and of the electron-photon component were calculated for a circle of radius R = 30 m, for 2 groups of showers (with $\bar{N} = 3 \cdot 10^5$ and 10^5, respectively). The results are listed in Table 1 (see table). A discrepancy was found between the expected value of 10^{14} ev. of the energy of the nuclearactive component and the experimentally obtained value of $3.3 \cdot 10^{13}$ ev.; this discrepancy cannot be explained by measurement error. The possible source of the error is analyzed. Finally, the mean energy per electron is plotted on a figure (as a function of the distance from the shower axis). There are 4 figures, 1 table and 8 references:

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31529
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Distribution of energy-flux ...

7 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: Kraybill. Phys. Rev., 93, 1362, 1954.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute im. P. N. Lebedev AS USSR)

Table 1

N		
$E_{\mu}(30)$	$4,5 \cdot 10^{10}$	$1,6 \cdot 10^{10}$
$E_{em}(30)$	$3,3 \cdot 10^{10}$	$1,1 \cdot 10^{10}$
E_{tot}	$6,6 \cdot 10^{10}$	$2,3 \cdot 10^{10}$
$\frac{E_{em}(30)}{E_{\mu}(30)+E_{tot}}$	0,33	0,33

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NIKOLSKIY, S.I.

31530
S/627/60/002/000/012/027
D299/D305

3.2410 (1559, 2205, 2705)

AUTHORS: Dovzhenko, O. I., Zatsepin, G. T., Murzina, Ye. A., Nikol'skiy, S. I., and Yakovlev, V. I.

TITLE: Energy spectrum of nuclearactive component of cosmic radiation at 3860 m, and related extensive air showers

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye Atmosfernyye livni i kaskadnyye protsessy, 144-151

TEXT: Two series of experiments are described, of 1955 and of 1957. The apparatus used in 1957 permitted detecting extensive air showers exceeding 1000 particles only. The relation is established between the nuclearactive particles and the ionization bursts in the chambers. Computations showed that if the integral energy-spectrum of the incident nuclearactive particles is expressed by the power law $f(>E) = AE^{-\gamma}$, then the ionization spectrum is also described by a power law with the same γ. The experimentally obtained

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Energy spectrum of ...

energy spectrum of the nuclearactive component is plotted in a figure. From the figure it is clear that the integral energy spectrum of nuclearactive particles in the range of 10^{12} to $5 \cdot 10^{13}$ ev., can be expressed in the form $f(>E) = AE^{-\gamma}$, where $\gamma = 1.5 \pm 0.1$. The absolute intensity of the nuclearactive particles with energy $>10^{12}$ ev. is 5.5 ± 0.6 hour^{-1}sterad^{-1}. By comparing the obtained intensity with the spectrum of the primary radiation and the number of low-energy nuclearactive particles at sea level, one obtains the absorption length for nuclearactive particles. In order to detect the air showers accompanying the nuclearactive particles, 15 cylindrical ionization chambers were used. The obtained integral number-spectrum is shown in a figure. It was found that the percentage of nuclearactive particles, accompanied by air showers, increases monotonically with the energy of the nuclearactive particles, varying between 76 and 88% for energies of $2 \cdot 10^{12}$ to $2.5 \cdot 10^{13}$ ev. The inter-

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action free-path was calculated by the change in the number of the recorded nucleoactive particles as a function of increasing thickness of the graphite layer above the ionization chamber. It was also found that the integral energy spectrum of nucleoactive particles can be expressed in the form $F(>E) \sim E^{-n}$, where $n = 0.9 \pm 0.2$. This formula apparently characterizes the spectrum of the nucleoactive component as a whole. Further, the energy spectra of nucleoactive components for showers of different total number of particles is determined, as well as for various distances from the shower axis. The procedure used for this purpose is described. The air showers under investigation were divided into 3 groups (according to total number of particles). A peculiar feature of the spectrum at distances of 0 to 1 m was the absence of nucleoactive particles with energies below 10^{11} ev. The integral spectra of nucleoactive particles for the 3 groups of showers are shown in a figure. The spectra are characterized by smooth shape even in the region where a shower contains 1 to 2 particles. By averaging, one obtains the

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31538
S/627/60/002/000/015/027
D299/D304

3.2410 (1559, 2205, 2605)

AUTHORS: Kalachev, B. V., Nikol'skiy, S. I., Pomanskiy, A. A., and Tukish, Ye. I.

TITLE: On fluctuations in the number of μ-mesons in extensive air showers

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye atmosfernyy livni i kaskadnyye protsessy, 166-168

TEXT: The results are given of experiments for detecting fluctuations in the number of mesons and electrons in showers with number of particles $10^5 < N < 2 \cdot 10^6$. The experiments were conducted at an altitude of 3860 m (Pamir), in the fall of 1957. The apparatus consisted of hodoscoped counters, placed at 9 observation points. No fluctuations were observed which would have an appreciable effect on the mean values of the investigated quantities. The computed integral number-spectra were compared with the experimental spectra

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On fluctuations in the ...

for various distances from the shower axis. A larger number of showers with number of particles $N \leqslant 10^6$ were observed than was to be expected by the computations. This may be due either to a considerable contribution of showers, in which the density of the μ-meson component exceeds by many times the mean density as determined by Yu. N. Vavilov et al. (Ref. 2: ZhETF, 32, 6, 1319, 1957), or to the mean density having been underestimated. The second possibility is considered in more detail. Denoting the mean number of μ-mesons in the shower by $\bar{N}_\mu = \alpha N^\beta$, one obtains (in the first approximation) the formula

4

$$\frac{\Delta C}{C} = \left(n - \frac{\gamma}{\beta}\right)\frac{\Delta\alpha}{\alpha}$$

for $N \leqslant 10^6$; the left-hand side of the formula expresses the relative change in the number of recorded showers, and $\Delta\alpha/\alpha$ expresses the relative error in determining α. For distances of 40-50 m (as well

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On fluctuations in the ...

as for other distances), the quantity $\Delta C/C \simeq 0.3$, hence $\Delta\sigma/\sigma \simeq 20\%$, which does not exceed the limits of statistical error. Hence no fluctuations were observed in the experiments conducted, so as to effect the mean values of the quantities. There are 2 figures and 2 Soviet-bloc references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute P. N. Lebedev AS USSR)

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21537
S/627/60/002/000/020/027
D299/D304

3.2410 (3205, 2705, 2805)

AUTHORS: Nikol'skiy, S. I., and Fomanskiy, A. A.

TITLE: Dependence of various characteristics of extensive air showers on the total number of particles

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye atmosfernyye livni i kaskadnyye protsessy, 235-241

TEXT: Showers with number of particles N ranging from 10^4 to 10^6 were investigated. The showers were divided into 7 groups (according to the number of particles). It was found that the absorption of showers with $N_0 > 10^5$ essentially differs from the absorption of showers with $N_0 < 10^5$ (N_0 denoting the total number of particles in a shower of a certain group). It was found that the nucleareactive particles, too, are not monotonically varying in the case of showers with $N \sim 10^5$. The dependence of the number of μ-mesons on the

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total number of particles is more regular, yet showers with $N \sim 10^5$ exhibit a somewhat particular behavior in this respect, too. A qualitative study of these irregularities led to the conclusion of a change in the nature of elementary nuclear interactions for particle energies $E \geq 10^{14}$ ev. Some quantitative results are given which would elucidate this change. A particle was considered, corresponding to a traveling wave in a hydrodynamic system. Its energy was set equal to approximately $0.8\ E_0(E_c/\mu c^2)^{1/15}$. The energy spectrum of the secondary particles was selected in accordance with statistical theory; the nucleonic component was assumed as 0.27. The method of successive generations was used for calculating the absolute intensity of extensive air showers with $N = 10^4$, 10^5 and 10^6 respectively, the energy spectrum of primary particles, the number and energy of nuclearactive particles, and shower absorption in the atnosphere, After additional computations, the authors arrived at the following conclusions: Various irregularities were

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observed for showers with $N \sim 10^5$. These irregularities can be explained in two ways: a)In nuclear interactions, a sharp increase in the fragmentation of energy between secondary particles takes place, starting from energies of 10^{14} to $3 \cdot 10^{14}$ ev.; thereby it is necessary to assume that the elementary events called forth by π-mesons differ from those due to the nucleons, or to postulate the appearance of some new particles; b) in collisions of nucleons with energies higher than 10^{15} ev., it is possible that a considerable energy-fraction is transmitted to the electron-photon component. These two assumptions would also explain the experimental results. There are 7 figures, 1 table and 11 references: 9 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads as follows: G. Cocconi, V. Cocconi-Tangiorgi, K. Greisen. Phys. Rev., 75, 1063, 1949.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute im. P. N. Lebedev AS USSR)

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24(5)

AUTHORS: Dovzhenko, O. I., Nikol'skiy, S. I., Rakobol'skaya, I. V.

SOV/56-36-1-3/62

TITLE: Investigation of the Cores of Broad Atmospheric Showers of Cosmic Rays by Means of a Cloud Chamber (Issledovaniye stvolov shirokikh atmosfernykh livney kosmicheskikh luchey pri pomoshchi kamery Vil'sona)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 1, pp 17-23 (USSR)

ABSTRACT: In the present paper investigations are described which were carried out (on sea level) in Moscow in 1957. Interest in investigations of extensive air showers increased considerably recently, because the investigation of structure, composition, energy distribution of particles as well as the Cherenkov radiation produced in the atmosphere can supply information concerning particles interaction at energies $> 10^{13}$ eV. In this connection especially the investigation of shower cores is of importance, which also forms the subject of the present paper.

For the investigation a rectangular cloud chamber and counters were used. The arrangement was such that such cases of

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shower passages were selected for measurements, in which the flux of shower particles above the cloud chamber was greater than that recorded by more distant counter groups (Fig 1). The device is then described. Furthermore, the differential shower spectrum is calculated according to the number of particles on the basis of the following assumptions: 1) The shower particles are symmetrically distributed round the shower axis in form of a circle. 2) The differential distribution spectrum is assumed to have the form:

$f(N)dN \sim N^{-(\gamma+1)}dN$, where $\gamma(N)$ is taken from reference 3. 3) The number of shower axes with particle numbers $N > 10^5$ amounts to $7.10^{-3}/m^2$ per hour (Ref 3). 4) The probability distribution of particle recording is assumed to correspond to the Poisson (Puasson) law. Calculation results are shown by figure 3.

Also the number of showers recorded par hour and the mean value of the density of charged particles was calculated, and calculated and experimental values are compared (Table 2). Agreement is good. Further, the number of shower cores of the electron-photon components for $N < 3.5.10^4$ and $N > 3.5.10^4$ are

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calculated. In the former case, calculation results in ~10, and the experimental result is 9; in the latter case the calculated result is ~3, the experimental result 2. For the number of nuclear-active particles with energies of $\geq 10^{11}$ ev 5 and 1-2 was calculated, while the experimental value was 4 and 0 respectively for the two N-values. 4 photographs are attached: Figure 4 shows a cloud chamber photograph of a penetrating electron-photon shower with $N \approx 10^4$, figure 5 a nuclear interaction at an energy of nuclear active particles of $> 10^{11}$ ev and $N = 3.3.10^4$; figure 6 also shows a nuclear interaction caused by charged particles in the first plate of the chamber, at an energy of nuclear active particles of $\geq 2.10^{11}$ ev and $N = 2.5.10^4$, and figure 8 shows a nuclear interaction at an energy of $< 10^{10}$ ev. The authors finally thank N. A. Dobrotin, Professor, and G. T. Zatsepin for their interest, N. G. Birger and D. S. Chernavskiy for discussing the

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Investigation of the Cores of Broad Atmospheric Showers of Cosmic Rays by Means of a Cloud Chamber

SOV/56-36-1-3/52

results, and O. A. Kozhevnikov, A. M. Mozhayev, B. V. Subbotin, and Ye. N. Tarasov for helping to carry out measurements. There are 7 figures, 3 tables, and 7 references, 4 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: June 14, 1958

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

21 (8)

AUTHORS: Zatsepin, G. T., Nikol'skiy, S. I., Pomanskiy, A. A.

SOV/56-37-1-31/64

TITLE: Decay Processes in the Development of Nuclear Cascades in the Atmosphere (Raspadnyye protsessy pri razvitii yadernykh kaskadov v atmosfere)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 1(7), pp 197 - 201 (USSR)

ABSTRACT: As the energy of the primary particle is not directly measured in experiments on atmospheric showers, the development of avalanches must also be considered by giving the initial conditions in the depth of the atmosphere. The usual method of successive generations is not suitable for the solution of such problems. Nucleons and pions are assumed to participate in the nuclear cascade process. The effective cross section of nuclear collisions is assumed to be equally large for nucleons and pions. The initial conditions are assumed to be given in the depth x_0: $N(E,x_0)dE$ and $\overline{N}(E,x_0)dE$, respectively, are assumed to denote the number of nucleons and $\pi^{\pm}$-mesons, respectively, with an energy

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of E, E + dE in the depth x_0. The kinetic equations are written down in the form $\frac{\partial N(E,x)}{\partial x} = -N(E,x) + \int_0^{\infty} [N(E',x)W_{NN}(E',E) + N(E',x)W_{\pi N}(E',E)]dE'$, $\frac{\partial \Pi(E,x)}{\partial x} = -\Pi(E,x)(1+\frac{E_\pi}{Ex}) + \int_0^{\infty} [N(E',x)W_{N\pi}(E',E) + \Pi(E',x)W_{\pi\pi}(E',E)]dE'$. W_{NN}, $W_{N\pi}$, $W_{\pi N}$, $W_{\pi\pi}$ denote the energy spectra of the particles corresponding to the second index which originate in the nuclear collision of a particle with the energy E' (which is designated by the first index). $E_\pi = mc^2_0/\tau_0\rho(x_0) = 1.4.10^{11}$eV denotes the critical energy of the $\pi^{\pm}$-mesons, at which the probabilities of nuclear collision and of decay in the depth x=1 are equal to each other; $\rho(x_0)$ denotes the density of air in g/cm^3 in the depth x_0. The solution is written in the form of series $N(E,x) = e^{-(x-x_0)}\sum_{i=0}^{\infty} N_i(E,x)$, $\Pi(E,x) = e^{-(x-x_0)}\sum_{i=0}^{\infty} \Pi_i(E,x)$. The series resulting by substi-

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tuting these series into the above-mentioned kinetic equations are represented step by step. In the special case $x_0 = 0$, the solutions pass over into the known solution of the method of successive approximations. In the present solution, all terms of the series are positive, and the series is always convergent if the total energy of particles at x_0 is finite. The solution is, however, more extensive than in the case $x_0 = 0$. In some cases important for the interpretation of the experimental data, the role of the decay process can be considered in a much simpler way. The authors estimate which portion of the energy of the nuclear-active component (which is present in the showers at the altitude of the Pamir station) is consumed for the formation of muons and neutrinos in the further passage through the atmosphere. According to these calculations, at an energy spectrum of the type $E^{-2}dE$ of the nuclear-active component of showers at the altitude of the Pamir, about 50% of its energy must be used up for the generation of muons and neutrinos, thus,

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being missing for the development of cascades. This conclusion is almost independent of the mechanism of the elementary process of nuclear collisions. There are 1 table and 6 references, 5 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences, USSR)

SUBMITTED: February 7, 1959

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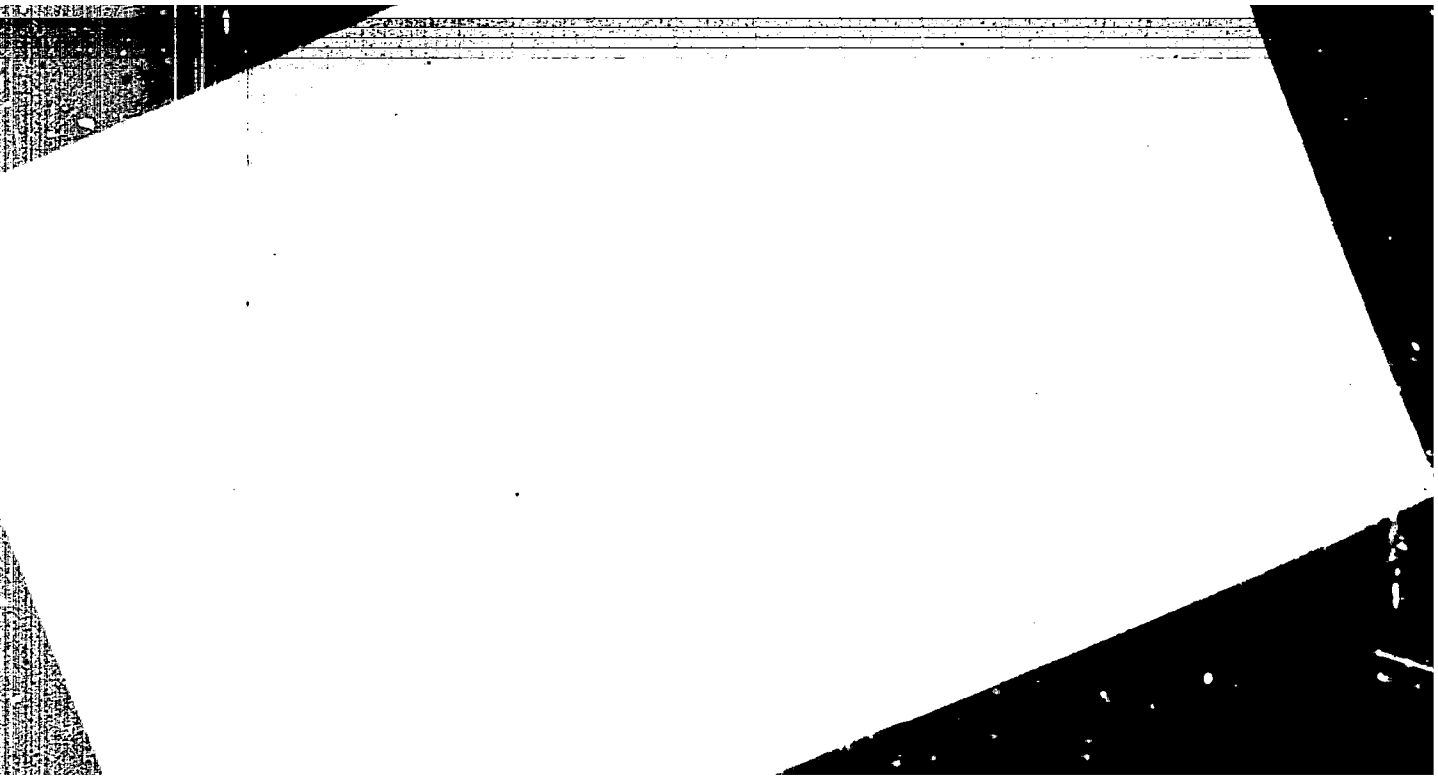

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

MISHNEV, S.I.; NIKOL'SKIY, S.I.

Number of extensive air showers of cosmic rays near sea level.
Zhur. eksp. i teor. fiz. 38 no.1:257-258 Jan '60. (MIRA 14:9)

1. Fizicheskiy institut im. P.N.Lebedeva AN SSSR.
(Cosmic rays)

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MISHNEV, S.I.; NIKOL'SKIY, S.I.

Number of extensive air showers of cosmic rays near sea level.
Zhur. eksp. i teor. fiz. 38 no.1:257-258 Jan '60. (MIRA 14:9)

1. Fizicheskiy institut im. P.N.Lebedeva AN SSSR.
(Cosmic rays)

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B006/B070

24.6900

AUTHORS: Dovzhenko, O. I., Nikol'skiy, S. I., Rakobol'skaya, I. V.

TITLE: The Energy Spectra of the Electron - Photon Component of Air Showers in the Neighborhood of the Shower Axis

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1561-1569

TEXT: The results given in publications on this topic are inexact and contradictory. The authors have therefore investigated the electron photon energy spectrum within 3 m of the shower axis. The method of measurement and the experimental arrangement are described in detail. Fig. 1 shows the arrangement of the cloud chamber in which six lead plates of different thicknesses (total: 120 g/cm^2) are placed over one another along with the surrounding counters for the two control systems. Only showers with low particle-flux densities ($\bar{N} = 9 \cdot 10^3$, $1.2 \cdot 10^4$, and $3 \cdot 10^4$) were selected for study. Of these, 2370, 1830, and 436 showers, respectively, were recorded. Nearly 70% of all particles lay within the chosen radius of 3 m. The spatial distribution of the charged particles in the showers with

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B006/B070

The Energy Spectra of the Electron - Photon Component of Air Showers in the Neighborhood of the Shower Axis

$\overline{N} = 9 \cdot 10^3$ is shown in Fig. 3; this may be represented by $Q(>0) \sim r^{-n}$ with $n = 1.0 \pm 0.1$. Fig. 4 shows the integral electron-photon spectrum of all three shower groups; Fig. 5 shows the ratio between the electron- and the photon flux densities in the showers with $\overline{N} = 3 \cdot 10^4$ and $\overline{N} = 1.2 \cdot 10^4$.

The ratio $\Delta = Q(\geq 10^9)/Q(>0)$ between the three shower groups was calculated to be 16 ± 4, 15 ± 3, and 13 ± 3, respectively. The data of the present work are compared with those of Refs. 2-4 in Table 1. Numerical data referring to the radial distribution of the particles are given in Table 2. Fig. 6 shows the integral distribution with respect to the number of electrons and photons of each group with $E \geq 10^9$ ev. Experimental data are given in an average over all showers along with those measured for 12 cases of shower cores that passed through the cloud chamber. Poisson's distribution curves are shown for both these distributions. The experimentally observed distribution does not agree with Poisson's. Fig. 7 shows the integral energy spectrum of electrons and photons within 3 m of the shower axis. Fig. 8 shows the spatial distributions of electrons and photons having energies $\geq 10^9$ ev for $r \leq 0.3$ m. For these high-energy particles the distribution

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The Energy Spectra of the Electron - Photon Component of Air Showers in the Neighborhood of the Shower Axis

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law $Q(\geq 10^9) \sim r^{-n}$ holds, where $n = 1.2 \pm 0.3$. The results obtained are compared with those of the cascade theory, for which purpose data of S. Z. Belen'kiy and I. P. Ivanenko are used. The conclusions are summarized as follows: 1) No change in the fraction of high-energy electrons and photons could be observed in the showers with an increase in the total number of particles. 2) The observed fraction of high-energy electrons and photons is considerably smaller than the theoretical one; and this is so whether the primary energy is assumed to be infinite, or an equilibrium between the electron-photon and the nuclear active components is assumed.

G. T. Zatsepin, I. P. Ivanenko, and L. I. Sarycheva are thanked for discussions; and D. F. Rakitin, O. N. Novoselov, I. A. Ivanovskaya, B. M. Mozharov, and L. K. Rocharov for their assistance in the experiments.

There are 8 figures, 2 tables, and 8 references: 7 Soviet and 1 US.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: December 18, 1959

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B006/B056

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24.6900

AUTHORS: Nikol'skiy, S. I., Smorodin, Yu. A.

TITLE: Interpretation of Experimental Data on the Spectrum of Electron-Photon Cascades Having Energies $> 10^{12}$ ev in the Upper Strata of the Atmosphere

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 4(10), pp. 1156 - 1157

TEXT: At the International Conference on Cosmic Radiation (Moscow 1959) a report was given on the original results obtained for the energy spectrum of electron-photon cascades at an altitude of 10 - 12 km. It was found that the energy spectrum of these cascades deviates considerably from the energy spectrum of primary cosmic radiation within the corresponding energy range ($\sim E^{-4}dE$ and $\sim E^{-2.7}dE$, respectively). As the assumption discussed at the conference that the energy fraction transferred in the electron-photon component decreases with growing interaction energy of the particles is not applicable to the data of extensive air

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8(4,24)

Interpretation of Experimental Data on the Spectrum of Electron-Photon Cascades Having Energies $> 10^{12}$ ev in the Upper Strata of the Atmosphere

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B006/B056

showers, the authors try to explain the data of energy spectra in a different way: they assume that the character of the elementary events of particle interaction at an energy from 10^{14} to 5.10^{14} ev changes. The authors calculated the total energy flux carried away by electrons and photons with energies higher than 10^{12} ev at an altitude of 10 - 12 km. The corresponding experimental data are given in a figure by circles (photoemulsion data) and squares (ionization chamber data). The total energy flux carried away by electrons and photons of energies $> 10^{12}$ ev is, if recording is done by ionization chambers, higher than when determined in photoemulsions. In order to determine the experimentally observed total energy flux, it is necessary to extrapolate for high energies. If, on this occasion, it is assumed that the energy spectra retain their shape, the energy fluxes measured by the photoemulsion metho are higher than those determined by means of ionization chambers. Agree- ment of experimental data may be obtained only by assuming that a large part of the electrons and photons with $E > 10^{12}$ ev, which are observed in

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86906

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B006/B077

9.9843

AUTHORS: Nikol'skiy, S. I., Pomanskiy, A. A.

TITLE: Calculation of the Averaged Characteristics of Extensive Atmospheric Cosmic Ray Showers

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1539-1546

TEXT: The present paper deals with a calculation of nuclear-cascade showers containing a given number of electrons at the observation level and also with a study of the distribution of the production altitude of extensive air showers containing total numbers of particles of 10^4, 10^5, and 10^6 at sea level (Moscow) and at an altitude of 3860 m (Pamir). The primary particles of such showers have an energy of 10^{12} to 10^{16} ev. The calculations are based on the following assumptions: The nuclear cascade consists of nucleons and charged pions which cause, in nuclear interactions, the production of neutral pions; the number of charged pions is also decreased because of $\pi \to \mu$ decay. Other nuclear particles are

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B006/B077

Calculation of the Averaged Characteristics of Extensive Atmospheric Cosmic Ray Showers

supposed not to be produced. The elementary event of nuclear interaction of primary particles with $E_0 > 10^{13}$ ev is considered by means of the hydrodynamic model, travelling waves being taken into account. The relations used for describing nuclear interaction events of nucleons with $E_0 < 10^{13}$ ev differ from those for $E_0 > 10^{13}$ ev only by an additional assumption on the particles corresponding to the travelling wave: they are supposed to be nucleons. For charged-pion interactions with $E_0 < 10^{13}$ ev the same hydrodynamic model is used, but without travelling waves being taken into account. The mean free path for nuclear interactions in air is taken to be 75 g/cm^2. $5.7 \cdot 10^9$ ev is taken as the minimum energy of particles involved in nuclear-cascade processes. A number of characteristics of these showers are averaged over various production altitudes and compared with the corresponding experimental data: The theoretical values are within the statistical limit of error of the latter. Considerations and comparisons are discussed by using diagrams and tables. Fig. 3 shows, e.g., the probability W that one shower observed at Pamir (the two upper diagrams)

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Calculation of the Averaged Characteristics of Extensive Atmospheric Cosmic Ray Showers

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or Moscow (the two lower diagrams) with a given number of particles N is produced at a certain depth of the atmosphere. Fig. 4 shows the production probability of a shower with $N = 10^5$ as a function of E_0. The authors

thank Professor G. T. Zatsepin for discussions and G. Ya. Goryacheva for computations. N. L. Grigorov and V. Ya. Shestoperov are mentioned.
There are 5 figures, 4 tables, and 19 references: 16 Soviet, 2 US, and 1 Italian.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: June 3, 1960

Legend to Table 3: 1) Altitude, 2) Energy of the nuclear shower component, 3) calculated, 4) experimental.
Legend to Table 4): 1) Altitude, 2) Energy of the electron-photon component of the shower, 3) calculated, 4) experimental, 5) mean total energy carried away by nuclear particles of a shower of N particles at the observation level x_0.

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Таблица 3

N	Высота, м	Энергия ядерно-активной компоненты лавин, eV	
	1	3 расчет	4 опыт
10^{6}	3860	$6\cdot10^{15}$	$\sim4,4\cdot10^{15}$
	0	$8,8\cdot10^{15}$	$\geq1,7\cdot10^{15}$
10^{8}	3860	$4,6\cdot10^{15}$	$\geq1,1\cdot10^{15}$
	0	$7,7\cdot10^{15}$	$> 2\cdot10^{15}$
10^{8}	3860	$4\cdot10^{16}$	$\sim2,3\cdot10^{16}$
	0	$8,2\cdot10^{16}$	$\geq1,2\cdot10^{16}$

Fig. 3

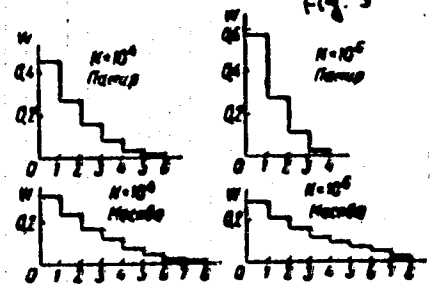

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Таблица 4

N	4 Высота, м	Энергия электронно-фотонной компоненты лавин, eV		$\bar{\varepsilon}(N,\varepsilon_1)$, eV
		3 расчет	4 опыт	5
10^{6}	3860	$2,8\cdot10^{15}$	$2,3\cdot10^{15}$	$4,1\cdot10^{15}$
	0	$2,3\cdot10^{15}$	$2\cdot10^{15}$	$3,5\cdot10^{15}$
10^{8}	3860	$3,2\cdot10^{15}$	$2,3\cdot10^{15}$	$3,8\cdot10^{15}$
	0	$2,4\cdot10^{15}$	$2\cdot10^{15}$	$3,5\cdot10^{15}$
10^{8}	3860	$3,4\cdot10^{16}$	$2,2\cdot10^{16}$	$4,1\cdot10^{16}$
	0	$2,5\cdot10^{16}$	$2\cdot10^{16}$	$3,5\cdot10^{16}$

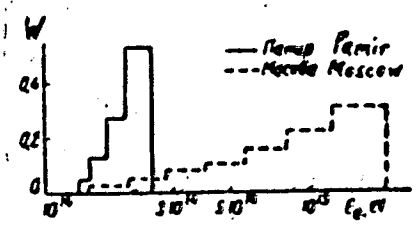

Рис. 4

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

NIKOLSKIY, S. I., MUKZINA, Ye. A. and YAKOVLEV, V. I.

"High Energy Nuclear-Active Particles and the Extensive Air Showers Which Accompany Them"

Report presented at the International Conference on Cosmic Rays and Earth Storm, 4-15 September 1961, Kyoto, Japan

P. N. Lebdev Institute of Physics, Moscow, USSR

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B113/B214

9.9843

AUTHORS: Denisov, Ye. V., Zatsepin, V. I., Nikol'skiy, S. I., Pomanskiy, A. A., Subbotin, B. V., Tukish, Ye. I., Yakovlev, V. I.

TITLE: Observation of nuclear-active particles and electron-photon avalanches with energies greater than 10^{12} ev at a height of 3860 m above sea level

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 2, 1961, 419-425

TEXT: The nuclear-active and electron-photon component of high-energy cosmic radiation were studied to obtain additional data on the nature of nuclear interaction at energies $\geq 10^{13}$ ev. The observations were made in 1959 on the Pamir. The detector consisted of four rows of ionization chambers between which were placed lead and carbon, and over which were 10 hodoscope groups containing 12 counters (550 cm^2 each). Besides, two cylindrical chambers were placed at a distance of 7 m from the middle of this setup, a hodoscopic point and detector of the energy density of the

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Observation of nuclear-active...

electron-photon component were at a distance of 18 m from the center and served to study the fluctuations of the particle flux. If the axis of the extensive atmospheric shower hits the recording area of the detector, the number of particles in the shower may be determined from the formula $N = 1000\ Q_{,2}$ where Q is the effective particle density of the particle flux per m^2. Assuming that in every event, nucleons and pions impart 1/3 of their energy to the new resulting pions, the energy of the nuclear-active particles was found to be given by $E = 2.5 \cdot 10^6 N^{1.04}$ ev which holds for the range 10^{11} ev $\leq E \leq 5 \cdot 10^{14}$ ev. In this energy range, the nuclear interaction cross section does not decrease with the increasing energy of the nucleons involved. From a comparison with the experimental data of other papers, the integral energy spectrum of the nuclear-active particles in the range $10^{12} \div 10^{15}$ ev can be expressed in the form $f(E) \sim E^{-n}$, where $n = 1.57 \pm 0.1$. For energies of nuclear-active particles $< 10^{15}$ ev, the energy spectra are determined from the spectral form of the primary particles with the help of the mean free path for nucleon interaction and the value of the inelasticity coefficient. In the intermediate range, the

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NIKOL'SKIY, S.I.; MURZINA, Ye.A.; TUKISH, Ye.I.; YAKOVLEV, V.I.

Particles with active nuclei and high energy avalanches of electrons and photons in the trunks of wide atmospheric showers of cosmic rays. Izv.AN SSSR.Ser.fiz. 26 no.5:668-673 Ap '62. (MIRA 15:5)

1. Fizicheskiy institut im. P.N.Lebedeva AN SSSR.
(Cosmic rays) (Electrons) (Photons)

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43457

S/055/62/078/003/001/005
B165/B104

AUTHOR: Nikol'skiy, S. I.

TITLE: Wide atmospheric showers of cosmic radiation

PERIODICAL: Uspekhi fizicheskikh nauk, v. 78, no. 3, 1962, 365-410

TEXT: Experimental work on wide showers in the lower part of the atmosphere during the last 10 years is reviewed. The following nuclear-cascade conception is characteristic for the new point of view from which wide showers are regarded since 1948: (1) the primary cosmic rays are nucleons, (2) the first process is a nuclear interaction whose secondary products form the soft, the penetrating, and the nuclear-active component of the shower, (3) the secondary nuclear-active particles collide with the nuclei of the air atoms and form all components of the shower. The total number of particles N in the shower on the level of observation is chosen as parameter to characterize each recorded shower and the energy of its primary particle. For determining the axis of the shower and its total number of charged particles no assumptions about its structure are necessary except that of a symmetrical decrease of particle flux density

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and the reduction of the share of the total energy carried by the nuclear-active particles. There are two possible interpretations for the phenomena occurring when N exceeds 10^5: (1) The energy spectrum and composition of primary particles suffers a change in the corresponding energy interval (10^{14}-10^{15} ev), (2) The characteristics of elementary processes in collisions between nucleons change in the same energy interval, or there even are new processes which do not occur at lower energies. In case (2) the assumption of an increased inelasticity coefficient and of the production of groups of electrons or photons and μ mesons with energies above 10^{12} ev and transverse momenta of $p_\perp < 10^8$ ev/c would allow to explain all experimental facts for $N > 10^5$. There are 28 figures and 4 tables.

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NIKOL'SKIY, S.I., kand.fiz.-matem.nauk

Inter-American seminar on cosmic rays. Vest. AN SSSR 33 no.3: 101-104 Mr '63. (MIRA 16:3)

(Cosmic rays)

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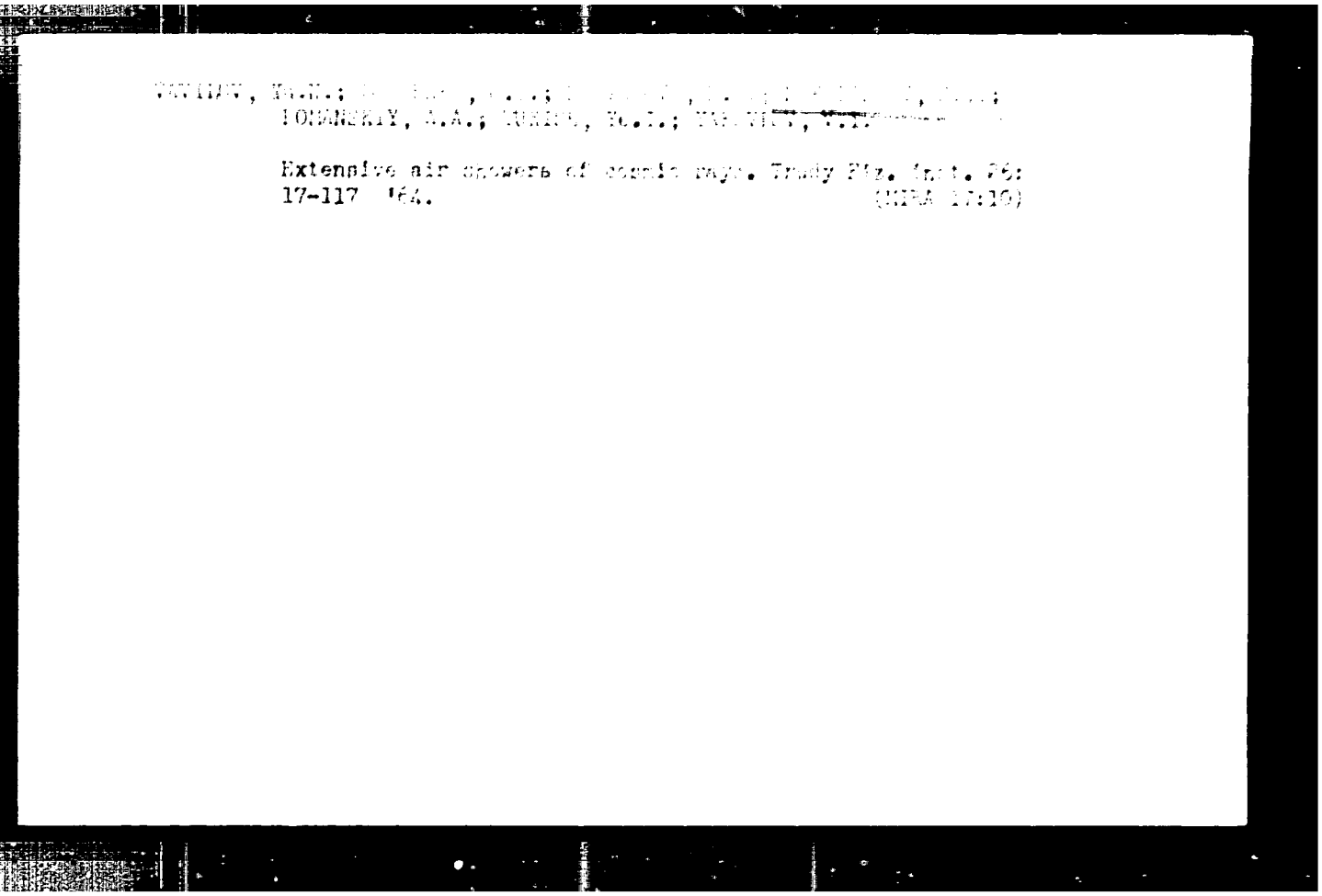

[illegible], V.M.; [illegible]
[illegible], A.A.; [illegible], V.I.; [illegible]

Extensive air showers of cosmic rays. Trudy Fiz. Inst. 26: 17-117 '64. (MIRA 17:10)

APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R0011372

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[illegible]-65 EWG(j)/EWT(m [illegible] AFWL [illegible] ASD [illegible]
[illegible] AS(mp)-2/AFMDC/AFETR/RAEM(c) [illegible]

ACCESSION NR: AP4049589 S/0048/64/028/011/1876/1885

AUTHOR: Zatsepin, G. T.; Nikol'skiy, S. I.; Khristiansen, G. B.

TITLE: Large atmospheric showers of cosmic radiation

SOURCE: AN SSSR. Izv. Seriya fizicheskaya, v. 28, no. 11, 1964, 1876-1885

TOPIC TAGS: electron, proton, atmospheric shower, Coulomb electron [illegible]ersion, photon, critical energy, primary radiation, energetic [illegible]um, magnetic field, diffusion coefficient, metagalactic ray,

ABSTRACT: Electrons constitute the most numerous part of charged [illegible]les in the atmospheric showers, [illegible] electrons in the [illegible]tion process causes the expenditure of much energy or absorption [illegible]wer particles during passage through the atmosphere. The results [illegible] measurements prove that Coulomb electron dispersion in atmospheric [illegible] is the fundamental process which determines the spatial [illegible]ination of electrons and [illegible] with energies near the [illegible]al energy in the radiation flux. The total energy [illegible] of electrons [illegible]tons at the mean density of showers [illegible] $10^{[illegible]}$ Mev at sea

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

ACCESSION NR: AP4049580

... and E = 2.1 x 10^8 Mev on mountains. Spectra of high-energy ... ary radiation were investigated by means of a special installation. ...ges in the energy spectrum and the composition of primary cosmic ... ic or simultaneously in the magnetic field, the strength of which ... rrives the value of the diffusion path length. The energy spectrum ... the composition of metagalactic rays differ from those of galactic ...in. Metagalactic rays are rich in protons and light nuclei of the ... energy as those of the galactic origin. The density of the ...n flux in usual showers is found to be tens and hundreds of times ... er than that obtained from theoretical computations. Orig. art. ... 5 figures, 10 formulas, and 1 tables.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: AA, ES

NO REF SOV: 019 OTHER: 008 ATD PRESS: 3140

Card 2/2

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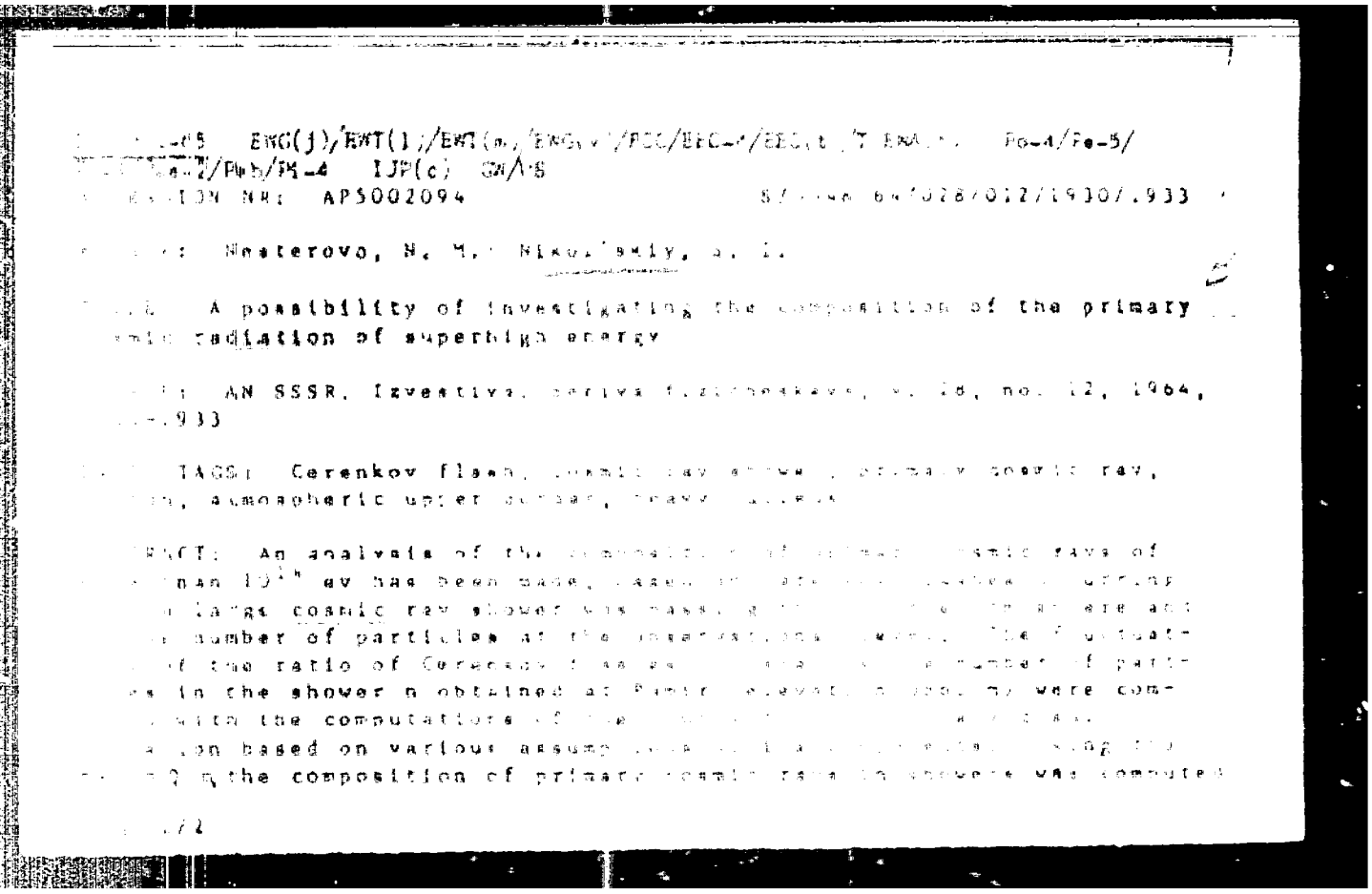
"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137



ACCESSION NR: AP5002094 S/0056/64/028/012/1930/1933

AUTHOR: Nesterova, N. M.; Nikol'skiy, S. I.

TITLE: A possibility of investigating the composition of the primary cosmic radiation of superhigh energy

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v. 28, no. 12, 1964, 1930-1933

TOPICS: Cerenkov flash, cosmic ray shower, primary cosmic ray, cosmic ray, atmospheric upper layer, heavy nuclei

ABSTRACT: An analysis of the [illegible] cosmic rays of more than 10^{15} ev has been made, based on the [illegible] of ultraviolet Cerenkov flashes from large cosmic ray showers with masses [illegible] and the number of particles at the observation level. The [illegible] of the ratio of Cerenkov flashes [illegible] number of particles in the shower n obtained at Pamir [illegible] were compared with the computations of the [illegible] on based on various assumptions [illegible] the composition of primary cosmic rays in showers was computed

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two assumed types of protons and other heavy articles. The first type contained data about the composition of primary cosmic rays with energies of 10^{10}–10^{12} ev at the upper limit of the atmosphere. The [illegible] type contained primary [illegible] with particle energies from [illegible] ev. The distribution of particles depends [illegible] primary cosmic [illegible] rig. art. has: [illegible]

[illegible] Fizicheskiy [illegible] Akademii Nauk [illegible] Institute of Physics, Academy of Sciences [illegible]

[illegible] 00 [illegible]

[illegible] 006 [illegible]

2/2

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"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

ACCESSION NR: AP4037566 S/0056/64/046/005/1561/1577

AUTHOR: Danilova, T. V.; Denisov, Ye. V.; Nikol'skiy, S. I.

TITLE: Determination of the total number of nuclear active particles in extensive air showers with the number of particles between $3 \cdot 10^5$ and 10^7

SOURCE: Zh. eksper. i teor. fiz., v. 46, no. 5, 1964, 1561-1577

TOPIC TAGS: cosmic ray, nuclear particle, nuclear active particle, cosmic shower, cosmic air shower

ABSTRACT: The dependence of the number of nuclear active particles N_n on the total number of shower particles N has been measured for $N = 3 \cdot 10^5 - 10^7$. The experiments were conducted at the Tian-Shan Cosmic Ray Station of the FIAN (Lebedev Physics Institute of the Academy of Sciences SSSR) during the winter and spring of 1961. Showers with a given number of particles and an axis which passed near the center of the experimental array were selected by combining coincidences and anticoincidences registered by counters covering a given

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ACCESSION NR: AP4037566

area. The nuclear active particles were recorded by five neutron detectors which differed in effective area, thickness of lead absorber, and distance from center of the array. According to data obtained, the integral number spectrum (at 3330 meters above sea level) can be expressed by the following formulas:

$$S(>N)=(1.1\pm0.1)\cdot10^{-4}\left(\frac{N}{2.5\cdot10^5}\right)^{-1.00}\ \text{hr}^{-1}\cdot\text{m}^{-2}\quad \text{for } N<2.5\cdot10^5,$$

$$S(>N)=(1.1\pm0.1)\cdot10^{-4}\left(\frac{N}{2.5\cdot10^5}\right)^{-1.6}\ \text{hr}^{-1}\cdot\text{m}^{-2}\quad \text{for } N>2.5\cdot10^5.$$

It is possible that, because of the effect of the change in the lateral distribution function of shower particles near the shower axis, the shower spectrum is reduced when N is small; however, the amount by which it is reduced does not exceed 0.1. The dependence of N_n on N can be represented by an exponential law with an exponent

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ACCESSION NR: AP4037566

of 0.72 ± 0.06. The absolute flux of nuclear active particles is in satisfactory agreement with the results of Cocconi and Hazeden obtained for the same threshold value, and leads to a reasonable result for the spectrum of nuclear active particles in showers with energies between $2 \cdot 10^8$ and $3 \cdot 10^9$ ev in comparison to the results of high energy measurements by Nikolsky and Legan. An estimate shows that the energy contribution of nuclear active particles is different for large and small showers. The results of various experiments on the dependence N_n on N show that a better approximation for the whole range $3 \cdot 10^5 < N < 2 \cdot 10^6$ than that given by $N_n \sim N^{\beta}$ (where β is a constant) is obtained by the following set of formulas: $N_n \sim N^{0.79}$ for $N < 5 \cdot 10^5$, $N_n \sim N^{0.4}$ for $5 \cdot 10^5 < N < 2 \cdot 10^5$, and $N_n \sim N^{0.96}$ for $2 \cdot 10^5 < N < 2 \cdot 10^6$. Orig. art. has: 14 formulas, 8 figures, and 3 tables.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute, Academy of Sciences SSSR)

SUBMITTED: 18Nov63 DATE ACQ: 09Jun64 ENCL: 00

SUB CODE: AA NO REF SOV: 006 OTHER: 015

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Pq-4/Pl-4/Pae-2/Peb IJP(c)/ASD(a)-5/AFWDC/AFETR GM/WS

ACCESSION NR: AP4037611 S/0056/64/046/005/1908/1911

AUTHOR: Nesterova, N. M.; Nikol'skiy, S. I.

B

TITLE: Investigation of the composition of primary cosmic radiation using fluctuations of Cherenkov light in extensive air showers

SOURCE: Zh. eksper. i teor. fiz., v. 46, no. 5, 1964, 1908-1911

TOPIC TAGS: cosmic rays, cosmic radiation composition, primary cosmic radiation composition, extensive air shower, Cherenkov flash, shower particle number

ABSTRACT: A new procedure is reported for the analysis of the primary cosmic radiation at energies above 10^{15} eV, based on the determination of the ratio of the intensity Q of a Cherenkov flash accompanying the passage of an extensive air

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ACCESSION NR: AP4037611

Mt. Pamir (elev. 3860 m). The results indicate that the distributions of O/N in extensive air showers depend strongly on the composition of the primary cosmic rays. The approximate nature of the assumptions made and the low experimental accuracy make it still impossible to conclude that the primary cosmic radiation has the same composition at low (10^{10}--10^{12}) and high ($\sim 10^{15}$) energies. Orig. art. has: 1 figure, 1 formula, and 1 table.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute, AN SSSR)

SUBMITTED: 11Nov63 ENCL: 02

SUB CODE: AA, OP NR REF SOV: 007 OTHER: 003

Card 2/4

APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001

"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

12-68

ACCESSION NR: AP5037613

ENCLOSURE 01

Distribution of relative values of the Cerenkov flash in extensive air showers at 3360 m above sea level. The abscissas are the quantities $(Q_i/N_i)/(Q/N) - 1$.

Calculated distributions: dash-dot -- for the case when all the showers are generated by protons; solid line - variant I, dashed line - variant II. Points - experimental data.

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L 7032-65

ACCESSION NR: AP4037611

ENCLOSURE: 02

Composition of primary cosmic radiation and corresponding number of extensive air showers observed at mountain altitudes

	Corresponding distribution (in %)		Corresponding distribution (in %)	
	Exposure I	Exposure II	Exposure I	Exposure II
P ($\bar{A}=1$)	21			
α ($\bar{A}=4$)	27	11	68	15
M ($\bar{A}=14$)	14	21	24	13
H ($\bar{A}=31$)	19	12	11	30
VH ($\bar{A}=51$)	13	28	7	27
				25

Composition of cosmic radiation (per cent)
Corresponding distribution of EAS at mountain altitudes (per cent)
variant

and A/A

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L 27825-65 EWG(j)/EWT(m)/FCC [illegible]
ACCESSION NR: AT4019081 S/2504/64/026/000/0017/0117

AUTHOR: Vavilov, Yu.N [illegible]ovchenko, O.I. Nesterova, N.M. Nikol'skiy, S.I. Pomanskiy, A.A., Tukish, Yu.I.; Yakovlev, V.I.

TITLE: Extensive cosmic ray air showers

SOURCE: AN SSSR. Fizicheskiy institut. Trudy*, v. 26, 1964. Kosmicheskiye luchi (Cosmic rays), 17-117

TOPIC TAGS: air shower, cosmic radiation, pi meson, secondary particle, nuclear cascade, nucleon, hodoscopic counter, Wilson chamber, ionization chamber, Cerenkov radiation, cosmic ray burst, air shower core, mu meson

ABSTRACT: The question of air showers is treated at length on the basis of work done from 1952 to 1959. Pp. 18-39 deal with methods of studying extensive air showers. The method used by the 1952 Pamir expedition is described. Individual sections deal with each of the following: the method of correlated hodoscopes used in the measurement of shower

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[redacted] experiments in the study of air showers. Pp. 40-72 deal with the composition of extensive air showers.

Card 1/3

[redacted]

ACCESSION NR: AT4049951

Individual sections are devoted to: radial distribution of charged particles, shower spectra with regard to number of particles at observation height (3860 meters); energy spectra of electron-photon components; energy flux of electron-photon components; radial distribution of nuclear-active particles and their number in showers with various numbers of charged particles at observation level; energy and composition of active particles; radial distribution of mesons and their number in extensive air showers with various numbers of charged particles; mu-meson energy spectra; radial distribution of Cherenkov radiation; energy expended by particles at observation level; and fluctuation of Cherenkov bursts. Pp. 73-92 deal with air-shower cores and high-energy nuclear-active particles with individual sec-

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ACCESSION NR: AT4049951

... appearance ... new ... elementary ... collision of 10^{14} - 10^{15} ev ... ons may be possible ... S. Nikol'skiy ... Grishin, B. Zhur- ... Pomorov, V. Sarantsev ... Tukish ... A. Smagin and V. Filonov ... Kolomiytsev, ... Kuznetsov ... ed in making the measurements ... The measurements in 1955 ... were carried out by A. Ye. Chudakov, N. M. Nesterova, V. I. Zatsepin, P. V. ... Ye. I. Tukish, Yu. N. Konovalov and V. Ya. Markov (members of the FIAN), as well as Yu. D. Volkov, Yu. V. Galaktionov, V. I. Dadykin, A. S. Korolev, V. I. Makare- ... and other students at Moscow State University. The Cerenkov radiation of extensive atmospheric showers at sea level was measured by members of FIAN and MGU under the guidance of V. I. Zatsepin. The energy of ... particles was calculated by Ye. A. Murzina, while Ye. P. Yudin took part in the calculation of the A... variant. Orig. art. has: ... figures, 13 tables and 7 formulas.

ASSOCIATION: Fizicheskiy institut AN SSSR (Physics Institute, AN SSSR)

SUBMITTED: 00 ENCL: 00 SUB CODE: AA

NO REF SOV: 094 OTHER: 040

Card 3/3

"APPROVED FOR RELEASE: Tuesday, August 01, 2000 CIA-RDP86-00513R001137

ZATSEPIN, G.T.; NIKOL'SKIY, S.I.; KHRISTIANSEN, G.B.

Extensive air showers of cosmic rays. Izv. AN SSSR. Ser. fiz. 28 no.11:1876-1885 N '64. (MIRA 17:12)

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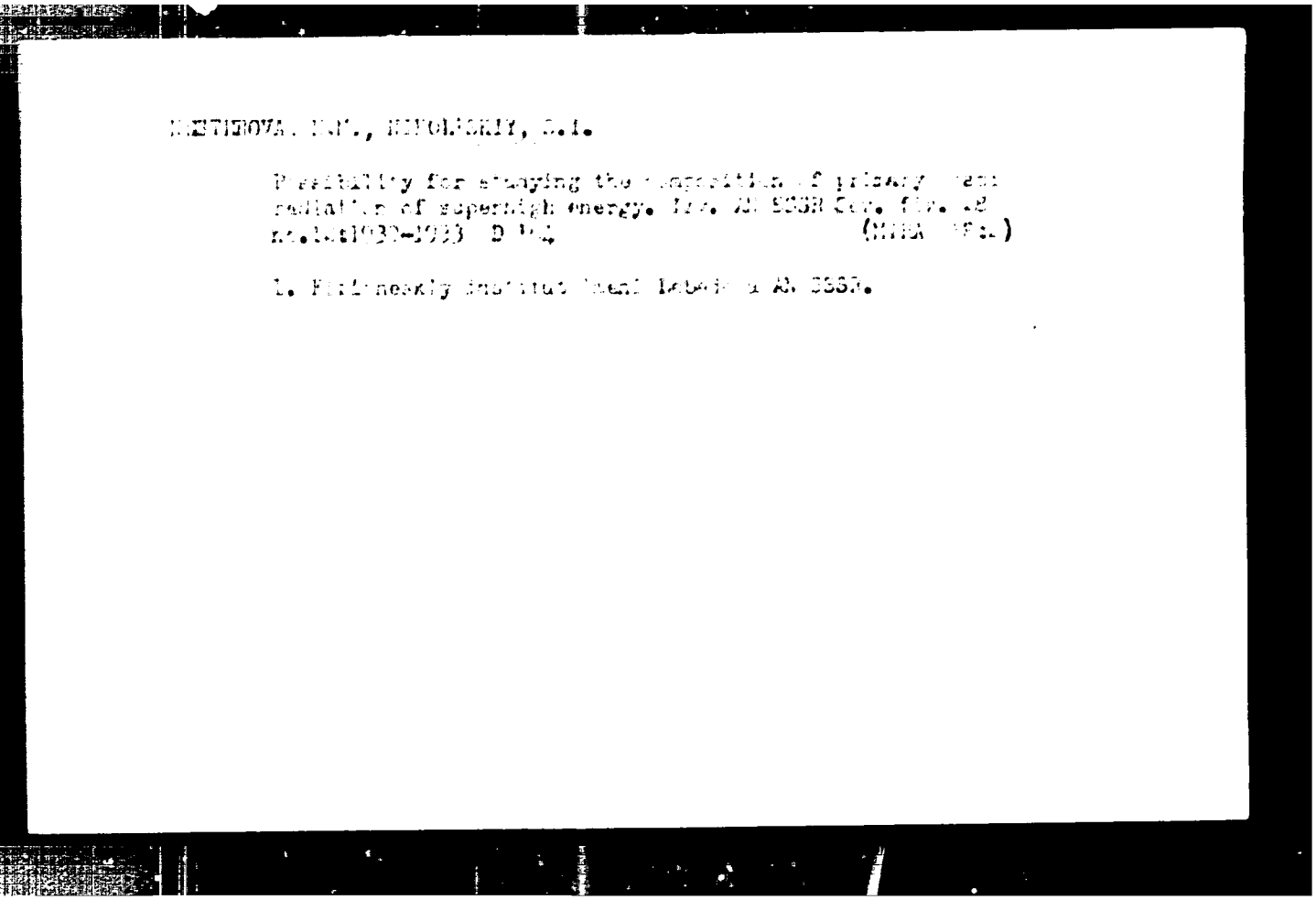

[illegible], V.V., MIKOLAISKIY, S.I.

Possibility for studying the composition of primary cosmic radiation of superhigh energy. Izv. AN SSSR Ser. fiz. 28 no.1:1929-1933 D '64. (MIRA 18:1)

1. Fiziceskiy institut imeni Lebedeva AN SSSR.

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