D has been measured at 635 Mev by Kumekin, Mescheryakov, Nuruschev, and Stolotov,[7] and at 315 Mev by Chamberlain et al.[3] The angular dependence of their results is similar to ours. Gammel and Thaler[4,8] try to fit data with a static potential plus a term linear in momentum ($\vec{L}\cdot\vec{S}$ term). They always find that the curves for D at various energies are parallel to each other. To reconcile the results of Taylor and Wood with those at higher energies, they would have to include a term of higher order in momentum.

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‡National Science Foundation Predoctoral Fellow.

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K^--HYDROGEN CHARGE-EXCHANGE SCATTERING*

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In the course of a bubble chamber investigation of the interaction of low-energy K^- mesons in hydrogen, we have observed forty-five reactions of the type $K^- + p \rightarrow \bar{K}^0 + n$ followed by the observable decay $K_1 \rightarrow \pi^+ + \pi^-$.[1]

The only other type of event which could be confused with the observed type is the much more frequent sequence $K^- + p \rightarrow \Lambda + \pi^0$, $\Lambda \rightarrow p + \pi^-$. However, in Λ decay, the proton usually stops, but if it does not, its greater ionization generally permits identification. In order to certify the identification, all V's in which the positive decay product did not stop in the chamber were measured and fitted to both the Λ and K_1 interpretations. All events fitted one or the other–there were no ambiguities.

The calculated momentum of the K^- at the point of interaction P_{K^-} depends sensitively on the $\bar{K}^0$-K^- mass excess, which has been measured in this and other experiments to be 3.9 ± 0.6 Mev.[2] The threshold for charge exchange is then 89 ± 5 Mev/c.

For each event, P_{K^-} was adjusted to give a simultaneous best fit to the production kinematics, by the use of the momentum of the K^- (computed from its decay kinematics), the curvature of the K^-, and the known momentum distribution of the K^- beam. The cross section below 300 Mev/c was then obtained by constructing an ideogram which gave the fraction of events in each of the four momentum intervals below 300 Mev/c shown in Fig. 1.

Data were also taken with the beam momentum adjusted for 310 ± 22 Mev/c and 410 ± 15 Mev/c. Even at these higher momenta the K^- velocity is low enough that ionization can be used to distinguish K^- from μ^- and π^- contamination in the beam.

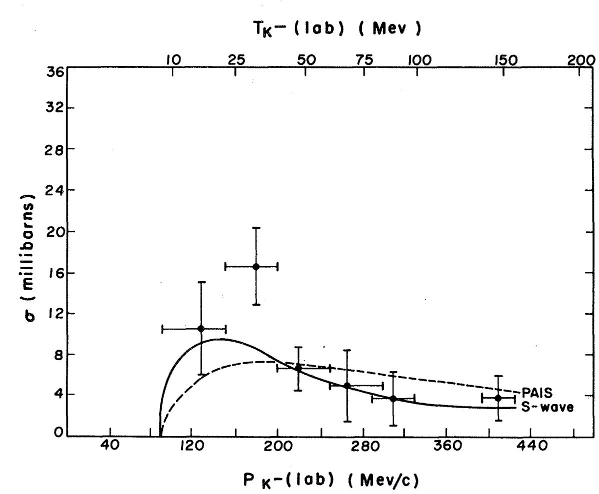

FIG. 1. K^--hydrogen charge-exchange cross section vs K^- laboratory momentum. The solid curve is the prediction of the S-wave zero-effective-range theory. The dashed curve (arbitrary ordinate) is the prediction of the Pais theory with $\lambda = -1$.

The fraction of K^0 decaying by the $\pi^+ + \pi^-$ mode was taken to be 0.34 ± 0.02.[3]

The $K_1{}^0$ mean life obtained from these events is $(0.87 \pm 0.13) \times 10^{-10}$ sec, in agreement with other experiments.[4]

Figure 1 shows the cross section as a function of K^- laboratory momentum. The solid curve represents the charge-exchange cross section as evaluated from the S-wave, zero-effective-range approximation,[5] which fits the data satisfactorily. The dashed curve is the charge-exchange cross section (with arbitrary ordinate) predicted by Pais[6] in his theory embodying opposite parities for charged and neutral K's. There is in this theory a free parameter λ which can range from -1 (the prediction of perturbation theory) to +1. We have plotted $\lambda = -1$ as being the theoretically simplest choice (it also fits the data best). It can be seen that our data are inadequate to distinguish between the two curves. Both curves have been modified to take into account the mass differences. For the effective-range theory this was done simply by the introduction of a factor $p_{\text{final}}/v_{\text{initial}}$ into the cross sections. These effects dominate near threshold and tend to obscure the swift p^2 rise which would otherwise be characteristic of the Pais theory.

Figure 2 shows the angular distribution as a function of momentum. The S-wave effective-range theory predicts, of course, isotropy. The dashed curve is the Pais prediction from $\lambda = -1$, $P_K = 180$ Mev/c. Chi-squared tests on the experimental angular distribution show a probability of about 5% associated with either the isotropic or Pais hypotheses.

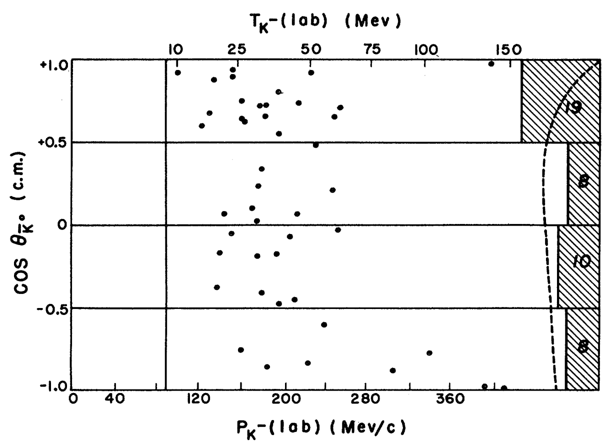

FIG. 2. Angular distribution of K^--hydrogen charge-exchange scattering vs K^- laboratory momentum. Each dot represents an event. A histogram appears at the right. The curve represents the prediction of the Pais theory for $\lambda = -1$ at a momentum of 180 Mev/c.

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NUCLEAR INTERACTION OF A PROTON OF ABOUT 10^{15} ev PRODUCING AN ELECTRON-PHOTON CASCADE OF 2.4×10^{13} ev*

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In a stack of 22 liters of Ilford G5 emulsion flown by a Skyhook balloon for 13 hours above 110 000 feet from Brownwood, Texas, a nuclear interaction initiated by a proton of type 6+16$_p$ was found. The angular distribution of the 16