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Authors

Goldhaber, Gerson
Goldhaber, Sulamith
Iloff, Edwin L.
et al.

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Gerson Goldhaber, Sulamith Goldhaber, Edwin L. Iloff,
Joseph E. Lannutti, and Francis H. Webb

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M. Widgoff - Harvard University

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A. Pevsner and D. Ritson - M.I.T.

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Gerson Goldhaber, Sulamith Goldhaber, Edwin L. Iloff,
Joseph E. Lannutti, and Francis H. Webb

Radiation Laboratory,
University of California,
Berkeley, California

and

M. Widgoff,

Harvard University, Dept. of Physics,
Cambridge, Massachusetts

and

A. Pevsner and D. Ritson,

Massachusetts Institute of Technology,
Cambridge, Massachusetts

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Together with the study of the interactions and decays of positive K particles,[1] we have also started a similar study on negative K particles in flight. The problem here is considerably harder because of the low abundance of negative K particles.[2]

In contrast to the behavior of K^+ particles, the observed interactions of K^- mesons in flight include occasional large stars, accompanied by π-meson emission. We also have evidence that the cross section for K^- interaction is larger than the K^+ cross section. In particular, we agree with Hornbostel and Salant[3] that the cross section may be geometric. All these factors add up to the striking difference in the nature of the interactions between positive and negative K particles. As mentioned before[1] these factors tend to confirm the concept of a quantum number[4,5,6] ("strangeness"), which has two different values for K^+ and K^- mesons.

The observed larger interaction cross section for K^- mesons can be considered evidence for a "stronger interaction".[5] It may also perhaps account partly for the much lower abundance of K^- mesons.[2] As production has so far been observed only with complex nuclei, it may be considered that the K^- once produced is more easily reabsorbed, while the K^+ under similar circumstances would be emitted. Of course a possible shorter lifetime (see below) for K^- mesons may also contribute to their lower abundance, as does the presumed requirement that K^- mesons be produced in pairs.[4,5,6]

We exposed an emulsion stack to the focused K^- beam[7] and, by techniques very similar to those described for K^+ mesons,[1] we have looked for K^- interactions and decays. One difference here was that scanning could be started right at the edge where the K^- mesons enter, as there are no protons of the same momentum.

In 3 meters of K^- followed, we have found six interactions in flight. We have also found three events which we have classified as decays in flight.

A. Interactions in Flight

The six interactions in flight of K^- mesons observed are described in Table I.

In three cases, numbers 1, 2, and 5, the visible energy release plus the binding energy of the outgoing particles exceeds the kinetic energy of the incoming K^- meson.

Of the six stars, at least two and probably three have pions coming out. The mean free path for K^--particle interaction is thus probably consistent with the geometric mean free path.

B. Decay in Flight

In the 3 meters of K^- track followed, three decays in flight were found. We have classified as a decay in flight an event having one outgoing prong that has a smaller grain density than the K^- track being followed. Of course, in the case of K^- mesons, it cannot be completely ruled out that some of these events are nuclear interactions in which just a π meson is emitted. However, because of the catastrophic nature of the K^- interactions in flight, it appears to us very unlikely that no sign of a recoil or black evaporation prong should appear in conjunction with a π emission.

The K^- track followed corresponds to a proper time of 1.95×10^{-8} second. The last 2 mm of K^- tracks that stopped were not included, since decays in flight in this part of the track cannot be readily identified. The resulting mean lifetime for K^- mesons is $0.65 \pm 0.45 \times 10^{-8}$ second. The error quoted is due to the statistical standard deviation, other errors being negligible in comparison. This appears to be shorter than the K^+ mean lifetime; however, with the small number of events involved, no definite conclusion can be reached.

This work was performed under the auspices of the U. S. Atomic Energy Commission.

Table I

K^- Interactions in flight

No.	Energy of K^- at Interaction (Mev)	Prong Number	Range	Energy* (Mev)	Identity	Comments
1	85 ± 5	1	180μ	5	(p)	
		2	440μ	9	(p)	
		3	---	55	(π)	Grain density is 1.5 x minimum. If Prong 3 is a proton, its energy is 380 Mev and the total energy would be 418 Mev.
		Pion rest energy		140		
		Binding energy		16		
			TOTAL	225		
2	87 ± 5	1	1790μ	20	(p)	
		2	>15.9 mm	> 68	(p)	
		3	370μ	8	(p)	
		4	28.8 mm	42	π^-	ends. Gives 1-prong star.
		5	113μ	4	(p)	
		6	230μ	6	(p)	
		7	75μ	3	(p)	
		Pion rest energy		140		
		Binding energy		48		
			TOTAL	>339		
3	77 ± 6	1	62μ	2.6	(p)	
		2	1490μ	17.8	(p)	
		Binding energy		16		
			TOTAL	36		
4	70 ± 6	1	716μ	12	(p)	
		Binding energy		8		
			TOTAL	20		
5		1			(p)	
		2			(π)	
6		1			(p)	
		2			(p)	
		3			(?)	Grey prong

*The visible energy release has been calculated on the assumption that all black prongs are protons.

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