Process in the Veneziano Model (*)

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Summary. — The possibility to write Veneziano formulae for the amplitudes of the process $\pi\omega \rightarrow \pi A_1$ is investigated. It is found that the asymptotic behaviours of the invariant amplitudes, the positions of the lowest poles, the elimination of parity doubling on the leading trajectories, the factorization properties of the Regge residues and the Adler condition can be consistently imposed and considerably reduce the number of arbitrary parameters. Using a current algebra technique in the soft-pion limit, a Veneziano-like expression for the pseudoscalar-vector-vector vertex is deduced. The result is consistent with the hypothesis of the meson dominance of the vectorial current.

Introduction.

The extension of the Veneziano formula (*) to the scattering of mesons with arbitrary spins has been recently approached from two different standpoints: several authors (2) performed the analysis in terms of the invariant amplitudes of the process, while the other point of view consisted in constructing Veneziano expressions for the helicity amplitudes free of kinematical singularities (3).

In this paper we investigate the inelastic scattering $\pi\omega \rightarrow \pi A_1$ in the Veneziano model, remarking that the use of the invariant amplitudes appears to be more convenient in this particular case. The interest in this process is

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also connected with the possibility to deduce a Veneziano-like form for the pseudoscalar-vector-vector (PVV) vertex.

Veneziano expressions for some of the invariant amplitudes of this reaction have been recently proposed by Pancheri-Srivastava (4) in connection with $\Lambda$- and B-meson decays. The author uses some hints suggested by PCAC and CVC and writes a minimum number of terms properly arranged in order to reproduce some results obtained from finite-energy dispersion relations. The consistency of the procedure requires however a rather unusual value for the $\rho$-trajectory slope (4), which has the effect of missing the $\rho'$-pole (5) in the $t$-channel of the $\pi\omega \to \pi\Lambda_1$ process.

Instead of using the rather uncertain guidelines offered by the finite-energy dispersion relations, we shall show in the following how a more systematic study of the Regge properties of the helicity and invariant amplitudes can provide us with sufficient conditions in order to reduce the arbitrariness of the problem. We impose the correct asymptotic behaviours on the invariant amplitudes and the presence of the lowest poles in the various channels. Expressing the invariant amplitudes in terms of amplitudes of definite helicity, we can deduce two kinds of asymptotic relations: one comes from the necessity of the helicity amplitudes having the right Regge-like behaviour and the other arises from the elimination of the parity doubling on the leading trajectories. The Adler self-consistency condition is also imposed. We lastly investigate the possibility of satisfying the factorization properties of the $\rho$-pole Regge residue and find that it can be satisfied, in the sense that both sides of the factorization equation have the same $s$ dependence (2). We briefly analyse the recent alternative of Dietz and Römer (6), who proposed to construct Veneziano generalized formulae for the regularized helicity amplitudes (RHA). It is shown that there are some difficulties related to the kinematic constraints that must exist among the helicity amplitudes. The simple recipe suggested in ref. (3) for $\pi\rho$ scattering appears to be too restrictive in our case. Finally, a current algebra connection (6) between the $\pi\omega \to \pi\Lambda_1$ amplitude in the soft-pion limit and the PVV vertex is used in order to derive a Veneziano-like expression for this vertex and to obtain the $S$-wave coupling constant of the $\Lambda_1\rho\pi$ interaction.

1. – General analysis of the $\pi\omega \to \pi\Lambda_1$ amplitude.

We consider the process

$$\pi^o(q_1) + \omega(p) \to \pi^\rho(q_2) + \Lambda_1^\rho(h)$$

(1.1)