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1. Introduction Due to the strong decrease of the energetic cosmic ray flux its direct detection at the top of atmosphere with air crafts is limited at the present time to about 10^5Gev. The intensity of all primary particles can be approximated in the range 10^2-10^5Gev by power function with power index 2.65. There are predominantly protons (about 40 %) and the rest is represented by several groups of nuclei (He, C-N-O, mean and heavy nuclei). In the range of 10^5-10^8Gev considerable disagreement is observed between the estimations of the primary spectrum that is most probably connected with the uncertainity of the indirect derivation of the energy and the type of primary particles on the basis of ground parameters of extensive air showers.

In this paper we will discuss our results for the primary spectrum in the range 10^5-10^8 Gev, obtained by implication of EAS data from mountain altitudes[1] registered with Tian Shan and Chacaltaya apparatuses.

2. Energy spectrum of primary cosmic rays at 10^5-10^8 Gev The mean energy of primary cosmic flux is obtained on the basis of electron and muon size spectra of EAS. For that purpose we have simulated the development of electron and muon components in EAS initiated by primary particles with fixed energy and atomic number. It was assumed the so called high multiplicity model for hadron interactions,normal mass composition of primary particles that is the same as below 10^5Gev. From the simulated showers we have constructed the fluctuation histograms of the total electron number and that of muons in EAS for several values of primary energy and groups of nuclei.The histograms are approximated by Gamma distributions the parameters of which are represented as functions of primary energy. It allows to obtain the conversion factor , W, with which we can convert shower size in primary energy, needed in order to obtain theoretically fluctuation distributions of primary energies.They were used to derive energy spectrum of all primary particles from the measured intensities of extensive air showers with different electron and muon size.It is compared in fig.I with the curve that is an approximation of the direct registration at lower energies. Our spectrum derived from the measured electron size distribution of EAS at mountain altitide smootly links the satelite data showing some tendency of a bump around 10^6Gev. The spectral index is changing from 2.4 to 2.76. In the same figure we have compared the corresponding estimation for primary energy spectrum of Nagano et al[2] obtained on the basis of Akeno data. They give too low intensities of the primaries most probably due to the relatively small

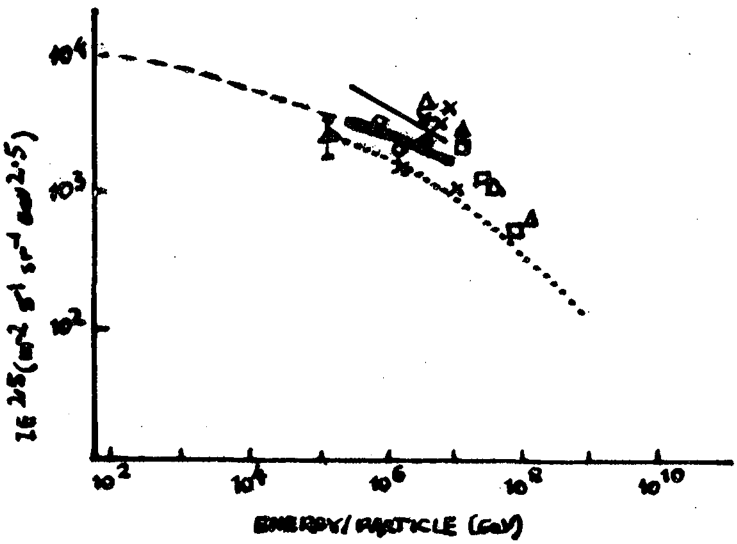

Fig.1 The all-particle energy spectrum : dash line - approximation of satelite and baloon data (Grigorov et al[3] o) ; JACEE collaboration[4] ; thick line - present calculation on the basis of electron size spectrum; full line - present calculations for muon size spectrum; dotted line - Nagano et al[2] estimations on the basis of Akeno data; Khristiansen et al[5] × ; Efimov et al [6] □ ; La Pointe et al[7] Δ .

size of showers detected with fixed intensity. (As a ground parameter they used the number of electrons in the maximum of showers. So far as shower cascade curves are not determined around the maximum in Akeno (920 $g.cm^{-2}$) these authors have multiplied Akeno data by the ratio, $R=N^{Ch}_{max}/N^{Ch}_{920}$, taken from the Chacaltaya experiments at different zenith angles).

Our primary spectrum derived from the muon size distribution disagrees with the measured spectrum at lower energies. The high-multiplicity model predicts higher intensities of all primary particles from the converting of muon data. They do not link to the intensities of cosmic particles with lower energies. Better consistency could be obtained if we assume the new phenomenological model[1] with breaked Feynman scaling, because the latter gives smaller values for the mean energy of primary particles initiating showers with a fixed size than in the case of high-multiplicity model. Apart of that, our complex analysis of all muon data[1] gave also ground in favour of the new phenomenological model if we assume normal primary composition in the range 10^5-10^8 Gev. However, when we applied the new phenomenological model for calculation of electron component characteristics and for convertion of electron shower size in primary cosmic ray spectrum we obtain considerable disagreement. It forced us to inspect both our model assumptions for interactions and mass compositio of cosmic rays.

3. Discussion In order to clear up why the new phenomenological model predicts slower development of the electron component of EAS whereas its predictions are fitting the muon data from different experiments we have to mention first of all that in the simulation of electron-photon cascades we assumed the upper value (37.7 g/ cm^{-2}) of the radiation length. The latter is varying from 35 in different authors calculations. It is necessary to stress also that unlike with the case of the muon component, the electron component is governed predominantly by the very first pion interactions[1] occuring at very high energies ($\gtrsim 10^5$ Gev). The highest accessible energies of the modern accelerators do not exceed 2.10^5 Gev as is the case of the SPS experiment in CERN with proton-antiproton colliding beams. So far as pion interactions are not measured at high energies we have adjusted their properties from the measurements with accelelerators at lower energies. Analysing EAS data we made conclusion that some increase of the total inelastic cross section and the total coefficient of inelasticity in pion-air nucleus collisions should provoke increase of the effective multiplicity and consequently faster development of the electron component in EAS. Similar conclusion we derive from the examination of the hadron component of EAS[2]. In fact there are some experimental evidences[9-13] from low energy accelerator experiments allowing to assume considerably pion interaction cross section and inelasticity at energies above 10^5Gev. However, it must be poined out that several authors[14-17] have already shown that such corrections only partly improve the consistency of the calculated properties of electron and hadron components of EAS with experimental data.

It is worth-while to note that there is without doubt un increase in the yeld of baryon (and anti-baryon) production at very high energies observed already in the SPS Collider experiment[18]. Tonwar[19] finds in cosmic ray experiments strong evidence for such increase in the fraction of baryons with energy, the value reaching at least 15 % by 10^5Gev. (The percentage of baryons in our calculations with high-multiplicity model had been neglected whereas it was assumed to be about 10 % in the new phenomenological model). It is certainly possible that the observed fast development of EAS above 10^5Gev is partly due to the considerable baryon production that leads to shorter mean path of cosmic ray interactions in the air.

At last we can not dismiss high energy gamma rays in the primary spectrum above 10^5Gev. All gamma ray saurces detected at present time have energy spectra wkth power index about 1 in comparing with 2.6 of other particles. Thus, the γ/proton ratio may approaching 10^{-3} at 10^6Gev [20]. In this connection is the hypothesis of Wdowczyk and Wolfendale[20] that about 30 objects as Cyg X-3 is needed in the Galaxy to produce the bulk of the cosmic ray particles if as much energy went into particles as into gamma rays. However in order to obtain as much muon as they are observed in showers initiated by gamma rays emitted from the specific sources (Cyg X-3 and Crab) we have to assume some convergence of the electromagnetic cross section of photon production to that of the strong interaction pion production at too low energies (say, about 10^5-10^8 Gev).

Thus, we can conclude that the problem of determination of the energy and mass spectrum of primary cosmic flux insists further complex investigation of both particle interactions at high energies and the astrophysical mechanisms of different particles acceleration.

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