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Evidence of the nontrivial nature of the alignment phenomenon at superhigh energies

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This work presents the more profound study of the cluster structure of gamma families recorded in cosmic rays using X-ray emulsion chambers located at mountain altitudes ('Pamir'experiment). It has been confirmed that, using the χ_ij and z_ik metrics for cluster analysis, it is possible to collect products, i.e., particles produced in the last strong interactions which directly contribute to the family, into individual separate clusters with the efficiency as high as >80%. It means that applying the given clustering procedure it is possible to "rejuvenate" gamma families and move on to analyzing the characteristics of particles from the previous generation of the nuclear-electromagnetic cascade (NEC) that generates the observed gamma families in the Earth's atmosphere. This approach was used to study an unusual effect associated with the coplanar emission of the most energetic particles produced in nuclear interactions at ultra-high energies, leading to a linear alignment of the most energetic structures in the target gamma-ray family diagram. This effect was first discovered in the Pamir experiment, which still holds the world championship in the number of recorded aligned events. The work shows that the proposed method of clustering gamma families increases the efficiency of identifying aligned structures, thereby increasing the statistics of unusual events. An analysis of the ultimate anisotropy of the most energetic clusters, carried out using the λ parameter, allows us to confirm the nontrivial nature of the alignment effect observed in cosmic rays, which may indicate the existence of processes that go beyond the Standard Model. If the alignment observed in experimental gamma families were random in nature, it would be impossible to obtain a significant increase in the proportion of aligned events precisely at those critical values of χ_c and z_c that correspond to the optimal collection of the products of the last and penultimate strong NEC interactions, as well as the optimal collection of particles from the decay of neutral pions, respectively.

Internet talk

Maybe

Is this an abstract from experimental collaboration?

No

Name of experiment and experimental site

PAMIR

Is the speaker for that presentation defined?

Yes

Details

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