meteorological effect, δN, is shown by the dashed line in the Figure). Then, using the observed $\delta \overline{I}_h$, one concludes that the diurnal variation of the intensity of the hard component of cosmic rays has a non-meteorological origin and amounts to about 1% (shown in the Figure by the dot-and-dash line).

4. It should be noted that the seasonal variation of the diurnal effect of cosmic rays can be explained by the seasonal change in the diurnal fluctuation of meteorological factors. It is known[7] that the largest diurnal temperature fluctuations of the troposphere occur in summer, the smallest in winter. If the diurnal variation of the intensity of cosmic rays predicted by the meteorological effect is opposite to the one observed, then one should expect that the diurnal effect observed should be smallest in summer and largest in winter. This indeed occurs, as is seen in Table 3, where are shown the amplitudes of the first harmonic, calculated from the seasonal averages of the diurnal variation of the intensity of the hard component of cosmic rays, $\delta \overline{I}_h$. It is seen that the diurnal effect in summer is only half that in winter, and this agrees with the increase in the diurnal meteorological effect in summer (Table 1).

TABLE III

	Winter	Spring	Summer	Autumn	Year-round
Amplitudes in % . . .	0.18 ± 0.004	0.15 ± 0.004	0.09 ± 0.004	0.12 ± 0.005	0.13 ± 0.002
Time of maximum (in hours).	13.9	13.9	13.4	13.3	13.4

However, the data in Table 3 contradict the work of Duperier[1] who observed, by a coincidence method, that the total intensity of cosmic rays exhibited a larger effect during summer months than in winter. This disagreement could be explained by a considerably larger contribution of the diurnal variation of meteorological factors to those measurements than to ours, because the average particles observed there were softer. For this reason, perhaps, the seasonal changes of the diurnal effect observed there directly reflected the meteorological component of the diurnal effect of cosmic rays.

In conclusion, the author thanks Prof. E. L. Feinberg and Iu. G. Shafer for valuable suggestions and advice. The author also thanks G. V. Skripin for his help in the calculations and analysis of the data.

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Translated by V. A. Nedzel
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Nuclear Fissions Associated with Heavy Unstable Particles

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1. WITH the aid of thick photoemulsions there have been found to date over one hundred nuclear fissions in which there are produced hyperons (charged hyperons $Y\pm$ and Λ^0 particles) and heavy mesons of mass $\sim 1000\ m_e$ (K and τ mesons). There were also detected about thirty secondary fissions produced by the nuclear capture of stopped negative heavy mesons.

This note gives a brief account of some results of the statistical analysis of these fissions. The conclusions should for the present be considered as likely hypothesis in need of additional verification and more complete proof.

TABLE

Star type	$Y^\pm$	Λ^0	$Y^\pm+\Lambda^0$	K	τ	Stars observed in the stratosphere
$\bar{N}_h$ . . .	19.3±2.5	18.8±1.9	19.0±1.7	18.0±1.8	11.2±1.9	12.3±0.9

2. The table shows the average number of gray and black rays N_h for starts containing charged hyperons, Λ^0 particles (more accurately excited fragments[1]), K mesons and τ mesons. For comparison there are also given data for ordinary cosmic ray stars observed in the strastophere[2].

In order to insure that the released energy is approximately the same in all cases only those stars were selected in which the number of relativistic particles N_s satisfied the condition $5 \leqslant n_s \leqslant 10$.

It is seen from the Table that, in regard to the value of $\bar{N}_h$, the conditions for the production of $Y\pm$ and Λ^0 particles are very similar. This agrees with the natural hypothesis that charged and neutral hyperons are particles of one type. Similarly, the concurrence of $\bar{N}_h$ for stars containing hyperons and K mesons is in agreement with the hypothesis of the pair production of particles[3,4]. On the other hand, cases are also known of hyperon and τ meson pair production[5,6]. It follows from the Table, however, that in the present case the mechanism of pair production is not the determining one. Actually, if hyperons and τ mesons originated in pairs only, then stars containing these particles would be characterized by the same $\bar{N}_h$ values.

At the present time there is an intensive consideration of a hypothesis according to which K and τ mesons are not different particles, but different types of the decay of the same particle[3,7]. If this is so, then the values of $\bar{N}_h$ for stars containing K and τ mesons must be the same. The sharp discrepancy between this conclusion and the experimental data permits one to conclude that K and τ mesons are distinct particles.

3. The value of $\bar{N}_h$ for ordinary stars agrees with that for stars containing τ mesons but differs markedly from $\bar{N}_h$ for stars containing K mesons and hyperons. This means that the probability of a τ meson production in the fission of a light nucleus of a photo emulsion is the same as in the fission of a heavy nucleus. On the contrary, K mesons and hyperons are formed mainly in the heavy emulsion nuclei. At the present time one cannot give a well-defined interpretation of this fact. It is of interest to note that qualitatively this fact agrees well with Powell's hypothesis[3,4], which assumes that hyperons and K mesons are formed in two stages during the nuclear interactions of nucleons. The first stage consists of the production of a π meson shower, the interaction of which with the nucleons in the same nucleus leads in the second stage to the pair production of hyperons and K mesons.

4. In the investigation of the stars formed as a result of the capture of stopped negative mesons with mass $\sim 1000\, m_e$, which we call conventionally K mesons, two characteristics are worthy of notice:

a) the formation of π mesons with energies $\sim 30 - 40$ Mev ;

b) the release of very small energies in a considerable number of cases.

Detailed analysis of these and certain other facts leads to the conclusion that the nuclear capture of $K-$ mesons takes place with the formation of Λ^0 particles according to the following schemes:

$$K^- + p \to \Lambda^0 + \pi^0,\ K^- + p \to \Lambda^0 + \gamma,$$

$$K^- + p \to \Lambda^0 + \nu.$$

Moreover, the Λ^0 particles remain, as a rule, bound within the nucleus, forming a system similar to a stationary excited fragment. Subsequent events take place as in the decay of excited fragments.

It is not excluded that during the capture of a $K-$ meson there is also formed a bound charged hyperon which is then changed inside the nucleus into an Λ^0 particle.

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Determination of the Absolute Concentrations of Atoms in a Multi-Component Arc-Vapor

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THE Prilezhaeva method[1] makes it possible to determine the absolute concentrations of atoms in the positive column of a direct-current arc[2, 3]. It is generally believed that absolute concentrations can be measured by this method only in the case where the arc-vapor contains two components (a compound which is difficult to ionize --- air and carbon --- and an easily ionized one --- the vapor of the element being investigated). However, we have also applied the Prilezhaeva method in the case of a more complex arc-vapor.

Let an arc-vapor contain k elements which are to be analyzed and whose concentrations are N_1, N_2, . . . N_k respectively. The general idea of the concentration of atoms is based on the fact that the degree of ionization of a mixture of different gases at a given temperature depends on the composition of the gas. By determining the fractional ionization of the gas experimentally, it is possible to determine the concentrations of the base components of the mixture.

The resultant (average) fractional ionization of the gas as a whole (i.e., the mixture), $\bar{x}$, is related to the concentrations of the components in the following way:

$$\bar{x} = \sum_{i=0}^{k} x_i N_i \Big/ \sum_{i=0}^{k} N_i, \qquad (1)$$

where x_i is the fractional ionization of the ith component. Consequently, in order to determine the N_i, it is necessary to know the average fractional ionization of the gas and also the fractional ionizations of all the components. To determine these quantities, it suffices to measure experimentally the temperature of the gas and the fractional ionization of only one of the components. Then the Saha equation can be written for each component:

$$\lg \frac{x_i}{1-x_i} \frac{\bar{x}}{1+\bar{x}} = 2.5 \lg T - \frac{5040}{T} V_i - 6.5, \qquad (2)$$

where T is the temperature and V_i is the ionization potential of each component in electron volts. From Eq. (2) as written for that component whose fractional ionization is measured, it is possible to determine $\bar{x}$, and then from this same equation as written for all the remaining components, it is possible to determine all the x_i. However, knowing $\bar{x}$ and the x_i is still not sufficient for finding the N_i from Eq. (1). It is necessary to have additional relations between the concentrations, N_i. Such relations can be obtained if we measure $k-1$ ratios of the intensities of pairs of spectral lines (regardless of whether they are atomic or ionic) of the elements being investigated. For example, we take the ratio of two atomic lines of the ith and nth components to be:

$$\frac{I_i}{I_n} = \frac{N_i}{N_n} \frac{A_i g_i g_{n0}}{A_n g_{i0} g_n} e^{-(E_i - E_n)/kT} \frac{\nu_i}{\nu_n}, \qquad (3)$$

where A is the transition probability, g is the statistical weight and E is the excitation potential of the line.

The ratio N_i/N_n can be determined from Eq. (3). Here, however, a complication arises from the fact that it is necessary to know the transition probabilities of the lines which are being used. In order to determine k quantities, the N_i, from $k-1$ relations in the form of Eq. (3) and Eq. (1), it is still necessary that N_0, the last unknown quantity in Eq. (1), be eliminated. In the denominator, N_0, enters together with the N_i in the form of a sum. Since the pressure p (atmospheric) and the temperature T are known, this sum can be determined very simply from a consideration of gas kinetics by the formula:

$$N = \sum_{i=0}^{k} N_i = \frac{9.7 \cdot 10^{18}}{T} p, \qquad (4)$$

where p is the pressure in mm Hg.

The numerator term containing N_0 can usually be neglected, i.e., in the majority of cases:

$$\sum_{i=1}^{k} x_i N_i \gg x_0 N_0. \qquad (5)$$

This is always justified when the ionization potential, V_i, of even one of the components, which is

ERRATA

	reads	should read
Rodionov et al, Soviet Phys. JETP 1, 64 (July, 1955)		
p. 64, column 2, line 19	methyl or ethyl	methylal or ethylal
Bogoliubov and Zubarev, Soviet Phys. 1, 83 (July, 1955)		
p. 88, column 1, line 6	omits	is taken over
p. 88, col. 1, 4th line from bottom	appears in	are
Grametitskii et al, Soviet Phys. JETP 1, 562 (November, 1955)		
p. 562, title	"fissions"	"disintegrations"
p. 562, paragraphs 1 and 2 (3times)	"fissions"	"disintegrations"
p. 563, column 1, 5th line from bottom	"fissions"	"disintegrations"

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Our apologies to Academician Abram Fedorovich Ioffe for interpreting his anniversary biography as an obituary. Like the report of Mark Twain's demise, it was a great exaggeration.

ANNOUNCEMENT

Beginning with the next issue (August, 1956), Soviet Physics JETP will appear monthly. Volume 3 (August, 1956-January, 1957) will contain translations of all articles appearing in Volume 30 of the Journal of Experimental and Theoretical Physics of the USSR (January-June, 1956). Volume 4 (February-July, 1957) will be a translation of Volume 31 (July-December, 1956) of the Soviet Journal.

Subscribers to Soviet Physics JETP for the calender year 1956 will receive Volume 3 as the completion of their subscription. For new subscribers (beginning with Volume 3) the subscription price will be \$60.00 per year (two volumes, twelve issues) in the United States and Canada, \$64.00 per year elsewhere. The single issue price will remain at \$6.00.

Beginning in either July or August, 1956, the American Institute of Physics will commence translations of the Journal of Technical Physics of the USSR, the Acoustics Journal of the USSR andthe physical sciences portions of Doklady. Price schedules for these journals are given below. Subscriptions should be addressed to the American Institute of Physics, 57 East 55 Street, New York 22, N. Y.

Soviet Physics—Technical Physics

A translation of the "Journal of Technical Physics" of the Academy of Sciences of the U.S.S.R. Eighteen issues per year, approximately 4,000 Russian pages. Annually, \$90.00 domestic, \$95.00 foreign.

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A translation of the "Physics Section" of the Proceedings of the Academy of Sciences of the U.S.S.R. Six issues per year, approximately 900 Russian pages. Annually \$25.00 domestic, \$27.50 foreign.