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Differential cross sections for the charge-exchange reactions (I)–(IV) have been measured in the Serpukhov energy range. These reactions

\[ \pi^- + p \rightarrow \pi^0 + n, \]  
\[ \pi^- + p \rightarrow \eta + n, \]  
\[ K^- + p \rightarrow K^0 + n, \]  
\[ p + p \rightarrow n + n, \]

are among the simplest processes of exchange scattering, because the asymptotic behaviors of their amplitudes are dominated by t-channel contributions from one or two poles with the quantum numbers of the \( \rho \) and \( A_2 \) mesons. Figures showing some of the results are included in Amaldi’s rapporteur talk.

Measurements for the reactions I and II were taken at incident momenta \( p = 21, 25, 32.5, 40 \) and \( 48 \) GeV/c [1]. Photon pairs from \( K^- \) decay were detected by an optical spark spectrometer. The differential cross section for (I) has a maximum at \(-t \approx 0.04\) (GeV/c)^2; then in the interval \( 0.1 < -t < 0.6 \) (GeV/c)^2 it falls rapidly with increasing \(-t\), and for \(-t > 0.6\) (GeV/c)^2 it goes through a second maximum. In the momentum range \( 6 < p < 50 \) GeV/c the differential cross section at zero angle is described by the power function

\[ d\sigma/dt (t=0) = (1.35 \pm 0.15) p^{-0.83 \pm 0.05}. \]  

From Eq. (1) it follows that the value of the \( \rho \) trajectory at \( t = 0 \) is

\[ a_\rho (0) = 0.58 \pm 0.03. \]  

This value is in disagreement with data for the total cross section difference \( \Delta \sigma = \sigma(K^- p) - \sigma(K^- n) \), with data above 25 GeV/c. This discrepancy is probably connected with the correction for nucleon screening in the deuteron. To remove the discrepancy it is sufficient to increase the Glauber correction by 13%.

The forward peak of \( K^- p \rightarrow K^0 n \) scattering shrinks slowly with increasing energy; the slope parameter \( b \) is described by a logarithmic \( s \)-dependence:

\[ b = (4.7 \pm 0.5) + (0.8 \pm 0.4) \ln (s/s_0). \]

This means that the contributions of \( \rho \) and \( A_2 \) exchange are not yet important and the asymptotic regime for reaction (IV) occurs at considerably higher energies.

For reaction (II), the parametrization of the \( A_2 \) trajectory is nonlinear:

\[ a_{A_2} (t) = (0.52 \pm 0.04) + (1.2 \pm 0.3) t + (0.7 \pm 0.2) t^2. \]

In the region \( t \approx 0 \), this \( A_2 \) trajectory goes considerably higher than values deduced from data at lower energies. The forward scattering cone shrinks slowly as energy increases, for \( 0.2 < -t < 1 \), and at \(-t = 1.1\) (GeV/c)^2 the differential cross section has a flat minimum.

Cross sections for reactions (III) and (IV) have been measured at 25, 35 and 39 GeV/c [2,3]. The energy dependence at \( t = 0 \) for reaction (III) is described by

\[ \frac{d\sigma}{dt} (t=0) = (5 \pm 1) p^{-1.47 \pm 0.10}. \]

and is below the optical limit defined by the total cross section difference \( \Delta \sigma = \sigma(K^- p) - \sigma(K^- n) \), with data above 25 GeV/c. This discrepancy is probably connected with the correction for nucleon screening in the deuteron. To remove the discrepancy it is sufficient to increase the Glauber correction by 13%.

The forward peak of \( K^- p \rightarrow K^0 n \) scattering shrinks slowly with increasing energy; the slope parameter \( b \) is described by a logarithmic \( s \)-dependence:

\[ b = (4.7 \pm 0.5) + (0.8 \pm 0.4) \ln (s/s_0). \]

where \( b \) is measured in (GeV/c)^2 and \( s_0 = 10 \) GeV^2.

The cross section for \( pp \rightarrow nn \) continues to fall as rapidly with increasing energy as at \( p \lesssim 20 \) GeV/c:

\[ \sigma(pp \rightarrow nn) = (11 \pm 2) p^{-1.8 \pm 0.1}. \]

A narrow peak is clearly seen in \( d\sigma/dt (0 \leq -t \leq 0.02\) (GeV/c)^2), which is analogous to that observed at lower energies. The cross section decrease is equally rapid at all \( t \)-values (\( \sim 1/p^2 \)). This means that the contributions of \( \rho \) and \( A_2 \) exchange are not yet important and the asymptotic regime for reaction (IV) occurs at considerably higher energies.
REFERENCES

[1] SOLOTOV (V.N.) et al., papers 357 and 358
[2] SOLOTOV (V.N.) et al., papers 425 and 426