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RESULTS FROM AN ENRICHED NEGATIVE K-MESON BEAM

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We have recently obtained a K^--meson beam from the Bevatron in which the intensity was greatly enhanced by selection of particles emitted in the forward direction. We further improved the usefulness of the beam incident on our emulsion stacks by causing the magnetically analyzed particles of 435 Mev/c to traverse a polystyrene degrader of 18.36 g/cm^2 and undergo a second bending of 180°, thus discarding the pion component of the beam. The remaining background tracks are chiefly muons and electrons. A small emulsion stack exposed in order to evaluate the beam has already yielded useful information. Although much more work is planned on this and a larger stack, some of the data now in hand are of sufficient interest and reliability for a preliminary report. In order to make quantitative measurements the emulsion density was carefully determined, and we employed our new range-energy curve.[1] The numbers in Table I were derived from along-the-track scanning of 1224 K mesons. Of these 21 decayed in flight, 182 interacted inelastically in flight with emulsion nuclei, 6 scattered elastically from free protons in the emulsion, 2 interacted in flight with free protons to produce negative hyperons, and

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

[1] Barkas, Barrett, Cüer, Heckman, Smith, and Ticho, Phys. Rev. 102, 583 (1956); Phys. Rev 100, 1797 (1955); and Bull. Am. Phys. Soc. II, 1, 184 (1956).

only 2 interacted at rest with free protons to produce charged hyperons (the two had opposite signs). The K-meson energy interval for which the interaction cross sections were calculated was 30 to 90 Mev. Analysis of hyperfragments and their parent stars was carried out on an IBM 650 digital computer using a program kindly supplied by Dr. C. Violet. We are greatly indebted to Ernestine Beleal, Anna-Mary Bush, Thoma Davis, John Dyer, Renée Feldman, Hester Lowe, Lynn Reynolds, and Toni Woodford for their conscientious scanning work.

Table I

K^- mean life	$1.46^{+0.38}_{-0.31} \times 10^{-8}$ sec
K^--proton elastic scattering cross sections	$52^{+31}_{-21} \times 10^{-27}$ cm^2
K^- free path for inelastic collisions in emulsion	27.2 ± 2.3 cm
Σ^+ mass (from $\Sigma^+ \rightarrow$ proton decay)	2327.8 ± 0.7 m_e
Σ^- mass (from $\Sigma^- - \Sigma^+$ mass difference)	2341.5 ± 2.3 m_e
K^- mass (from $K^- + p \rightarrow \Sigma^+ + \pi^-$ at rest)	965.3 ± 1.5 m_e
K^- mass (from $K^- + p \rightarrow \Sigma^- + \pi^+$ in flight)	961.4 ± 3.3 m_e
K^- mass (from $K^- + p$ elastic collisions)	978 ± 57 m_e
Binding of Λ^0 in $_\Lambda He^5$	3.0 ± 0.6 Mev
Binding of Λ^0 in $_\Lambda He^4$	1.2 ± 1.0 Mev
Binding of Λ^0 in $_\Lambda Li^9$	3.8 ± 3.0 Mev
Decay branching ratio $\frac{\Sigma^+ \rightarrow p + \pi^0}{\Sigma^+ \rightarrow N + \pi^+}$	13/13

Frequency distribution of prongs from K^- stars at rest

0:1:2:3:4:5:6:7:8:9	36:43:63:30:28:20:9:2:2:1

Frequency distribution of prongs from K^- stars in flight

0:1:2:3:4:5:6:7:8:9:10:11:12	16:22:46:34:31:14:8:4:0:1:1:0:1

Frequency distribution of prongs from K^- stars that emit hyperfragments

1:2:3:4:5:6:7:8	1:3:11:12:6:3:2:3:1

Frequency distribution of hyperfragment prongs

1:2:3:4:5:6:7	4:11:15:5:3:1:1

Frequency of hyperfragment emission from K^- stars 28/1152

Ratio of mesonic to nonmesonic decay of hyperfragments 9/42