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Publication Date
1958-06-28

UCRL 8372

UNIVERSITY OF CALIFORNIA

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BERKELEY, CALIFORNIA

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Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

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Printed for the U. S. Atomic Energy Commission

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We have classified apparent Σ hyperon decay events in a large emulsion stack of 240 9" × 12" pellicles into those judged to have occurred at rest and those in flight. Of 36 decay events at rest, 21 secondaries were observed to be protons of about 1675 microns range; these were classified as belonging to the decay mode $\Sigma^+ \rightarrow p + \pi^0$. The remaining 15 Σ-like particles which decayed at rest all produced secondaries of near-minimum grain density compatible with the reaction $\Sigma^+ \rightarrow \pi^+ + n$.

Of the events decaying in flight, 23 were decays into protons and 46 were decays into near-minimum secondaries.

There were in addition 5 decays into protons and 19 decays into near-minimum secondaries which we were not able to classify definitely as at rest or in flight.

We have attempted to trace the tracks of 35 of the lightly ionizing secondaries. The results of this effort are summarized in the following table. Events in flight in which the decay product was emitted in the backward hemisphere relative to the Σ momentum were given first priority, as these events have secondaries of the shortest ranges.

Circumstances of decay	No. of events	No. of secondary tracks followed	Sec. stops in stack π^+	Sec. stops in stack π^-	Disp. in Flight	Star in Flight	Out of Stack	Lost
Flight	46	32	11†	4	5	1	8	3
Rest	15	2	1	0	1*	0	0	0
?	19	0	0	0	0	0	0	0

(†) 1 π^+ decays in flight. Charge of pion established by identifying π^- from 2-prong K^- star which produced Σ.

(*) This event may be $\pi \rightarrow \mu$ decay in flight. Possible light secondary observed at point of disappearance.

From the above we make the following observations:

1. All secondaries which come to rest are pions with ranges consistent with the decay modes $\Sigma^{\pm} \rightarrow \pi^{\pm} + n$.

2. We have followed a total of 157 cm of secondary track, so that were the nuclear cross-sections geometrical, the expected number of interactions in flight would be 6. The number of stars and disappearances is therefore consistent with strongly interacting secondaries. (An event is called a "disappearance" if the track suddenly terminates in the emulsion, presumably charge-exchanging or making a zero prong star.) One track disappeared after traversing a distance of only 0.35 centimeters of path. This distance is too short for identification of a positron by its radiative energy loss, so that the possibility that this track is that of a positron that annihilated in flight cannot be ruled out.

3. The events listed in the table under "out of stack" all are consistent with the pion mode of decay. If we assume the pion decay mode, and estimate the velocity of the Σ hyperon at the decay point from the track opacity, then at the observed angle of emission in each case a pion would have been energetic enough to escape from the stack. Attempts to determine the particle masses by measuring the grain densities at the points of emergence from the stack have not yielded conclusive identifications of these tracks.

4. There is no event in which a low energy lepton is emitted. If any case of three-body leptonic decay is present the charged secondary particle must have received nearly its maximum allowable energy, and we are not able to separate this event from the pion modes with our present analysis.