**Symmetry and the High-Energy Reactions $NN \rightarrow YY$.**

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**Summary.** — A study of the high-energy reactions $NN \rightarrow YY$ is presented within the framework of $O_{3,1}$ partial-wave expansion formalism for arbitrary momentum transfer. We found that the high-energy helicity amplitudes receive contributions from both $j_0 = 0$ and $j_0 = 1$ Lorentz poles. We also found that the angular distribution has a minimum around the points $t \simeq -0.3 \text{(GeV/c)}^2$ and $t \simeq -1.4 \text{(GeV/c)}^2$. Our predictions are compared with the results of the absorption model and with the experimental data for momentum of the incident antiproton $P_L = 5.7 \text{(GeV/c)}$.

In this paper we analyse the high-energy reactions $NN \rightarrow YY$ within the context of $O_{3,1}$ symmetry following the formalism of Delbourgo, Salam and Strathdee (DSS). We used our results to fit the experimental angular distribution for antiproton momentum $P_L = 5.7 \text{(GeV/c)}$ assuming that the leading trajectory $K^*$ is parallel to the $\phi$-trajectory and it dominates the amplitude at the energy in question. We have neglected the contribution of the K-meson exchange since its trajectory lies lower than the $K^*$-trajectory.

Employing the DSS formalism, we expand the helicity amplitudes $\langle \lambda_3 \lambda_4 | T | \lambda_1 \lambda_2 \rangle$ in terms of a set of reduced amplitudes $T_{s'k'k}^s(s, t)$ as follows (1):

\[
\langle s_3 \lambda_3 \lambda_4 | T | s_1 \lambda_1 \lambda_2 \rangle = \sum_{s'k'k} \langle s_4 \lambda_4 | s_2 \lambda_2 | s' \lambda' \rangle T_{s'k'k}^s(s, t) \langle s_3 \lambda_3 \lambda_4 | s_1 \lambda_1 \rangle,
\]

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where \( \langle s_1 \lambda_1 | s_2 \lambda_2 \rangle \) are the Clebsch-Gordan coefficients. For the process \( \mathcal{N}^0 \rightarrow \mathcal{Y} \mathcal{Y} \) we number the particles such that

\[
\mathcal{N}(\lambda_1) + \overline{\mathcal{N}}(\lambda_2) \rightarrow \mathcal{Y}(\lambda_3) + \overline{\mathcal{Y}}(\lambda_4),
\]

where \( \lambda_1, \lambda_2, \lambda_3, \lambda_4 \) are the corresponding helicities.

The next step is to express the reduced amplitudes \( T_{\mathcal{X} \mathcal{Y}}(s, t) \) in terms of a new set of reduced amplitudes \( T'_{\mathcal{X} \mathcal{Y}}(s, t) \). We obtain

\[
T_{\mathcal{X} \mathcal{Y}}(s, t) = \sum_j |t|^{2/2} \langle s' \lambda' | A | \Delta J' \lambda' \rangle T'_{\mathcal{X} \mathcal{Y}}(s, t),
\]

where

\[
-\Delta = (\lambda_1 - \lambda_2) - (\lambda_3 - \lambda_4) = \lambda - \lambda'.
\]

Again following DSS, we expand the new amplitudes \( T'_{\mathcal{X} \mathcal{Y}}(s, t) \) as follows:

\[
T'_{\mathcal{X} \mathcal{Y}}(s, t) = \sum_{j=0}^{\min(J', \sigma)} \frac{1}{2} \int_{-i\infty}^{i\infty} \frac{d\sigma(j_0^2 - \sigma^2)}{j_0^2 - \sigma^2} \left[ \hat{d}_{j_0}^{\sigma}(\xi_i) + (-1)^{j+j'} d_{j_0}^{\sigma}(\xi_i) \right] T'_{\mathcal{X} \mathcal{Y}}(j_0, \sigma, t),
\]

where \( \hat{d}_{j_0}^{\sigma} \) are the matrix elements of the unitary representation of \( O_{3,1} \) and

\[
\text{ch} \frac{\xi_i}{2} = \frac{s - u}{2m_N^2 + 2m_N^2 - u}
\]

and \( m_N, m_Y \) are the masses of the nucleon and the hyperon respectively. The amplitude \( T'_{\mathcal{X} \mathcal{Y}}(s, t) \) given by the formula (4) is explicitly parity invariant (2) and its high-energy behaviour is assumed to be dominated by the leading Lorentz pole which in our case is associated with the \( K^0 \) Regge trajectory \( (\sigma = x_K + 1) \). The single-pole contribution to the amplitude (4) is given by the formula

\[
T_{\mathcal{X} \mathcal{Y}}(s, t) = \sum_{j_0=0}^{\min(J', \sigma)} \frac{1}{2} \left( j_0^2 - \sigma^2 \right) \hat{\rho}_j^{(\sigma)}(t) \left[ \hat{d}_{j_0}^{(\sigma)}(\xi_i) + (-1)^{j+j'} d_{j_0}^{(\sigma)}(\xi_i) \right],
\]

where \( \hat{\rho}_j^{(\sigma)} \) are the residues of the amplitudes \( T'_{\mathcal{X} \mathcal{Y}}(j_0, \sigma, t) \) at \( \sigma \). Combining the expressions (1), (2), (6), we obtain the asymptotic helicity amplitudes of the reactions \( \mathcal{N}^0 \rightarrow \mathcal{Y} \mathcal{Y} \). The results are given in Table I. We observe that the

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