Dr. G. W. Fox for the privilege of working at the synchrotron laboratory of the Iowa State College.

* On leave from Tokyo University, Tokyo, Japan.
[1] Compare with distribution curves given by Heitler, The Quantum Theory of Radiation (Oxford University Press, London, 1944), Fig. 14, p. 170.
[2] McElhinney *et al.*, Phys. Rev. **75**, 542 (1949); Johns *et al.*, Phys. Rev. **80**, 1062 (1950); B. C. Diven and D. M. Almy, Phys. Rev. **80**, 407 (1950).
[3] G. C. Baldwin and G. S. Klaiber, Phys. Rev. **73**, 1156 (1948).

Cloud-Chamber Observations of the Neutral *V*-Particle Disintegration*†

R. W. THOMPSON, HANS O. COHN, AND R. S. FLUM
Indiana University, Bloomington, Indiana
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IN a sea level magnet cloud-chamber experiment on penetrating showers, now in progress, nine examples of the V^0-particle disintegration process[1] have been observed. The cloud chamber, of 11-inch inside diameter and 3-inch illuminated depth, is mounted between the poles of an iron electromagnet producing a uniform magnetic field of 3100 gauss. Track distortions produced by the chamber are empirically determined for long tracks to correspond to radii of curvature of about 100 meters, so that the maximum detectable momentum is about 10 Bev/c. The chamber is actuated by a Geiger counter arrangement which favors the detection of penetrating showers produced in a lead layer immediately above the chamber.

In two of the V^0-particle photographs, the positive particle is identified to be a proton. In the first of these (film No. 92), shown in Fig. 1, the positive particle has a momentum of 0.38 ± 0.06 Bev/c, and the track is heavily ionizing by an estimated factor of 3 to 6, to be compared with a factor of 5 for a proton of this momentum. The negative particle is ejected toward the back of the chamber and the track is too short to permit an accurate measurement of the momentum.

In the second case (film No. 55), the momentum of the positive particle is 0.75 ± 0.1 Bev/c, and the track is 2 to 4 times minimum ionization. A proton of this momentum would be heavily ionizing by a factor 2. The negative particle has a momentum of 0.24 ± 0.02 Bev/c, and the track is of minimum ionization, so the negative particle cannot be much heavier than a π-meson. Under the assumption that the event represents the disintegration of a V^0-particle into a proton and a negative π-meson ($\theta=23.8°$), the Q-value of the disintegration is 28 ± 10 Mev, which corresponds to a V^0-mass of $2165\pm20m_e$.

FIG. 1. V^0-disintegration resulting in a heavily ionizing proton.

An apparently similar example (film No. 51; $p_+=1.2\pm0.2$ Bev/c, $p_-=0.22\pm0.01$ Bev/c, $\theta=28.6°$) gives $Q=31\pm5$ Mev, or a V^0-mass of $2170\pm10m_e$.

On the other hand, we have observed a V^0 disintegration, shown in Fig. 2, in which the positive particle, although of minimum ionization, has a momentum of only 0.27 ± 0.03 Bev/c, and thus cannot be much heavier than a π-meson. A proton of this momentum would be heavily ionizing by a factor 10. The negative particle, of momentum $1.3_{-0.6}^{+1.0}$ Bev/c, is very near minimum ionization and so cannot be identified. The fact that the momentum of the negative particle is much greater than that of the positive particle suggests, although it does not prove, that the negative particle is much heavier than the positive particle. It is interesting to consider the possibility that a negative proton is involved. Under this assumption, the V^0-mass is about $2220m_e$, a value which is similar to those given above. Thus, if the event represents the decay of a V^0-particle with mass corresponding to the values given above, the particle here observed is likely to be a negatively charged nucleon. These arguments are quantitatively but not qualitatively changed if a light neutral particle is produced in the disintegration (3-particle disintegration).

However, the event may be equally well explained by the assumption of a different type of V^0-particle, of about $1020m_e$, which decays into two π-mesons. The asymmetry in the momenta would then be understood if the negative π-meson had been emitted in the forward direction in the center-of-mass system.

FIG. 2. V^0-disintegration in which the positive particle is probably a π-meson.

Very recently, the Manchester group has published an account[2] of very beautiful and extensive work from which closely similar conclusions have been drawn concerning the V^0-particles and their disintegration fragments.

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† Reported at the Washington meeting of the American Physical Society, Phys. Rev. **83**, 194 (1951).
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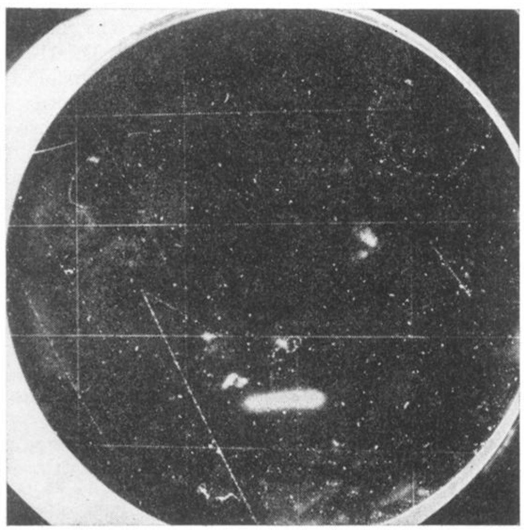

FIG. 1. V^0-disintegration resulting in a heavily ionizing proton.

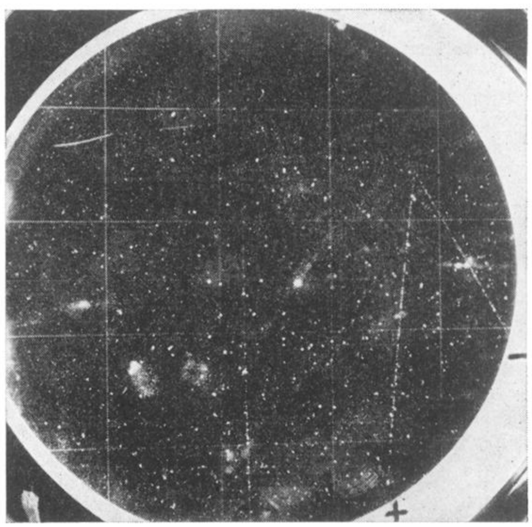

FIG. 2. V^0-disintegration in which the positive particle is probably a π-meson.