BUBBLE CHAMBER WORK ON NON-DIFFRACTIVE WASI-TWO-BODY REACTIONS
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A quasi-two-body reaction is completely described by the $s$- and $t$- dependence of all its amplitudes, but this detailed information is normally not available. In most well-known processes only the $s$- and $t$-dependences of the cross-section and of the density matrix elements of the resonances involved are experimentally known. New results on the $s$- and $t$-dependences of some reactions are reviewed first, followed by a discussion of some papers dealing with other subjects.

1.- $s$-DEPENDENCE. The ABCLV-collaboration studied the energy dependence of some $K\bar{p}$ many-body-reactions at 6, 10 and 16 GeV/c \([1]\). The reactions were divided into subreactions depending upon which particles go forward or backward in the cm system. The method, referred to as "binary LPS", is a generalisation of a method used by Morrison \([2]\), to study quasi-two-body reactions. The cross-sections of the various subreactions were parametrised by $\sigma \propto p_{\text{lab}}^{-n}$, where $n$ is empirically related to the quantum numbers exchanged between the forward and backward going particles and the values found are very similar to those obtained from quasi-two-body reactions.

The Tel-Aviv-Heidelberg collaboration investigated the energy dependence of the reactions $K^{0}_\Lambda \rightarrow K^{+} \pi^{+} p$, $E^{0}_\Lambda \rightarrow K^{+} \pi^{+} p$ in the incident momentum range 0.8 to 3.0 GeV/c \([3]\). They were especially interested in the production of the systems $K^{890} N$. Using the results of this experiment and some already existing $K^{+} \rightarrow K^{890} N$ data, an isospin analysis of $KN \rightarrow K^{890} N$ and $KN \rightarrow F^{890} N$ was carried out. In both reactions the $I = 0$ part is larger than the $I = 1$ part. The interference in the second reaction is compatible with zero whereas it is very large and negative in the first reaction (fig.1).

2.- $t$-DEPENDENCE. BNL submitted a paper on a systematic study of the reactions $\pi^{+} \rightarrow \rho^{+} \pi$ and $\pi^{+} \rightarrow \rho^{0} \pi$ at 6 GeV/c \([4]\). An isospin analysis shows that there is no interference between the amplitudes for $I = 0$ and $I = 1$ exchange. The $I = 0$ part if well described by $\omega$-exchange and the $I = 1$ part if dominated by $\pi$-exchange. Using a simple model for $\pi$-exchange (a modification of the Williams model \([5]\)) and Harari's dual absorption model for $\omega$-exchange \([6]\), an amplitude analysis for this process is carried out.

Bouchez and Mallet presented preliminary results from an amplitude analysis of the reaction $\pi^{+} p \rightarrow \rho^{0} n$ and $\rho^{0} p$ at 3.9 GeV/c \([7]\). The amplitudes and their relative phases have been determined as a...
Eisenberg et al. investigated the quasi-two-body reaction \( \pi^+ p \rightarrow p^0 \Delta^{++} \) at 5 GeV/c in a large statistics experiment [8]. They found a very strong forward peak in the \( d\sigma/dt' \) with a slope of \( 22 \pm 2 \) GeV\(^2\)/t' (which comes from the dominance of \( \pi \)-exchange in this process), but no other structure was found in this distribution. A strong dip at \( |t'| = 0.2 \) GeV\(^2\) was observed in the helicity-flip-1 natural parity exchange part; it is probably due to \( A_2 \) exchange.

The reaction \( \pi^+ n \rightarrow \omega p \) at 4 GeV/c was studied by the Durham-Birmingham-Rutherford collaboration [9]. From the density matrix elements they concluded that both B and \( \rho \)-exchange are needed. Conclusions on detailed results may however be modified since no corrections were applied for the 30% background under the \( \omega \).

Karshon et al. [10] investigated the reaction \( \pi^+ p \rightarrow B^+ p \) at 5 GeV/c which was not very well studied up to now. There are indications that \( d\sigma/dt' \) has a shoulder at \( t' = -0.2 \) GeV\(^2\), and that \( \rho_{00} \)
\( d\sigma/dt' \) has a dip here (in agreement with a corresponding \( \pi^- p \) experiment at similar energies [11]). This result can be explained by the dominance of \( \omega \)-exchange. The suppression of \( A_2 \) exchange is also apparent in a study [10] of the reaction \( \pi^+ p \rightarrow B^0 \Delta^{++} \) with a five times smaller production cross section than for the final state \( B^+ p \). However, the Rochester group finds a strong \( (\pi A_2 B) \) coupling in the reaction \( \pi^- n \rightarrow B^- \Delta^0 \), studied in \( \pi^- d \) interactions at 7 GeV/c [12].

The Toronto group investigated \( \pi^+ p \rightarrow \pi^0 \Delta^{++} \) and \( \pi^+ p \rightarrow \pi^0 \Delta^+ \) at 5.45 GeV/c [13]. Both reactions exhibit cross-sections with a similar power law \( n = 1.59 \pm 0.09 \) for \( \pi^0 \Delta^{++} \) and \( n = 1.57 \pm 0.15 \) for \( \pi^0 \Delta^{++} \). The first reaction is dominated by \( \rho \) and the second by \( A_2 \)-exchange.

The CERN-Birmingham-Brussels-Mons-Saclay-Paris collaboration studied systematically the reaction \( K^+ p \rightarrow K^{*0} \Delta^{++} \) from 4.6 to 16 GeV/c [14]. \( d\sigma/dt' \) has a strong forward peak. This and the large value of the density matrix element \( \rho_{00} \) in the forward direction (see fig.2) indicate dominance of \( \pi \)-exchange. Fits to \( d\sigma/dt' \), \( \rho_{00} \) and \( \rho_{11} \) - \( \rho_{11} \)-1 (in either the Jackson or helicity frame) give an effective Regge-trajectory with an intercept that is
much too low ($\alpha = -.24 \pm .05$) and a slope that is too flat for a $\pi$-Regge pole.

Two other submitted papers study simple one-pion-exchange for the reactions $np \rightarrow \Delta^- \Delta^{++}$ at 3GeV/c [15] and $pp \rightarrow \Delta^- \Delta^{++}$ at 5.7 GeV/c [16]. Both experiments found a strong forward peak consistent with $x$-exchange. Statistical tensors calculated for the double decay were inconsistent with the predictions of simple OPE. This indicates that absorption is needed to explain the data.

Backward production of $\pi^0$, $\omega^0$ and $\rho^0$-mesons was studied by the Rutherford-Birmingham-Durham collaboration [18]. In the case of $\rho$ and $\omega$, the results were compared with vector-dominance model predictions. A large negative interference between the $\omega$ and $\rho$-amplitudes was found to be necessary to obtain agreement with the model at least for $|t| > 0.5$ GeV$^2$.

3. MISCELLANEOUS. - In this part I would like to mention two items. Tenner et al. [19] submitted a paper in which the reactions $K^*p \rightarrow K^{*0} \pi^0p$ are described in terms of Veneziano amplitudes. Data at 14 different momenta from 2.7 to 12.7 GeV/c have been compared with the model calculation and the agreement is quite good.

Another paper makes a comparison of the quark model with the reactions $\pi^0p \rightarrow \omega$ and $\rho^{0\Delta^{++}}$ at 5 GeV/c [20]. The Class A quark model relations are satisfied within statistics for $\pi^0p \rightarrow \omega \Delta^{++}$ (even at large momentum transfers), but there are deviations from the model for the $\pi^0p \rightarrow \rho\Delta^{++}$ data.

REFERENCES

[1] GÖSSLER (H.), et al., Aachen-Berlin-CERN-London Vienna collaboration, paper 80
[3] ALEXANDER (G.) et al., Tel-Aviv-Heidelberg collaboration, paper 77
[4] GORDON (H.) et al., BNL, paper 19
[7] BOUCHEZ (J.) and MALLET (J.), paper 289
[8] RIENZENBERG (Y.) et al., Weizmann Institute, paper 312
[10] KARSHON (U.) et al., Weizmann Institute, paper 313
[11] CHALOEPEA (V.), private communication
[12] COHEN (D.) et al., paper 93
[13] BLOODWORTH (I.J.) et al., Toronto, paper 180
[15] ANSORGE (R.E.) et al., Cambridge, paper 249
[16] ATHERTON (H.W.) et al., CERN-Prague collaboration, paper 254
[17] CHARRIERE (G.) et al., CERN-Munich-Mons-Brussels collaboration, paper 292
[18] CHARLESWORTH (J.A.) et al., Rutherford-Birmingham-Durham collaboration, paper 274
[19] TENNES (A.G.), VERSTEEG (M.F.), WOLTERS (G.F.), paper 250
[20] LYONS (L.) et al., Weizmann Institute, paper 347.