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Abstract

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A POSSIBLE CASE OF DECAY OF A τ'-MESON WITH EMISSION OF AN ELECTRON-POSITRON PAIR

(Presented by Academician N. N. Bogolyubov, June 6, 1957)

During examination of an emulsion stack exposed in the stratosphere, L. U. Bannik found a case of decay of a heavy meson (Fig. 1, 1) with formation of a π^+-meson 2 and an electron-positron pair 5, 6.

The heavy meson was produced in a star $3 + 0n$ with a small visible energy release. Both tracks of the parent star belong to stable particles. After traveling 17 mm, the heavy meson stopped inside the emulsion. The mass of particle 1, determined from the density of gaps and from the residual range, is $m_1 = (860 \pm 50)m_e$.

Track 2 stops at point C^* and gives rise to a steep track 3 of length $\sim 540\mu$. To verify that at point C a π-meson decay occurs, and not scattering of a μ-meson, measurements were made of the gap density on track 2 and on tracks of calibration π-mesons. From the end of track 3 there emerges the track of a relativistic particle 4.

Tracks 5 and 6 both have ionization corresponding to a plateau. The angle between them is $\sim 1 \div 2^\circ$. Track 5, after traveling $\sim 250\mu$, disappears inside the emulsion layer. Multiple-scattering measurements on track 6, performed over a length of ~ 6 mm, led to the value $p\beta = (66 \pm 10)$ MeV/c.

The data on the geometry of the event and the results of measurements carried out on the individual tracks are given in Table 1.

The event is, apparently, the decay of a τ'-meson, $\tau' \to \pi^+ + \pi^0 + \pi^0$, with subsequent decay $\pi^0 \to \gamma + e^+ + e^-$. At present several cases of decays of $K_{\pi 2}$- and $K_{\mu 3}$-mesons have been found (1-5), and one decay of a τ^0-meson (6) with formation of electron-positron pairs.

It is known (7) that in approximately one out of 80 cases the π^0-meson, instead of the usual decay $\pi^0 \to \gamma + \gamma$, decays according to the alternative scheme $\pi^0 \to \gamma + e^+ + e^-$. Up to now about 100 cases of decay of τ'-mesons have been found (3). Thus, the discovery of a case of τ'-meson decay with emission of an electron-positron pair should not be considered unexpected.

Fig. 1

Figure 1: Fig. 1

Fig. 1

* The apparent decrease of ionization at point E is connected with the transition of the track from one plate to another.

Table 1

Track No.	Residual range	Dip angle in the unprocessed emulsion	Type of measurement carried out on the track	Results of measurements	Particle identification
1	17 000 μ	15-20°	Density, length of gaps	$m = (860 \pm 50)m_e$	τ'-meson
2	1 930 μ	25-30°	Density of gaps	–	π^+
3	540 μ	60°	–	–	μ^+
4	–	–	–	–	e^+
5	Annihilates after 250 μ	Plane	–	–	e^+
6	>6 mm	Plane	Multiple scattering	$p\beta = (66 \pm 10)$ MeV/c	e^-
6	>6 mm	Plane	Grain count	$g = 22.5 \pm 1.2$ gr/100μ	e^-

In conclusion the author expresses gratitude to M. I. Podgoretskii for discussion of the work and to N. V. Kirsanova and Z. P. Golovina, who carried out the principal measurements.

Note added in proof. After the present note had been written, we were able to become acquainted with a preprint by Levi-Setti and Slater in which a case analogous to the one found by us is described.

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Note: Figure translations are in progress. See original paper for figures.