

Research of Microstructure of event with an HALO with measured energy $4.2 \cdot 10^{15} eV$.

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The interaction with derivation an halo registered on complex installation in exposure 23 on Tien-Shan located on height 3340 above a sea level is presented. The emulsion chambers (XREC) consisting from X-ray films and nuclear emulsion worked together with an ionization calorimeter. The research of interactions in a X-ray film has lead to in detection of event with an halo. The detailed analysis of this event on a nuclear emulsion under microscope has allowed to define, that the halo consists of two precisely divided groups with distance between them 1,2 mm.

Research of a spatial distribution of gamma-quantums of gammas - families, included in a composition on the diagram of target, i.e. in a plane perpendicular to an axis of the family has shown, that the considerable part of events has an azimuth anisotropy. Some families of gamma-quantums in a plane target of the diagram allocate not in limits of a circle, that should take place at an isotropic dispersion of quantums, and look like the ellipse. Most carefully and on a major statistical material this appearance was investigated in experiment "Pamirs" [1]. For the analysis of an anisotropy in allocation of particles on the diagram of target in experiment of Pamirs the parameter α was used [2]. Is remarkable, that the parameter α is sensitive to model of interaction and does not depend on multiplicity of quantums - n_γ .

By an extreme case of an azimuth anisotropy was the effect of splitting of the gamma - family on two subfamilies. For the first time given appearance - formation of pair gammas - families was revealed by us in 1977 [3]. As a result of interaction in a target located apart $H = 1,8$ above the emulsion camera were formed two genetic bound gammas - family with total energy $\sum E_\gamma \approx 25 TeV$. Here it is necessary to mark, that above a target also was XREC, in which despite of careful review it was not revealed of gamma-quantums with corners and trajectories conterminous with the pair set. Thus, configuration of installation and the obtained data have allowed to state, that the interaction has taken place in a target. Total energy of each set is equal $\sum E_\gamma^{(1)} = 15,8 TeV$, $\sum E_\gamma^{(2)} = 7,7 TeV$. The average transversal impulse of quantums concerning a barycentre of each subfamily is equal $\langle P_\perp^\gamma \rangle = 0,22 \pm 0,03 GeV/c$ and does not differ from reference values P_\perp . At the same time, if to consider the given families as outcome of birth of two clusters generator jet of particles, the mutual transversal impulse of these jets makes the value $P_\perp = 22,5 GeV/c$.

The further analysis of the represented event has shown, that in the supposition of formation in interaction of two clusters their mass makes $\approx 36 GeV/c^2$.

Two years after, in 1979 of physics Japan -Brazilian collaboration have detected presence of pair birth of gammas - families have termed such class of events binocularis [4]. These families were interpreted by them as outcome of birth of two hadrons of high energy being products of decay of heavy quantum with a mass $\approx 25 GeV/c^2$ and subsequent generation these hadrons of gammas - families in an atmosphere. Subsequently presence binoculars was confirmed in experiment "Pamirs" [1].

It is necessary to note, that all events of a binocular type in Japan-Brazilian and experiments of Pamirs, as against 1-st binocular detected by us, were products of interaction in an atmosphere, i.e. there was not a precise information on height of a point of interaction. Therefore experimenters were forced to operate not

with precise values H, P_{\perp} and with their clones $\langle ER \rangle, X_{1,2} = R_{1,2} \sqrt{E_1 E_2}$ etc. Here $R_{1,2}$ - distance between two centres of families, E_I - energy of each of 2 families binocular.

In high-mountainous experiments with XREC the events with so-called "halo" - major diffuse spot on a X-ray film accompanying tracks highenergies of particles in gammas - families (i.e. in kern EAS) are observed. To the present time in experiments with X-ray films by cameras the great many of events with an halo is revealed. First such "Andromeda" superset is circumscribed in operation Japanese physicists [5] and has attracted attention of extremely high energy.

With the help XREC and ionization calorimeter in our experiment two interactions in an atmosphere were registered at primary energies above $10^{15} eV$, which are characterized by presence "halo" in XREC and nuclear - electronic cascades in a calorimeter [6]. At levels of observation in XREC the X-ray film ($PT-6$) and nuclear photographic emulsion ($P-2T$) was used.

For obtaining the various characteristics of the registered events with the halo was carried out scanning a X-ray film and nuclear emulsions by a Spiral Reader SR-2 [7]. On a nuclear emulsion the measurements of energy and coordinates EFC on microscopes MBI-9 were carried out. The procedure of measurement of the characteristics an halo on an ionization calorimeter and the observed datas on XREC are published in operation [6].

At scanning the halo till a X-ray film is observed a diffuse spot with step-by-step decrease of density of a blackening from centre to periphery, as shown in a fig. 1.

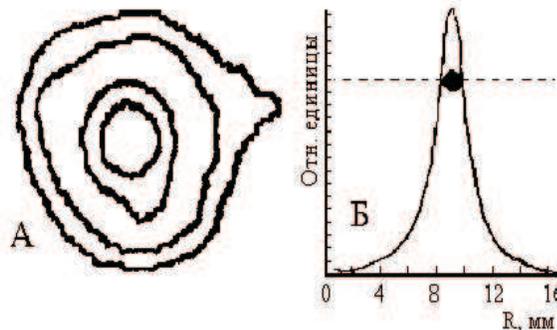


Figure 1. Allocation on density of a darkening in an halo. A- isodense are carried out at levels $D = 0,7; 1,0; 2,0$ and $3,0$ - allocation in a central part an halo (slit across a spot)

On a nuclear emulsion in a central part an halo the structure of event shown on a fig. 2 was detected. It is explained to that the size of a grain in a nuclear emulsion (average size of a grain on a diameter $0,25-0,40$ microns) is much less than sizes of a grain in a X-ray film (average size of a grain on a diameter $2,16$ microns). In a figure 2. we precisely distinguish two-ink-jet structure, event such as binocular. Complete energy of the given event is equal $4200,0$ TeV. Energy between two events was arranged as $1:2,2$, that corresponds to energies of each event 2900 and 1300 TeV.

Some ways were applied to an estimate of height of derivation of event. Height was defined on the basis of constancy of average transversal impulse. The process decascading, i.e. association EFC in the initial gamma-quantums and method decascading step by step was used. All methods have given height of generation of the given event about 500 meters.

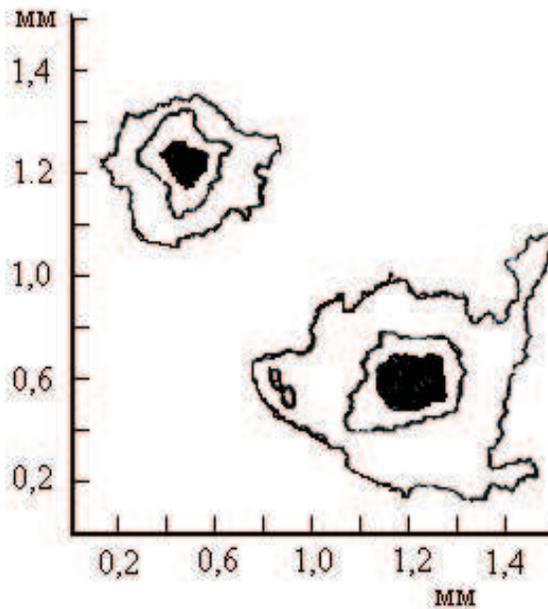


Figure 2. Fig. 2. Research of a central part of event with an halo by a method of scanning of a nuclear emulsion with step 6 microns.

If to interpreter formation of two-jet events as outcome of decay of the intermediate system, from a kinematic relation it is possible to define a mass of this hypothetical system:

$$M_0 = R\sqrt{E_1 E_2 / H c^2} \quad (1)$$

Here R - distance between jets; $E_{1,2}$ - energy of each jet; H - height of their generation. From a relation (1) we obtain value of a mass $M_0 \approx 4,6 \text{ GeV}/c^2$. It is necessary to note, that in this case there is a complete mass, instead of about selected in the neutral component, as it is usual done. Presence of the information from an ionization calorimeter allows to spot the value θ without engaging the aprior suppositions about value to K_γ - part of energy transferred in gamma-quantums.

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