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PROPOSAL FOR INELASTIC K^+p REACTION STUDIES

by G. Ekspong, Stockholm University

Summary : By investigating pion production

in $K^+ + p \longrightarrow \begin{cases} K^o + p + \pi^+ \\ K^+ + n + \pi^+ \end{cases}$

correlations between KN can be looked for. A suitable beam is one with 2,5 GeV/c K^+ (separated) into a hydrogen bubble chamber, the 81 cm HBC.

Background.

The present proposal might be seen as a parallell to the experiments in which baryon isobars with negative strangeness have been found, i. e. Y^{*}. Besides studying the direct reaction the experiment aims at exploring a hypothetical resonance having quantum numbers, S = +1 and N = +1 with positive charge.

Theories have utilized the analogy between the three leptons (μ e ν) and the three baryons (Λ n p). In view of the possibility that two types of neutrinos exist, prof. O. Klein has pointed out that the above scheme might be saved by enlarging it to encompass four leptons and likewise four baryons. The added baryon should then have strangeness S = +1 and be an isotopic singlet with positive charge. However, if its mass is above the KN threshold it will not be longlived but decay quickly to K^++n and K^o+p. Tentatively, its mass could be searched between 1435 MeV and about $m_\Lambda + m_N \approx$ 2100 MeV. The upper limit of course being very uncertain.

Experimental possibilities :

A search for a K^+N-resonance might be made in the reactions :

(a) $K^+ + n \longrightarrow Y^+ \longrightarrow K^+ + n$
$\qquad\qquad\qquad\qquad\qquad\quad \hookrightarrow K^o + p$

(b) $K^+ + p \longrightarrow Y^+ + \pi^+ \longrightarrow K^+ + n + \pi^+$
$\qquad\qquad\qquad\qquad\qquad\quad\ \hookrightarrow K^o + p + \pi^+$

(c) $\pi^- + p \longrightarrow Y^+ + K^- \longrightarrow K^o + p + K^-$
$\qquad\qquad\qquad\qquad\qquad\quad\ \hookrightarrow K^+ + n + K^+$

The first reaction has been explored by Goldhaber et. al. up to 812 MeV/c, corresponding to a maximum of 1700 MeV for the Y^+-mass. Reaction (a) needs a deuterium bubble chamber and a number of beam momenta to cover the proposed mass region.

Reaction (b) seems to be better suited as a HBC is used and a large mass-region is explored with a single beam. A beam momentum somewhat above 2 GeV/c corresponds to the upper mass limit suggested. Therefore, 2,5 GeV/c is suggested as the most suitable beam momentum. It is recalled, that the K^+p total cross sections as measured by Burrows et. al. below 2 GeV/c and by von Dardel et. al. above 2,9 GeV/c did not fit each other around 2.5 GeV/c. There was a gap from 13 to 24 mb. Not too much can be made of it as it might be due to systematic errors and in view of the results of Cook et. al. in their attenuation experiments. They got a constant σ_{total} = 17 mb here.

Beam : 2.5 GeV/c K^+ separated.
Chamber : Preferable the 81 cm HBC.
No of pictures : 40 000 pictures if 5 K^+ per picture
20 000 " if 10 K^+ " "