A Veneziano Model for the Reaction $\pi^- p \rightarrow \pi^+ \pi^- n$ (*) (**).

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Summary. — A generalization of the one-pion exchange model for the reaction $\pi^- p \rightarrow \pi^+ \pi^- n$ in the resonant $\pi\pi$ region is developed by means of the five-point function of Bardakci and Ruegg. The model, using the slope of the pion trajectory as the only adjustable parameter, has appropriate spin content and proper Regge behavior. We have used a $K$-matrix unitarization scheme for mesons, generalized for the production process. The model is applied over a wide range of energies, and variations of all four remaining independent variables are also examined. The results are in general agreement with experiment, suggesting that the formulation is a desirable improvement over previous phenomenological models.

1. – Introduction.

We shall concern ourselves in this work with the construction of an adequate description of the production process $\pi^- p \rightarrow \pi^+ \pi^- n$. Processes of this nature have enjoyed considerable theoretical and experimental scrutiny over the past decade, but, as is often the case, theoretical models have had to become increasingly complex and ponderous in order to meet the demands of refined data. Models such as OPE plus absorption or Regge plus absorption generally contain a large number of arbitrary parameters. The partial successes of vector-

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dominated five-point dual models (1-3) in improving this situation, however, provide encouragement for the investigation of pion-dominated production reaction within the five-point context.

In order to put \( \pi^-p \rightarrow \pi^+\pi^-n \) into a broader context, we note that the \( \pi\pi N\bar{N} \) system is limited by isospin invariance to four distinct charge combinations. They can be chosen to be, for all particles incoming,

I) \( \pi^+\pi^-p\bar{p} \),

II) \( \pi^+\pi^-p\bar{n} \),

III) \( \pi^-\pi^+p\bar{n} \),

IV) \( \pi^0\pi^0p\bar{p} \).

The second and third classes are of particular interest because their charge exchange nature forbids the vector \( \omega \) \( (I = 0) \) trajectory from mediating the reaction. Class II) has the additional advantage of fewer noncyclic nonanticyclic graphs because of the exclusion of exotic resonances. From this class, it is natural to choose the \( \pi^-p \rightarrow \pi^+\pi^-n \) charge state because of the relative abundance of experimental data. We do not attempt an explicit verification of the crossing symmetry of the model, although other \( B_5 \) models have demonstrated this property (1-3).

In the following work we will describe an amplitude which contains both the correct Regge asymptotic behavior and spin content in the sense of Feynman tree diagrams. For example, at the double poles \( s_{\pi\pi} = m^2_\rho \) and \( t = m^2_{\Lambda_1} \), we have verified that our amplitude contains \( \rho - \Lambda_1 \), \( \rho - \Lambda_1 \) daughter, \( \varepsilon - \Lambda_1 \) and \( \varepsilon - \Lambda_1 \) daughter tree graphs. If the amplitude had contained \( \Lambda_1 \) ancestors, or had there been no \( \rho - \Lambda_1 \) coupling for example, we would have rejected that particular

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