III-4-31. Air Shower Projects in USSR

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Discussion

Kitamura, T.: How could you distinguish the bundle of μ-mesons from cascade showers and penetrating showers produced by μ-mesons?

Zatsepin, G.T.: The underground detector ensured the registration of only penetrating particles. The cascade showers, therefore, could not be confused with the passage of μ-mesons. Even if penetrating showers are produced in the earth, π-mesons can hardly decay before they arrive at μ-detector underground. Therefore, it is almost impossible to explain the μ-meson bundle in terms of this process.

Oda, M.: Regarding μ-bundle I wish to quote works by Osaka group and by Dr. Tanahashi, that the lateral distribution of μ-mesons appears to have the slope up to the distance of 1 m. This makes the nature of distribution of μ-mesons around the core more or less singular and, therefore, the statistics to be used is not necessarily Poisson and we have to suffer the difficulty of statistics.

Zatsepin: They have taken into account in their statistical treatment that there is a slope of lateral distribution of μ-mesons upto small distance from the core. In fact, there are bundles of μ-mesons with distances 5 m or more between each other. Unless you suppose the existence of irregularity in μ-meson component, I think you cannot have such μ-bundles.

Rossi, B. B.: Is the counting rate of Chudakov's Cerenkov detector sufficiently high, so that the method may be applied not only to the exploration of possible point sources of γ-rays but also to study a more diffuse source, such as that due to collisions of cosmic ray particles with interstellar matter in the galaxy?

Zatsepin: The counting rate is $100\sim200$/min.

Hayakawa, S.: (1) Japanese groups, as remarked by Oda, are inclined to conclude that the bundle of μ-mesons is not extraordinary but is associated with an ordinary extensive air shower. Does your experimental result disagree with ours or does your statistical treatment lead to the different conclusion?

(2) Taking your conclusion for granted, couldn't you explain the bundle as produced by the heavy primary, as I pointed out several years ago?

Zatsepin: (1) The experimental data are very similar. But the methods of analysis are different. Probably the method used by Vernov and others is more sensitive in bundle detection. Certainly, additional analysis and additional experiments are required for final conclusions. (2) I think that heavy nuclei through the well known processes can not produce narrow μ-meson bundles with energies above 10 Gev.

Linsley, J.: Soviet group gives 80–85 g/cm² and Tokyo group has given about 100 g/cm² for the nuclear mean free path of the primary particle. I wish to ask whether, in your opinion, values of this range are inconsistent with the idea that a large proportion of primaries might be heavy nuclei.

Zatsepin: I think that the method used for evaluating mean free path gives only the upper limit, because we took the simplest model in this analysis in which all fluctuations are assumed to be due to the height of the first collision, while other fluctuations in the development were not taken into account.