Search for Mass-500 Particle as a K^+ Decay Product (*).

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If the mass-500 particle ⁽¹⁾ is a decay product of a known particle, the only possibilities for the parent are the K-meson and the Ξ -hyperon. The K-meson decay is energetically more favorable by at least 100 MeV. For the K-meson there are two feasible cases.

Case 1.

The mass-500 particle is a lepton (μ' in our notation) with the decay modes

$$\begin{aligned} K &\rightarrow \mu' + \nu \\ \mu' &\rightarrow \begin{cases} e + \nu \\ \mu + 2\nu \end{cases} \end{aligned}$$

Case 2.

The mass-500 particle is a boson (π' in our notation) with the decay modes

$$\begin{aligned} K &\rightarrow \pi' + \pi^0 \\ \pi' &\rightarrow \begin{cases} e + \nu \\ \mu + \nu \end{cases} \end{aligned}$$

In either Case 1 or 2 the mass-500 secondary would usually appear quite similar to the secondary of a $K_{\mu 3}$ and could easily be misclassified as a $K_{\mu 3}$ decay in nuclear emulsion. Using mass limits of 540 ± 50 electron masses ⁽¹⁾, the secondary range in Case 1 would be $1.3 \text{ cm} < R_{\mu} < 3.3 \text{ cm}$. For Case 2 the limits would be $0.4 \text{ cm} < R_{\pi} < 1.4 \text{ cm}$.

In a systematic study of K^+ -endings with secondaries heavier than 1.25 times minimum ⁽²⁾ we found 32 events with secondaries between 0.4 and 3.3 cm range which were originally classified as μ^+ secondaries. These were from a total sample of about 5000 K^+ endings. We have now re-examined these 32 secondaries by carefully grain counting them at the K-ending and find them all still consistent with the muon mass. A mass-500 particle would give a grain density about 40% higher than that expected for a muon of the same range.

We conclude that in our sample of 5000 K-endings, there is not one case of a mass-500 particle as a decay product.

⁽¹⁾ ALIKHANIAN *et al.*: *Zur. Exp. i Teoret. Fiz.*, **31**, 955 (1956).

⁽²⁾ J. OREAR, G. HARRIS and S. TAYLOR: *Phys. Rev.*, **104**, 1463 (1956), and S. TAYLOR, G. HARRIS and J. OREAR: *Bull. Am. Phys. Soc.*, **2**, 20 (1957).

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