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BACKWARD SCATTERING IN THE QUARK MODEL WITH ADDITIVE BARYON EXCHANGE

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The quark model with additive baryon exchange is applied to reactions of the type $0^- + 1/2^+ \to 0^- + 1/2^+$ and $0^- + 1/2^+ \to 0^- + 3/2^+$. The predictions for measurable quantities are given.

1. Introduction

In this paper we would like to apply a quark model of the baryon exchange mechanism at higher energy previously proposed by Białas, Gołąb-Meyer and Zalewski [1] to the reactions of the type

$$0^- + 1/2^+ \to 0^- + 1/2^+ \tag{1.1}$$

and

$$0^- + 1/2^+ \to 0^- + 3/2^+. \tag{2.1}$$

Let us briefly remind basic ideas of the model. The mechanism is summarized in the Fig. 1. The baryons (initial, virtual and final) are considered as three-quark systems according to the usual rules of the quark model. The incident baryon emits the final meson. The resulting virtual baryon propagates and then absorbs the incident meson and becomes the final baryon.

We assume that both emission and absorption processes are described according to the additivity rules of the quark model (*e.g.* [2]).

Thus amplitude for each of the processes (1.1) and (2.1) is a sum of many terms, each of them being a formal product of three factors:

1) an emission amplitudes of the final meson by a single quark
2) a propagator
3) an absorption amplitude of initial meson by a single quark.

The details of the model and technical problems related to the construction of the scattering amplitudes were given in Ref. [1] and we will not repeat them here. The plan

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of this paper is as follows: In Section 2 after introducing necessary notation we collect in five tables the transversity amplitudes for the processes:

Processes	Number of table	Exchanges
$\pi N \to N\pi$ $\pi N \to \Delta\pi$	I	N, Δ
$\bar{K}N \to \Sigma(\Lambda)\pi$ $\bar{K}N \to \Sigma^*\pi$	II	N, Δ
$\pi N \to \Sigma(\Lambda)K$ $\pi N \to \Sigma^* K$	III	$\Lambda, \Sigma, \Sigma^*$
$KN \to \Xi\bar{K}$ $KN \to \Xi^*\bar{K}$	IV	$\Lambda, \Sigma, \Sigma^*$
$KN \to NK$ $KN \to \Lambda K$	V	$\Lambda, \Sigma, \Sigma^*$

In Section 3 general predictions of the model *i.e.* relations between measurable quantities such as cross-sections and statistical tensors are presented. Finally in Section 4 we present possibilities of experimental checking the model.

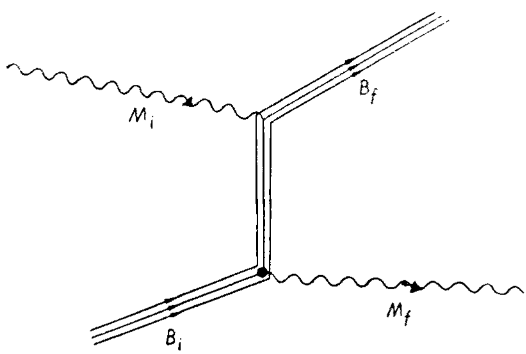

Fig. 1

2. *Transversity amplitude for the processes (1.1) and (2.1)*

We use the following notation:

Emission amplitudes		Absorption amplitudes	
$a \equiv (p_+ \to n_-\pi^+)$		$\bar{a} \equiv (\pi^- p_+ \to n_-)$	
$b \equiv (p_- \to n_+\pi^+)$		$\bar{b} \equiv (\pi^- p_- \to n_+)$	
$m \equiv (p_+ \to \lambda_- K^+)$		$\bar{m} \equiv (K^- p_+ \to \lambda_-)$	
$w \equiv (p_- \to \lambda_+ K^+)$	(1.2)	$\bar{w} \equiv (K^- p_- \to \lambda_+)$	(2.2)

Other amplitudes needed for the description of the processes entering the Tables I–V are calculated from isospin invariance. The processes from Table I are described by the following quark amplitudes:

$$\Sigma a\Phi_I\bar{a} = D_I$$

$$\Sigma a\Phi_I\bar{b} = A_I$$

$$\Sigma b\Phi_I\bar{b} = C_I$$

$$\Sigma b\Phi_I\bar{a} = B_I$$

Φ_I denote propagators of intermediate baryons. Σ is over all possible intermediate baryons, which have spin and unitary spin wave functions as N and $N^*(3/2^+)$. I denotes double exchanged isospin.

Similarly the processes in the Table II are described by:

$$\Sigma b\Phi_I\bar{m} = I_I$$

$$\Sigma a\Phi_I\bar{w} = J_I$$

$$\Sigma b\Phi_I\bar{w} = K_I$$

$$\Sigma a\Phi_I\bar{m} = L_I.$$

The meaning of the Φ_I, Σ and I is the same as for the Table I.

The amplitudes from Table III described by:

$$\Sigma w\Phi_I\bar{a} = Z_I$$

$$\Sigma m\Phi_I b = Y_I$$

$$\Sigma m\Phi_I\bar{a} = \mathcal{N}_I$$

$$\Sigma w\Phi_I\bar{b} = \mathcal{M}_I$$

and finally the amplitudes from Tables IV and V are described by:

$$\Sigma w\Phi_I\bar{m} = P_I$$

$$\Sigma m\Phi_I\bar{w} = R_I$$

$$\Sigma w\Phi_I\bar{m} = \mathcal{P}_I$$

$$\Sigma w\Phi_I\bar{w} = \mathcal{R}_I.$$

Here Φ_I denote propagators of intermediate baryons. Σ goes over all possible intermediate states which have spin and unitary spin wave functions as Λ, Σ and $\Sigma(3/2^+)$. I goes over 0, 1 and 1_D.

On the bottom of the tables we give the isospin relations from which other amplitudes can be calculated.

TABLE I

Reactions \ Transversity amplitudes	T_{--}	T_{++}	$T_{-,\frac{3}{2}}$	$T_{+,-\frac{3}{2}}$
$\pi^- p \to p\pi^-$	$-\frac{2}{3} B_3 + 2A_3$	$-\frac{2}{3} A_3 + 2B_3$		
$\pi^+ p \to p\pi^+$	$-\frac{25}{9} B_1 - \frac{2}{9} B_3 + \frac{2}{3} A_3$	$\frac{2}{3} B_3 - \frac{25}{9} A_1 - \frac{2}{9} A_3$		
$\pi^+ p \to \Delta^+\pi^+$	$\frac{5\sqrt{2}}{9} B_1 + \frac{4\sqrt{2}}{9} B_3 + \frac{2\sqrt{2}}{3} A_3$	$-\frac{2\sqrt{2}}{3} B_3 - \frac{5\sqrt{2}}{9} A_1 - \frac{4\sqrt{2}}{9} A_3$	$\frac{10}{3\sqrt{6}} C_1 - \frac{4}{3\sqrt{6}} C_3$	$-\frac{10}{3\sqrt{6}} D_1 + \frac{4}{3\sqrt{6}} D_3$
$\pi^- p \to \Delta^+\pi^-$	$-\frac{2\sqrt{2}}{3} B_3 - \sqrt{2} A_3$	$\frac{2\sqrt{2}}{3} A_3 + \sqrt{2} B_3$	$\sqrt{\frac{2}{3}} C_3$	$-\sqrt{\frac{2}{3}} D_3$

$$T(\pi^- p \to n\pi^0) = \frac{1}{\sqrt{2}} (T(\pi^+ p \to p\pi^+) - T(\pi^- p \to p\pi^-))$$

$$T(\pi^- p \to \Delta^-\pi^+) = \sqrt{3} (T(\pi^- p \to \Delta^+\pi^-) + T(\pi^+ p \to \Delta^+\pi^+))$$

$$T(\pi^- p \to \Delta^0\pi^0) = -\frac{1}{\sqrt{2}} (2T(\pi^- p \to \Delta^+\pi^-) + T(\pi^+ p \to \Delta^+\pi^+))$$

$$T(\pi^+ p \to \Delta^{++}\pi^0) = -\sqrt{\frac{3}{2}}\, T(\pi^+ p \to \Delta^+\pi^+)$$

TABLE II

Reactions \ Transversity amplitudes	T_{--}	T_{++}	$T_{-,\frac{3}{2}}$	$T_{+,-\frac{3}{2}}$
$K^-p \to \Sigma^-\pi^+$	$\frac{5}{9} I_1 - \frac{2}{9} I_3 + \frac{2}{3} J_3$	$\frac{5}{9} J_1 - \frac{2}{9} J_3 + \frac{2}{3} I_3$		
$K^-p \to \Sigma^+\pi^-$	$-\frac{2}{3} I_3 + 2J_3$	$-\frac{2}{3} J_3 + 2I_3$		
$K^-p \to \Lambda\pi^0$	$-\frac{5}{\sqrt{12}} I_1$	$-\frac{5}{\sqrt{12}} J_1$		
$K^-p \to \Sigma^{*-}\pi^+$	$\frac{5\sqrt{2}}{9} I_1 - \frac{2\sqrt{2}}{9} I_3 - \frac{\sqrt{2}}{3} J_3$	$-\frac{5\sqrt{2}}{9} J_1 + \frac{2\sqrt{2}}{9} J_3 + \frac{\sqrt{2}}{3} I_3$	$\frac{10}{3\sqrt{6}} K_1 + \frac{2}{3\sqrt{6}} K_3$	$-\frac{10}{3\sqrt{6}} L_1 - \frac{2}{3\sqrt{6}} L_3$
$K^-p \to \Sigma^{*+}\pi^-$	$-\frac{4}{3\sqrt{2}} I_3 - \frac{2}{\sqrt{2}} J_3$	$\frac{4}{3\sqrt{2}} J_3 + \sqrt{2} I_3$	$\frac{2}{\sqrt{6}} K_3$	$-\frac{2}{\sqrt{6}} L_3$

$$T(K^-p \to \Sigma^0\pi^0) = -\frac{1}{2}\left(T(K^-p \to \Sigma^+\pi^-) + T(K^-p \to \Sigma^-\pi^+)\right)$$

$$T(K^-p \to \Sigma^{*0}\pi^0) = -\frac{1}{2}\left(T(K^-p \to \Sigma^{*+}\pi^-) + T(K^-p \to \Sigma^{*-}\pi^+)\right)$$

TABLE III

Reactions \ Transversity amplitudes	T_{--}	T_{++}	$T_{+,\frac{3}{2}}$	$T_{+,-\frac{3}{2}}$
$\pi^- p \to \Lambda K^0$	$\frac{1}{9}\sqrt{\frac{3}{2}}(-2Z_1+2Z_{1D}-6Y_{1D})$	$\frac{1}{9}\sqrt{\frac{3}{2}}(-2Y_1+2Y_{1D}-6Z_{1D})$		
$\pi^- p \to \Sigma^- K^+$	$-Z_0+\frac{2}{9}Z_1+\frac{1}{9}Z_{1D}-\frac{1}{3}Y_{1D}$	$-Y_0+\frac{2}{9}Y_1+\frac{1}{9}Y_{1D}-\frac{1}{3}Z_{1D}$		
$\pi^+ p \to \Sigma^+ K^+$	$-Z_0-\frac{2}{9}Z_1-\frac{1}{9}Z_{1D}+\frac{1}{3}Y_{1D}$	$-Y_0-\frac{2}{9}Y_1-\frac{1}{9}Y_{1D}+\frac{1}{3}Z_{1D}$		
$\pi^- p \to \Sigma^{*-} K^+$	$\frac{1}{\sqrt{2}}\left(Z_0+\frac{1}{9}Z_1-\frac{4}{9}Z_{1D}-\frac{2}{3}Y_{1D}\right)$	$-\frac{1}{\sqrt{2}}\left(Y_0+\frac{1}{9}Y_1-\frac{4}{9}Y_{1D}-\frac{2}{3}Z_{1D}\right)$	$\frac{3}{\sqrt{6}}\left(\mathcal{M}_0+\frac{1}{9}\mathcal{M}_1+\frac{2}{9}\mathcal{M}_{1D}\right)$	$-\frac{3}{\sqrt{6}}\left(\mathcal{N}_0+\frac{1}{9}\mathcal{N}_1+\frac{2}{9}\mathcal{N}_{1D}\right)$
$\pi^+ p \to \Sigma^{*+} K^+$	$\frac{1}{\sqrt{2}}\left(Z_0-\frac{1}{9}Z_1+\frac{4}{9}Z_{1D}+\frac{2}{3}Y_{1D}\right)$	$-\frac{1}{\sqrt{2}}\left(Y_0-\frac{1}{9}Y_1+\frac{4}{9}Y_{1D}+\frac{2}{3}Z_{1D}\right)$	$\frac{3}{\sqrt{6}}\left(\mathcal{M}_0-\frac{1}{9}\mathcal{M}_1-\frac{2}{9}\mathcal{M}_{1D}\right)$	$-\frac{3}{\sqrt{6}}\left(\mathcal{N}_0-\frac{1}{9}\mathcal{N}_1-\frac{2}{9}\mathcal{N}_{1D}\right)$

$$T(\pi^- p \to \Sigma^0 K^0) = \frac{1}{\sqrt{2}}(T(\pi^+ p \to \Sigma^+ K^+) - T\,\pi^- p \to \Sigma^- K^+))$$

$$T(\pi^0 p \to \Lambda K^+) = \frac{1}{\sqrt{2}}(T(\pi^- p \to \Lambda K^0))$$

$$T(\pi^- p \to \Sigma^{*0} K^0) = \frac{1}{\sqrt{2}}(T(\pi^+ p \to \Sigma^{*+} K^+) - T(\pi^- p \to \Sigma^{*-} K^+))$$

TABLE IV

Transversity amplitudes / Reactions	T_{--}	T_{++}	$T_{-,\frac{3}{2}}$	$T_{+,-\frac{3}{2}}$
$K^-p \to \Xi^0 K^0$	$-\frac{5}{9}P_1+\frac{2}{9}P_{1D}-\frac{2}{3}R_{1D}$	$-\frac{5}{9}R_1+\frac{2}{9}R_{1D}-\frac{2}{3}P_{1D}$		
$K^-p \to \Xi^- K^+$	$\frac{1}{2}P_0-\frac{5}{18}P_1+\frac{1}{9}P_{1D}-\frac{1}{3}R_{1D}$	$\frac{1}{2}R_0-\frac{5}{18}R_1+\frac{1}{9}R_{1D}-\frac{1}{3}P_{1D}$		
$K^-p \to \Xi^{*0} J^0$	$-\frac{\sqrt{2}}{9}P_1+\frac{4\sqrt{2}}{9}P_{1D}+\frac{2\sqrt{2}}{3}R_{1D}$	$\frac{\sqrt{2}}{9}R_1-\frac{4\sqrt{2}}{9}R_{1D}-\frac{2\sqrt{2}}{3}P_{1D}$	$-\frac{2}{3\sqrt{6}}\mathscr{P}_1-\frac{4}{3\sqrt{6}}\mathscr{P}_{1D}$	$\frac{2}{3\sqrt{6}}\mathscr{R}_1+\frac{4}{3\sqrt{6}}\mathscr{R}_{1D}$
$K^-p \to \Xi^{*-} K^+$	$\frac{1}{\sqrt{2}}P_0+\frac{1}{9\sqrt{2}}P_1-\frac{4}{9\sqrt{2}}P_{1D}-\frac{2}{3\sqrt{2}}R_{1D}$	$-\frac{1}{\sqrt{2}}R_0-\frac{1}{9\sqrt{2}}R_1+\frac{4}{9\sqrt{2}}R_{1D}+\frac{2}{3\sqrt{2}}P_{1D}$	$\sqrt{\frac{3}{2}}\mathscr{P}_0+\frac{1}{9}\sqrt{\frac{3}{2}}(\mathscr{P}_1+\mathscr{P}_{1D})$	$-\sqrt{\frac{3}{2}}\mathscr{R}_0-\frac{1}{9}\sqrt{\frac{3}{2}}(\mathscr{R}_1+\mathscr{R}_{1D})$

$$T(\overline{K}^0 p \to \Xi^0 K^+) = T(K^-p \to \Xi^0 K^0) + T(K^-p \to \Xi^- K^+)$$

$$T(\overline{K}^0 p \to \Xi^{*0} K^+) = T(K^-p \to \Xi^{*0} K^0) + T(K^-p \to \Xi^{*-} K^+)$$

TABLE V

Reactions \ Transversity amplitudes	T_{--}	T_{++}	$T_{-,\frac{3}{2}}$	$T_{+,-\frac{3}{2}}$
$K^+p \to pK^+$	$\frac{3}{2}P_0+\frac{1}{18}P_1+\frac{1}{9}P_{1D}-\frac{1}{3}R_{1D}$	$\frac{3}{2}R_0+\frac{1}{18}R_1+\frac{1}{9}R_{1D}-\frac{1}{3}P_{1D}$		
$K^0p \to nK^+$	$\frac{1}{9}P_1+\frac{2}{9}P_{1D}-\frac{2}{3}R_{1D}$	$\frac{1}{9}R_1+\frac{2}{9}R_{1D}-\frac{2}{3}P_{1D}$		
$K^+p \to \Delta^+K^+$	$-\frac{\sqrt{2}}{9}P_1-\frac{2\sqrt{2}}{9}P_{1D}-\frac{3\sqrt{2}}{9}R_{1D}$	$\frac{\sqrt{2}}{9}R_1+\frac{2\sqrt{2}}{9}R_{1D}+\frac{3\sqrt{2}}{9}P_{1D}$	$\sqrt{\frac{2}{3}}\left(-\frac{1}{9}\mathscr{P}_1+\frac{1}{9}\mathscr{P}_{1D}\right)$	$\sqrt{\frac{2}{3}}\left(\frac{1}{9}\mathscr{R}_1-\frac{1}{9}\mathscr{R}_{1D}\right)$

$T(K^0p \to pK^0) = T(K^+p \to pK^+) - T(K^0p \to nK^+)$

$T(K^+p \to \Delta^{++}K^0) = -\sqrt{3}\,T(K^+p \to \Delta^+K^+)$

$T(K^0p \to \Delta^+K^0) = -T(K^+p \to \Delta^+K^+)$

$T(K^0p \to \Delta^0K^+) = T(K^+p \to \Delta^+K^+)$

3. *General predictions of the model*

One can see Tables I–V that the number of the quark amplitudes describing a group of the processes is smaller than the number of considered reactions. This implies some relations between measurable quantities. In this paper we would like to discuss only relations which come simply from the expressions for the amplitudes given in Tables I–V[1].

These relations represent a test of the basic assumptions of the model. We will limit ourselves to the linear relations because they are practically more important (it means more easy for experimental checking).

Relations are divided into groups from the point of view of difficulty in experimental checking.

i) Selections rules

Our model is an usual baryon-exchange model in which the vertices are calculated according to the rules of additivity. For these reactions in which conservation law forbids baryon exchange, the model predict vanishing cross-section. This feature is quantitatively very well established by the experiment.

ii) Relations between cross-sections

For the reactions of the Table II one can find:

$$\sigma(\Sigma^0\pi^0) = \sigma(\Sigma^-\pi^+) + \frac{1}{3}\,\sigma(\Sigma^+\pi^-) - \frac{1}{9}\,\sigma(\Lambda\pi^0) \tag{1.3}$$

and for the reactions from Tables IV and V:

$$\sigma(K^+p)_{el} + \sigma(K^0p)_{el} - \tfrac{1}{2}\sigma(K^0p \to K^+n)$$
$$= 9[3\sigma(\Xi^-K^+) - \sigma(\Xi^0K^+) + \tfrac{3}{2}\sigma(\Xi^0K^0)]. \tag{2.3}$$

There are all nontrivial relations between cross-sections following from the model.

iii) Relations requiring measurement of angular distributions of the decaying $3/2^+$ isobars

Let us denote:

$$S = \sigma - 2\sigma T_0^2 \tag{3.3}$$

where σ is a differential cross-section for the process (2.1) and T_0^2 the statistical tensor [4] in the transversity [5] frame. It is easy to see that

$$S = |T_{++}|^2 + |T_{--}|^2. \tag{4.3}$$

Consequently one obtains relations between S and cross-sections for the processes of the type (1.1). They read:

$$\sigma(\pi^+p) + \sigma(\pi^0n) - \sigma(\pi^-p)/3$$
$$= \tfrac{25}{6}\{(S(N^{*+}\pi^-) - S(N^{*-}\pi^+) + S(N^{*++}\pi^0)\} \tag{5.3}$$

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[1] For other relations, requiring further assumptions concerning quark amplitudes see Ref. [3].

$$\sigma(\Sigma^-\pi^+)+\tfrac{1}{3}\sigma(\Sigma^+\pi^-)-\sigma(\pi^0\Sigma^0)$$
$$=\tfrac{1}{4}\{S(\Sigma^{*-}\pi^+)+\tfrac{1}{3}S(\Sigma^{*+}\pi^-)-S(\Sigma^{*0}\pi^0)\} \tag{6.3}$$
$$\sigma(\Sigma^-K^+)+\sigma(\Sigma^+K^+)-\sigma(\Sigma^0\pi^0)$$
$$=S(\Sigma^{*-}K^+)+S(\Sigma^{*+}K^+)-S(\Sigma^{*0}K^0) \tag{7.3}$$
$$3\sigma(\Xi^-K^+)-\sigma(\Xi^0K^+)+\tfrac{3}{2}\sigma(\Xi^0K^0)$$
$$=\tfrac{1}{4}[4S(\Xi^{*-}K^+)-S(\Xi^{*0}K^+)+\tfrac{3}{2}S(\Xi^{*0}K^0)] \tag{8.3}$$

iv) Relations requiring measurement of polarization

a) polarization of the final hyperon

Let us introduce the following quantity:

$$R=(-3T_0^3+T_0^1)\cdot 2\sigma \tag{9.3}$$

where T_0^3 and T_0^1 denote statistical tensors of the decaying $3/2^+$ isobar and σ differential cross-section for the process in which this isobar is produced. To determine T_0^3 and T_0^1 it is necessary to measure polarization of the final baryon. See *e.g.* Ref. [6] for the details.

It is easy to show that:

$$R=\frac{10}{\sqrt{20}}(|T_{++}|^2-|T_{--}|^2). \tag{10.3}$$

Denoting

$$\Pi=\sigma\cdot P \tag{11.3}$$

(where σ is the cross-section and P the polarization of the final baryon in the reaction (1.1) we get

$$\Pi(\pi^+p)+\Pi(\pi^0n)-\Pi(\pi^-p)/3=\frac{25}{6}\frac{\sqrt{20}}{10}\{R(N^{*+}\pi^-)-R(N^{*-}\pi^+)+R(N^{*++}\pi^0)\} \tag{12.3}$$

$$\Pi(\Sigma^-\pi^+)+\frac{1}{3}\Pi(\Sigma^+\pi^-)-\Pi(\Sigma^0\pi^0)=\frac{\sqrt{20}}{4\times 10}\left\{R(\Sigma^{*-}\pi^+)+\frac{1}{3}R(\Sigma^{*+}\pi^-)-R(\Sigma^{*0}\pi^0)\right\} \tag{13.3}$$

$$\Pi(\Sigma^-K^+)+\Pi(\Sigma^+K^+)-\Pi(\Sigma^0K^0)=\frac{\sqrt{20}}{10}\{R(\Sigma^{*-}K^+)+R(\Sigma^{*+}K^+)-R(\Sigma^{*0}K^0)\} \tag{14.3}$$

$$3\Pi(\Xi^-K^+)-\Pi(\Xi^0K^+)+\frac{3}{2}\Pi(\Xi^0K^0)=\frac{\sqrt{20}}{4\times 10}\left\{3R(\Xi^{*-}K^+)-R(\Xi^{*0}K^0)+\frac{3}{2}R(\Xi^{*0}K^0)\right\} \tag{15.3}$$

For the reactions from Tables I and II one can find more relations, namely

$$\Pi(\pi^-p)=\frac{32}{5\cdot\sqrt{5}}R(\pi^-\Delta^+) \tag{16.3}$$

$$\Pi(\Sigma^+\pi^-)=\frac{32}{5\cdot\sqrt{5}}R(\Sigma^{*+}\pi^-). \tag{17.3}$$

The relations given in this section are particularly useful for strange hyperon production, because then the polarization experiments are easy to perform. For the nucleons and the Δ

productions they are less practical. In this case, it is easier to determine the behaviour of polarization from measurements on a polarized target. The corresponding relations are treated in the next section.

b) Relations requiring measurements on a target polarized perpendicularly to the reaction plane

The relations of this section are trivial generalization of the relations of previous section:

1) The relations (5.3)–(8.3) are valid also for scattering on polarized target, provided the target polarization is taken the same for all reactions entering in a given formula.

2) Instead of relations (16.3) and (17.3) we have

$$\tilde{\sigma}_P(\pi^- p) = 32\tilde{S}_P(\pi^- \Delta^+) \tag{18.3}$$

and

$$\tilde{\sigma}_P(\Sigma^+\pi^-) = 32\tilde{S}_P(\Sigma^{*+}\pi^-) \tag{19.3}$$

where

$$\tilde{\sigma}_P = \sigma_P - \sigma \qquad \tilde{S}_P = S_P - S$$

(σ_P and S_P denote quantities measured on polarized perpendicularly target).

4. *Comparison with experiment*

From the relations discussed in this paper only one can be checked at present. At 3 GeV/c incident momenta [7] there exist measurements of all processes entering to (1.3). The input data are:

$$\sigma_{\Sigma^-\pi^+} = 24 \pm 6\ \mu\text{b}$$

$$\sigma_{\Sigma^+\pi^-} = 44 \pm 6\ \mu\text{b}$$

$$\sigma_{\Lambda\pi^0} = 37 \pm 7\ \mu\text{b}$$

$$\sigma_{\Sigma^0\pi^0} < 32\ \mu\text{b}.$$

Right hand side of relation (1.3): $< 32\ \mu$b

Left hand side of relation (1.3): $= 37 \pm 8\ \mu$b.

The agreement is fair. It remains to be seen whether it improves at higher incident momenta.

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REFERENCES

[1] A. Białas, Z. Gołąb-Meyer, K. Zalewski, *CERN preprint* TH 1077 (1969) and *Acta Phys. Polon.*, **B1**, 165 (1970).
[2] R. P. Van Royen, V. F. Weisskopf, *Nuovo Cimento*, **50**, 617 (1967).
[3] Z. Gołąb-Meyer, *Thesis*, Jagellonian University, Institute of Physics, 1970.
[4] A. Kotański, K. Zalewski, *Nuclear Phys.*, **B4**, 559 (1968).
[5] A. Kotański, *Acta Phys. Polon.*, **29**, 699 (1966).
[6] A. Białas, A. Kotański, *preprint TPJU-2/70* (1970); to be published in *Nuclear Phys.*
[7] J. Badier *et al.*, *preprint CEA-R* 3037 (1966).