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EXPERIMENTAL CHECK OF THE JOHNSON-TREIMAN RELATION ON THE K-N TOTAL CROSS SECTIONS*

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Using the SU(6) theory[1] and the fact that K and π mesons belong to an octet of the $\underline{35}$ multiplet, and the proton to an octet of the $\underline{56}$ multiplet, Johnson and Treiman[2] have shown that there are two relations between the Kp and πp total cross sections:

$$\tfrac{1}{2}[\sigma(K^+p)-\sigma(K^-p)] = [\sigma(K^0p)-\sigma(\bar{K}^0p)], \qquad (1)$$

and

$$\tfrac{1}{2}[\sigma(K^+p)-\sigma(K^-p)] = [\sigma(\pi^+p)-\sigma(\pi^-p)]. \qquad (2)$$

Because of the mass difference between K and π mesons, the relation (2) is expected to hold only for the high-energy region. Johnson and Treiman[2] have pointed out that in the multi-BeV region, this relation agrees more or less with experiment. On the other hand, the relation (1) is expected to hold even at lower energy.[3] We would like to point out here that the relation (1) is supported by experiment in the region of momentum of the K meson from 0.6 to 3 BeV/c (in the laboratory).

Using charge symmetry one gets

$$\sigma(K^0p) = \sigma(K^+n) \text{ and } \sigma(\bar{K}^0p) = \sigma(K^-n). \qquad (3)$$

Therefore, relation (1) with charge symmetry gives the relation

$$R \equiv \frac{\sigma(K^+ + n) - \sigma(K^- + n)}{\sigma(K^+ + p) - \sigma(K^- + p)} = \frac{1}{2}. \qquad (4)$$

Because charge symmetry is known to hold for strong interactions, a check of relation (4) is equivalent to a check of relation (1).

In Fig. 1 we have plotted all the data known to us on the total cross section of K^-p, K^-n, K^+p, and K^+n interactions[4,5] below 4 BeV/c.

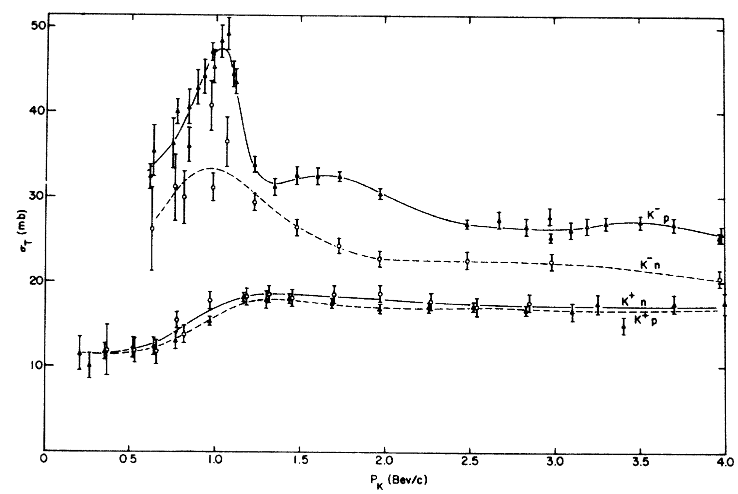

FIG. 1. Total cross sections of K-N interaction versus the laboratory momentum of the K meson. All data come from references 4 and 5.

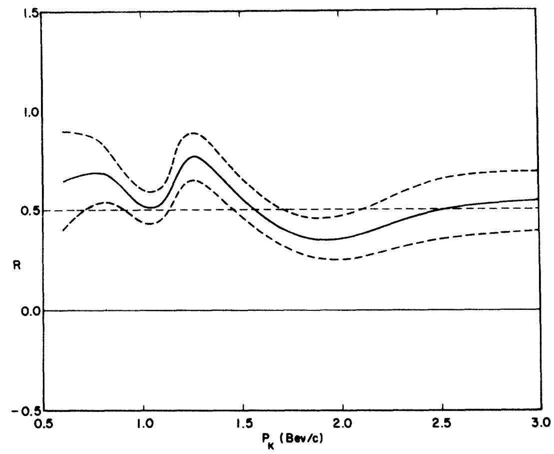

FIG. 2. The values

$$R \equiv \frac{\sigma(K^+n)-\sigma(K^-n)}{\sigma(K^+p)-\sigma(K^-p)}$$

versus the laboratory momentum of the K meson. The dashed lines represent the upper and lower limit of R (with one standard deviation).

The curves are visual fits to the data. In Fig. 2 we have plotted the values of R at all values of momentum of the K meson between 0.6 and 3 BeV/c. If there is no correlation, this value could be anywhere from $+\infty$ to $-\infty$; the fact that all the values are near (though not always consistent with) $+\frac{1}{2}$ shows that the relation (4) is strongly supported by experiment.

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ABSOLUTE DECAY RATE OF K_2^0 INTO CHARGED THREE-BODY MODES*

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We report here the results of a measurement of the absolute rate of decay of K_2^0 into the modes $\pi^\pm e^\mp \nu$, $\pi^\pm \mu^\mp \nu$, and $\pi^+\pi^-\pi^0$. Apart from the recently observed[1] mode $K_2^0 \to \pi^+ + \pi^-$, these three-body decays constitute all of the presently known decay modes of K_2^0 leading to charged products.

In this measurement, neutral K mesons were produced in the reaction $\pi^- + p \to \Lambda^0 + K^0$, using 1.0-BeV/$c$ pions from the Brookhaven National Laboratory Cosmotron incident on a liquid-hydrogen target. The experimental arrangement is shown schematically in Fig. 1. The incident pion track was observed in spark chamber I. The K mesons and Λ hyperons were observed to decay in the thin-plate spark chamber II. Counters 1, 2, and $\bar{7}$ formed the incident-beam telescope; counter $\bar{3}$ served to veto charged particles emanating directly from the target or indirectly from the decays of neutral particles upstream of chamber II; counter 4 or 5 was required to detect one of the charged particles from the decay of K^0 or Λ^0; counter 6, because of its small thickness, served to reduce the number of spurious counts arising from photons or neutrons incident on counters 4 and 5. The spark chambers were triggered by the coincidence requirement, $12\bar{7}\bar{3}$(4 or 5)6, with the important additional requirement that counters 4 and 5 were set in timing such that the protons from $\Lambda^0 \to p + \pi^-$ were preferred over the faster charged secondaries of either Λ^0 or K^0 by a factor of about 10. In addition, count-