Summary. — The possibility of dynamical constructing a Regge trajectory $a(s)$ is investigated under the assumption that it satisfies a once-subtracted dispersion relation. This implies a departure of $a(s)$ from a pure straight line behavior at sufficiently large $|s|$. This departure is shown to be connected to the rate of growth of the resonance-width function (which interpolates among the experimental width of the resonances lying on the Regge trajectory) and turns out to be very small, in agreement with the present data on resonant states.

1. - Introduction.

Much attention has been devoted in recent times to the investigation of the properties of Regge trajectories. The reasons for this interest are rather numerous. First of all, Regge trajectories (R.T. hereafter) interpolate among resonances with the same quantum numbers (except spin) and, therefore, allow a large economy of parameters in representing resonances. This is especially important if a duality point of view is taken. Secondly, the high-energy behavior is usually attributed to a Regge pole mechanism and detailed information on the properties of R.T. is thus needed. Finally it has been suggested that the R.T. are the fundamental entities to which apply a bootstrap program (1).

The experimental information that is at our disposal when studying the properties of R.T. are not, however, very detailed. Essentially, the only more or less universal property of a R.T. $a(s)$ seems to be the slope $a'(0)$, which is

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(with the exception of the Pomeranchon) consistently about \(1 \text{ (GeV)}^{-2}\). The intercept \(\alpha(0)\), on the other hand, is, by unitarity (\(^2\)), only constrained to lie below one and, phenomenologically seems to be around \(\alpha(0) \simeq \frac{1}{2}\) for meson trajectories. Experimentally, we can also say that a large exchange degeneracy (\(^3\)) occurs. This exchange degeneracy finds a rather natural explanation in the context of a duality program (\(^4\)).

Whereas, as pointed out previously, in the small \(|s|\) domain the behavior of a R.T. seems well approximated by a linear form, its behavior for large \(|s|\) is rather controversial. In the positive \(s\) region (resonance domain), the deviation from a straight line is, so far, very negligible (if at all detectable). In the negative \(s\)-region (scattering domain), however, the high-energy, fixed-angle scattering data seem to require a flattening of the \(s\)-dependence of \(\alpha(s)\) if a parametrization of the form \(t^{\alpha(s)}\) can still be used (\(^5\)). This is consistent with the apparently general property displayed by elastic angular distributions of becoming less and less rapidly falling as we move away from the forward diffraction peak. Typically, the expected behavior seems not to exceed the Cerulus-Martin bound (\(^8\)) and is, in practice, well described by the exponential behavior of Orear (\(^9,10\)).

On the theoretical side, the most widely accepted starting point in studying the properties of R.T. is the assumption of analyticity and boundedness. In many of the investigations along these lines, the conclusion is reached that \(\alpha(s)\) has to grow asymptotically more than \(\sqrt{s}\) (\(^11\)). On the other hand, in the bootstrap approaches (\(^1\)), the conclusion is drawn that the R.T. cannot depart very much from a straight-line behavior.

A somewhat different approach to the problem has been also suggested (\(^12\))


\(^4\) See for instance M. Jacob: Lecture Notes at the VIII Schladming Winter School, 1969, CERN preprint Th. 1010 (1969). See also ref. (\(^6\)).

\(^5\) E. Predazzi: Lecture Notes at the Theoretical Summer Institute, University of Colorado (1969) (to be published) and Indiana University preprint (1969).

\(^6\) This trend is explicitly shown in Fig. 2 of ref. (\(^7\)) where the data refer to elastic p-p scattering.


See also ref. (\(^10\)).

