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K^--p CHARGE EXCHANGE AT 1.22 GeV/c

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June 6, 1962

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(To be presented by Arthur H. Rosenfeld)

The reaction

$$K^- + p \rightarrow \overline{K}^0 + n \qquad (1)$$

has been studied at an incident K^- momentum of 1.22 GeV/c (1895 MeV total c.m. energy), using the Lawrence Radiation Laboratory 72-inch hydrogen bubble chamber and a separated K^- beam. The angular distribution for the reaction in the center of mass shows a prominent backward peaking of the $\overline{K}^0$. This behavior had been noticed in earlier experiments at lower K^- incident momenta, starting at about 760 MeV/c[1] and increasing steadily up to 1.22 GeV/c. Preliminary results at 1.53 GeV/c incident momentum (2025 MeV total c.m. energy) indicate the effect to have disappeared or, at any rate, to have lost its spectacular character.

The events appear in the chamber as incident tracks that interact in flight without outgoing charged prongs, accompanied by the two-prong decay of a neutral particle. The measurement of the associated decay products

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†National Academy of Sciences Fellow.

[1]Private communication from the Alvarez 15-inch bubble chamber group (Lawrence Radiation Laboratory, Berkeley); W. Graziano and S. G. Wojcicki, K^--p Interactions at 1.15 GeV/c (to be published in Phys. Rev.).

usually suffices to identify the decaying particle as K^0 or Λ. Cases of ambiguous kinematical fit are solved in general by ionization estimates on the positive track; a χ^2 criterion was imposed on the decay configuration such that only $\approx$ 1% of a pure sample of $K_1^0 \rightarrow \pi^+ + \pi^-$ would fail to satisfy it.

Figure 1 shows the spectrum for the total mass of the neutrals recoiling against the K^0. The separation of reaction 1 from the inelastic charge-exchange events is quite unambiguous. In order to correct for scanning biases, a cutoff was applied to the length of the K^0 in the chamber: the projected length of the K^0 was required to be greater than 5 mm in space before accepting the event. Afterward, a correction was applied to compensate for this loss.

Figure 2 shows the angular distribution in the center of mass of reaction 1. The values on the ordinate are based on a total $K^- + p \rightarrow K^0 + n$ cross section of 2.3 ± 0.1 mb. An expansion in powers of $\cos\theta$ requires the presence of at least $(\cos\theta)^6$. The values of the coefficients giving a satisfactory fit are shown in Table I.

The features of the angular distribution for the same reaction at 1.53-GeV/c K^- incident momentum (2025-MeV total c.m. energy) are shown in preliminary form in Fig. 3. Here the backward peak appears to be drastically reduced.

Further work is in progress.

Table I. Coefficients of $(\cos\theta)^n$ in the angular distribution for reaction 1.

n	a_n (mb/sr)
0	0.06 ± 0.01
1	-0.34 ± 0.05
2	0.79 ± 0.17
3	1.95 ± 0.21
4	-2.17 ± 0.55
5	-1.99 ± 0.21
6	2.01 ± 0.44

FIGURE CAPTIONS

Fig. 1. Mass spectrum of the neutrals in the reaction $K^- + p \rightarrow \overline{K}^0 +$ neutrals at 1.22 GeV/c incident K^- momentum (1895 MeV c.m. energy) for 916 events. The peak at the neutron mass corresponds to the events of reaction 1.

Fig. 2. Angular distribution in the center of mass of the reaction $K^- + p \rightarrow \overline{K}^0 + n$ at 1.22-GeV/c incident K^- momentum (1895-MeV c.m. energy). The dashed histogram represents the angular distribution of the events for which the projected length of the $\overline{K}^0$ was greater than 5 mm (500 events). The curve is a fit to the data up to the 6th power of $\cos\theta$.

Fig. 3. Angular distribution in the center of mass of the reaction $K^- + p \rightarrow \overline{K}^0 + n$ at 1.51-GeV/c incident K^- momentum (2025-MeV c.m. energy) for 217 events. The data are uncorrected for scanning biases.

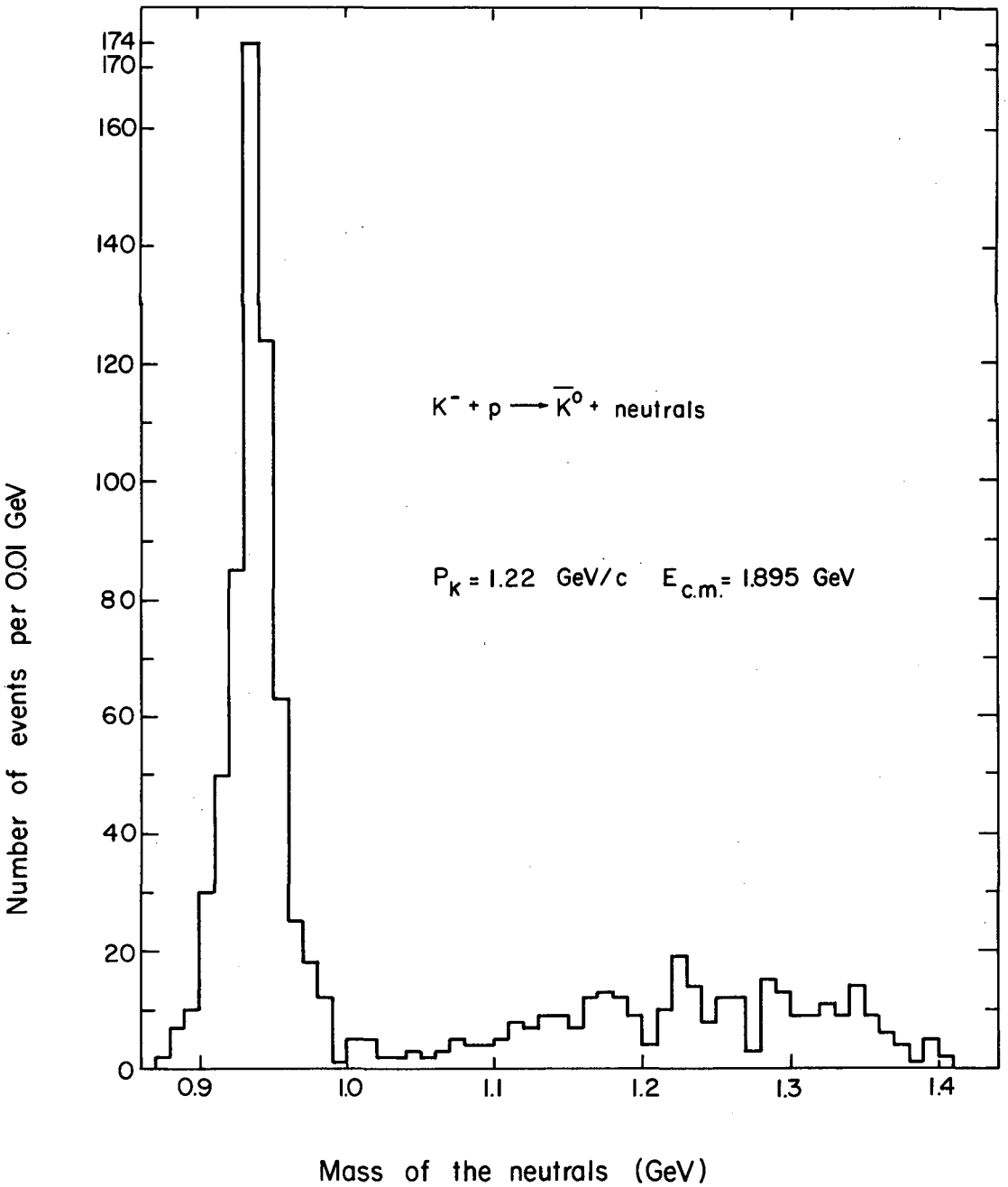
174
170
160
140
120
100
80
60
40
20
0
0.9
1.0
1.1
1.2
1.3
1.4
$K^- + p \longrightarrow \bar{K}^0 +$ neutrals
$P_K = 1.22$ GeV/c $E_{c.m.} = 1.895$ GeV
Number of events per 0.01 GeV
Mass of the neutrals (GeV)
MUB-1106

Fig. 1

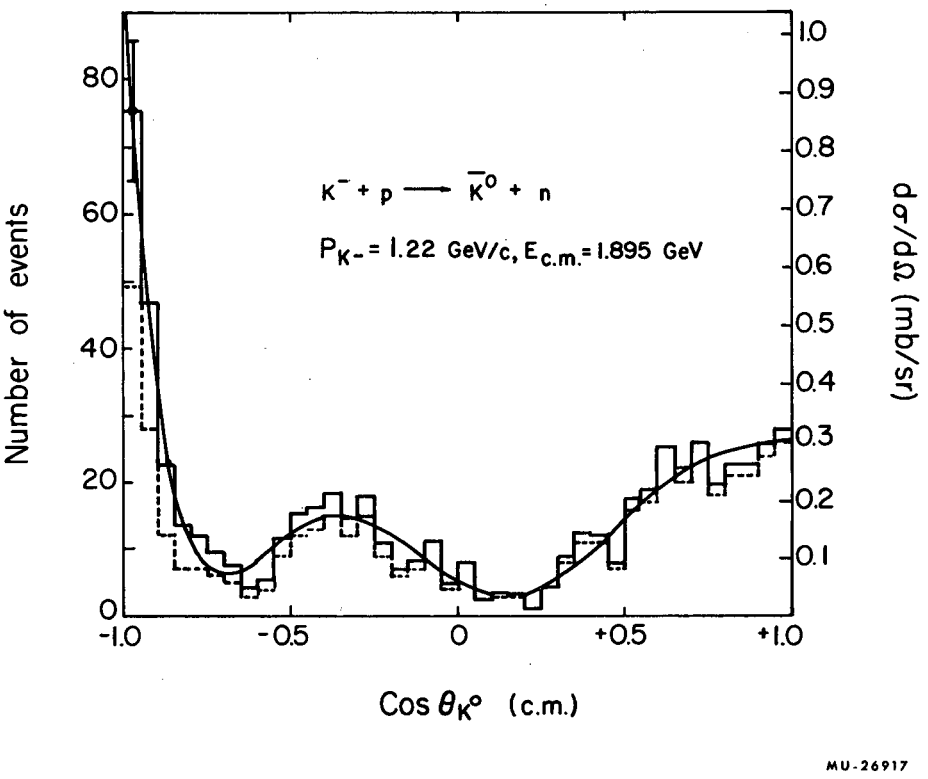
$K^- + p \longrightarrow \bar{K}^0 + n$
$P_{K^-} = 1.22$ GeV/c, $E_{c.m.} = 1.895$ GeV
Number of events
$d\sigma/d\Omega$ (mb/sr)
Cos θ_{K^0} (c.m.)
0
20
40
60
80
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
-1.0
-0.5
0
+0.5
+1.0
MU-26917

Fig. 2

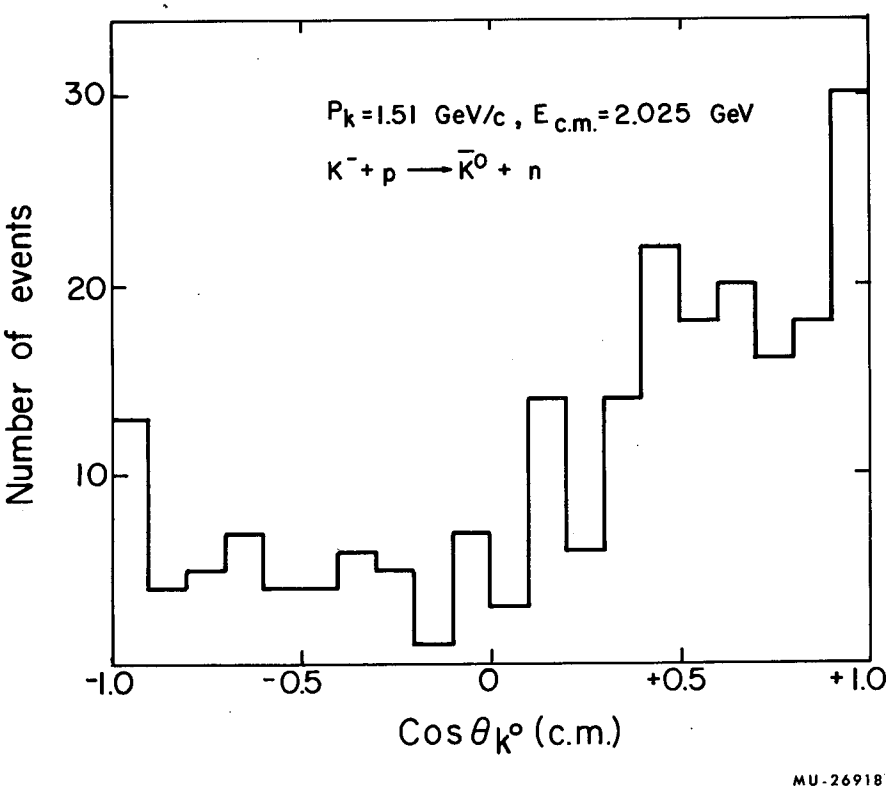
P_k = 1.51 GeV/c , $E_{c.m.}$ = 2.025 GeV
$K^- + p \longrightarrow \bar{K}^0 + n$
Number of events
30
20
10
-1.0
-0.5
0
+0.5
+1.0
Cos θ_{K^0} (c.m.)
MU-26918

Fig. 3