Summary. — The high-energy photoproduction and scaling limits of a previously constructed model for pion electroproduction off nucleons are studied. The amplitude has a satisfactory quark model mass spectrum, spin structure and factorization properties on the leading trajectory. Reasonable values are obtained for forward and backward photoproduction peaks. These results and their significance are discussed and backward pion-nucleon scattering is also examined in the same scheme. Lastly the possibility of our fixed final multiplicity amplitude contributing to the scaling limit of the imaginary part of a Compton-scattering amplitude is examined.

1. — Introduction.

In a previous paper (1) we examined the low-energy properties of pion photo- and electroproduction in a dual relativistic quark model. In such a model the particle spectrum on the leading trajectories is that of the quark model in which mesons consist of quark-antiquark pairs and baryons of three quarks in harmonic-oscillator potentials. Further the model is dual in so far as the Regge-behaved amplitude can be represented in terms of its meromorphic part in one variable (2), the crossed-channel singularities being generated by the controlled divergence of the infinite sum of resonances in the direct channel.

In such an approach factorization is only valid for the leading trajectory or at most for a finite number of trajectories and for these trajectories one does not have any spin-parity doubling since one only has the propagation of positive-parity quarks. This latter requirement is achieved through the introduction of, besides the usual dual functions, suitably constructed meromorphic dual functions whose complex-angular-momentum structure also includes fixed cuts and poles besides the usual Regge poles (2).

The photon coupling to hadrons occurs through an infinite sum of vector mesons and the amplitude constructed has been found to describe the data for low-energy pion photo- and electroproduction satisfactorily. Further, on factorizing at the lowest vector-meson pole in the current channel one recovers the hadronic vector-meson production amplitude.

The purpose of this paper is to examine the predictions of the previously constructed amplitude for high-energy forward and backward photoproduction. The former is discussed in Sect. 2 and the latter in Sect. 3. Further in Sect. 3 we also examine the predictions of the present approach to $U_8$ breaking (1) for the case of backward $\pi N$ scattering. In Sect. 4 we examine the possible contribution of our fixed final multiplicity amplitude to the scaling limit of the imaginary part of hadron Compton scattering.

Lastly in Sect. 5 our results are summarized and discussed.

2. – Forward photoproduction.

As previously discussed (1) we may write the total amplitude as

\begin{equation}
F(s, t) = f(s, t) + f(s, u) + f(u, t) + f(u, s) + f(t, s) - f(t, u),
\end{equation}

where for example $f(t, s)$ gives the leading-trajectory contribution at a $t$-channel pole dual to the $s$-channel and we note that because of this the dual functions are always nonleading by at least one unit in the $s$-channel (a). Similarly for the other terms.

Further we may write

\begin{equation}
f(t, s) = f_p(t, s) + f_v(t, s),
\end{equation}

where $f_p(t, s)$ contains the pseudoscalar and B-meson trajectories and $f_v(t, s)$ contains the vector, axial vector ($A_1$) and tensor trajectories, all of which are

(2) G. Venturi: Nuovo Cimento, 8 A, 431 (1972). We shall follow the approach in this paper concerning the number of units by which the dual functions are rendered nonleading. This implies that spin-flip factors cannot enhance the high-energy behaviour due to nonleading contributions so that they become leading. Thus, e.g., the $f(t, s)$ term does not contribute to the leading high-energy limit $|t| \to \infty$, $s$ fixed.