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ԳԻՏԱԿԱՆ ՀԱՂՈՐԴՈՒՄ НАУЧНОЕ СООБЩЕНИЕ

ЕФИ-100(74)

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ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ ЭКСПЕРИМЕНТА ПО ИДЕНТИФИКАЦИИ КОСМИЧЕСКИХ АДРОНОВ С ИСПОЛЬЗОВАНИЕМ РПИ-ДЕТЕКТОРОВ

Приводятся результаты исследования спектра адронов космического излучения с энергией $\geqslant 300$ Гэв. Нижний предел отношения N_π / N_p составляет 0,37 + 0,16. Данные получены на установке, состоящей из РПИ-детектора и сцинтилляционного калориметра.

Ереванский физический институт
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PRELIMINARY RESULTS OF THE EXPERIMENT ON THE IDENTIFICATION OF COSMIC HADRONS USING THE XTR-DETECTORS

The spectrum of cosmic hadrons with energies exceeding 300 GeV was measured by means of the arrangement consisting a XTR detector and a scintillation calorimeter. The lower bound of N_π/N_p ratio was obtained to make 0.37 ± 0.16.

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The theoretical and experimental investigations of X- ray transition radiation (XTR) in laminar media [I - 3] showed that in definite frequency intervals the intensity sharply increases with the increase of $\gamma = E/mc^2$. Then this dependence decreases and the value of $\gamma \geq (3 \div 4)\gamma_1$ where $\gamma_1 = \hbar\omega_e a(a+b)N$ (a is the thickness of the laminar medium plates, b is the distance between them, N is the number of electrons per I cm^3 of the substance of plates) the energetic dependence curve reaches the plateau. Thus, if there are two particles with the value of γ_2 and γ_3 accordingly satisfying the conditions $\gamma_2 < \gamma_1 < \gamma_3$ the probability of registration of the particles with γ_3 will be considerably higher than the particles with value of γ_2.

While using XTR-detectors for the registration of the particles with different masses in the experiments on cosmic rays the necessary acceptance and resolution can be provided by using the method of the deposition of energy [4].

In this case both charged particle and the generated radiation are registered by the same detector, namely, by proportional counters. The output signal of the counter will be proportional to the total deposition of the energy due to the absorption of the transition radiation and to ionization losses of the particle in the counter gas. In contrast to the transition radiation the ionisation losses of ultrarelativistic particles practically are independent of γ. Thus, at small values of γ the output signal will be defined by the ionisation losses, and at large γ - by the total deposition of the energy. Both Monte-Carlo calculations [5] and experimental investigations on accelerators [3,6] confirm the possibility of the usage of such XTR-detectors for high ener-

gy particle identifications.

On the cosmic ray station Aragats (3250 m above the sea level of Yerevan Physics Institute the registration of the ratio of the number of cosmic pions to that of protons at the energy exceeding 300 GeV was made by means of the arrangement using XTR-detectors.

The lay-out of arrangement [7,8] is given in Fig.I. It consists of the scintillation calorimeter, XTR-detector and spark chambers.

The scintillation calorimeter consists of six-layer scintillators interleaved with iron stacks with the total amount of substance ~ 830 g/cm^2. XTR-detector consists of the laminar medium (200 mylar foils, a-25μ, b-2cm) and the multiwire proportional chamber with the thickness of 3 cm, filled with the mixture of Ar 93% + 7% of propan. XTR-detector defines the value of $\gamma = E/mc^2$. thus, according to the known values of E and γ the pions and protons may be separated.

The spark chambers are used for the particle separations with no accompaniment (SC_1, and SC_2) and also for the inclusion of air electrons and knock-on electrons (SC_3, SC_4).

Geometrical factor of the arrangement is 6,5 . 10 cm^{2}ster).

The measurements were carried out with the laminar medium and without it. The measurement results are given in Fig.2. Here the dashed hystogram corresponds to the distribution of the energy deposition in the case of the laminar medium equivalent, that is to ionization losses of the hadrons with the energy of $\geqslant$ 300GeV. The dotted hystogram is obtained at runs with the laminar medium at the same hadron energies. Each hystogram includes about of data 200 hadrons.

As we can see from the comparison of two hystograms, the presence of the laminar medium leads to the increase of the event numbers with larger energy deposition. It follows from the analysis that such a shift in the values of the energy deposition can be related only to the transition radiation formed by π - mesons, as the contribution of the transition radiation of protons with the account of sharply decreasing spectra of hadrons is small in the given energy ranges,

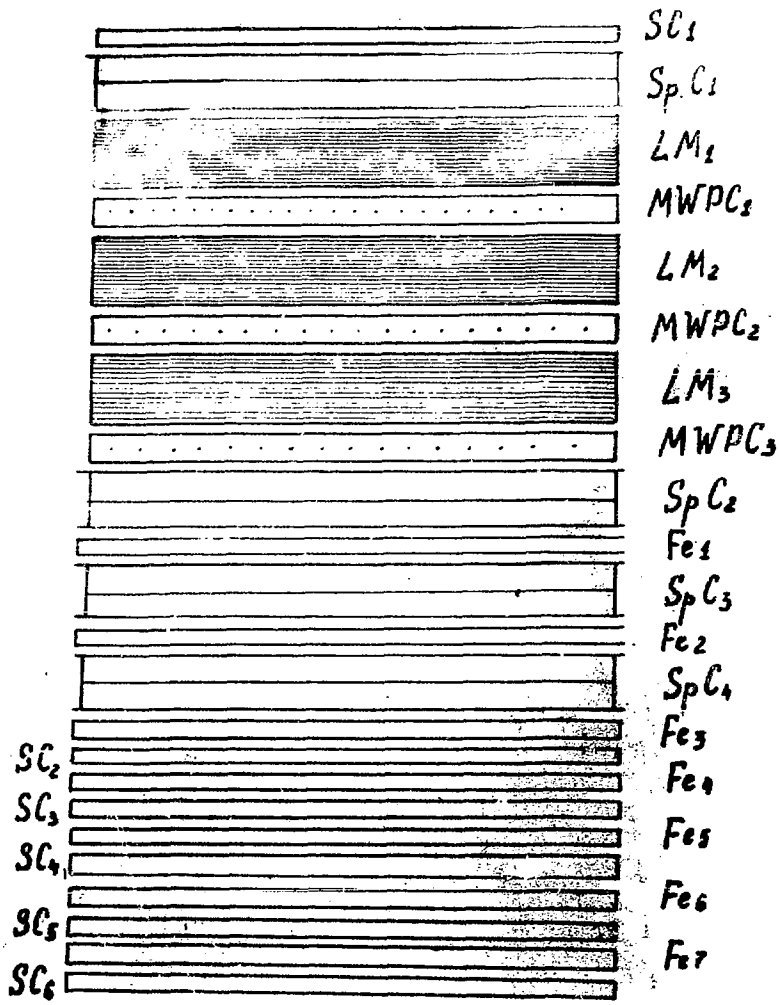
Basing on this assumption the lower bound of the ratio of N_π/N_p may be obtained. It appeared to be equal to 0,37 + 0,16; that doesn't contradict to the known data obtained in the same ranges of the energy [9-13].

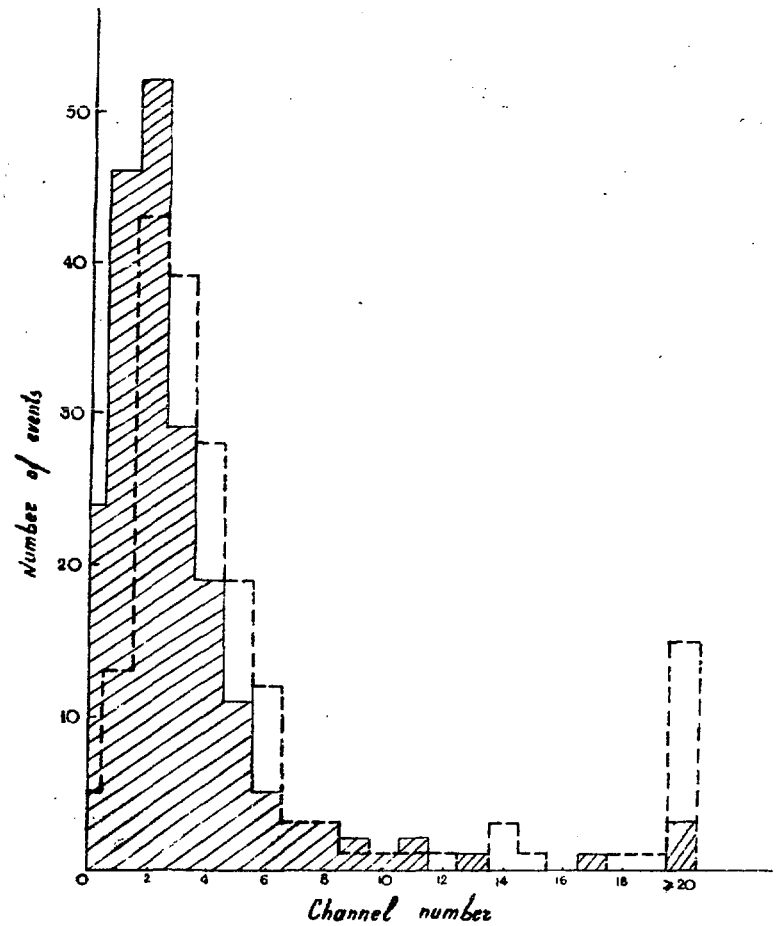
It should be pointed out that these data were taken with only one section of XTR-detector. Nevertheless the possibility of using of such a method of hadron identifications on the basis of these preliminary results has become obvious. The using of several sections of XTR-detectors, as well as the increase of the acceptance of the arrangement will allow one to use such a method for the identification of hadrons and also for studying the characteristics of their interactions up to several TeV.

FIGURE CAPTIONS

Fig.I. The layout of the arrangement (SpC-spark chambers, SC - scintillators, $MWPC$-proportional chambers, Fe - iron stacks, LM -laminar medium).

Fig.2. Distribution of hadron energy depositions with the laminar medium equivalent (dashed hystogram) and with the laminar medium (dotted hystogram).


SC1
Sp.C1
LM1
MWPC1
LM2
MWPC2
LM3
MWPC3
SpC2
Fe1
SpC3
Fe2
SpC4
Fe3
Fe4
Fe5
Fe6
Fe7
SC2
SC3
SC4
SC5
SC6


50
40
30
20
10
0
Number of events
2
4
6
8
10
12
14
16
18
≥20
Channel number

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