MULTI-REGGEON BEHAVIOUR
OF PRODUCTION AMPLITUDES

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Gribov has developed a calculus based on perturbation theory which permits a meaning to be attached to an arbitrary Reggeon diagram in two-body scattering. The rules that Gribov gives are for calculating the $t$-channel partial wave amplitude $a(j,t)$. It is indicated how Gribov's discussion can be taken over to the case of production amplitude for the process $A + B \rightarrow 1 + 2 + 3$.

Recently there has been much interest both phenomenological [1] and theoretical in multi-Reggeon exchange models of production amplitudes. These models are straight-forward generalisations of Regge exchange [2] in two-body scattering, namely

$$A(s,t) = g_1(t)s^{\alpha(t)}g_2(t),$$

where $A$ is the amplitude for the process

$$t = (p_A - p_1)^2, \quad s = (p_A + p_B)^2.$$ The corresponding amplitude for a production process $A + B \rightarrow 1 + 2 + 3$ which proceeds through double Reggeon exchange,
is
\[ T(s, s_1, s_2, t_1, t_2) = g_1(t_1) s_1^{\alpha_1(t_1)} f_{s_1 s_2} s_2^{\alpha_2(t_2)} g_2(t_2), \tag{2} \]
where
\[ t_1 = (p_A - p_1)^2, \quad t_2 = (p_B - p_3)^2, \quad s_1 = (p_1 + p_2)^2, \quad s_2 = (p_2 + p_3)^2. \]

A novel feature of this case is the amplitude \( f_{s_1s_2} \) which describes the coupling of the trajectories \( \alpha_1 \) and \( \alpha_2 \) to particle 2. This function depends on \( t_1, t_2 \) and \( \eta = s_1 s_2 / s \). In the limit of high energies
\[ \frac{s_1 s_2}{s} = m_2^2 - q^2, \tag{3} \]
where \( q' \) is that part of \( p_2 \) transverse to the incident beam in the lab or centre of mass frame. As one would intuitively expect \( f_{s_1s_2} \) really only depends on the momenta of the three objects whose coupling it describes.

In two-body scattering it is well known that there are contributions to the asymptotic behaviour which arise from cuts in the angular momentum plane of the \( t \)-channel reaction \( A + \bar{1} \rightarrow \bar{B} + 2 \). One of these contributions can be associated with the two Reggeon exchange diagram.

\[ \text{Fig. 3} \]

GRIBOV [3] has developed a calculus based on perturbation theory which permits a meaning to be attached to an arbitrary Reggeon diagram in two-body scattering. The rules that GRIBOV [3] gives are for calculating the \( t \)-channel partial wave amplitude \( a(j, t) \). They are:

1) Associated with the \( n^{th} \) line of the diagram, are a space-like two dimensional momentum \( k_n \), an angular momentum \( l_n \), and a Reggeon propagator \( (l_n - \alpha_n(k_n^2))^{-1} \).

2) At each internal vertex
\[ \sum k_i = \Sigma(l_i - 1) = 0, \tag{4} \]
where the Reggeon lines are suitably directed. A similar law holds at external vertices. This allows all momenta to be expressed in terms of loop variables and the external momentum \( q \) (chosen to be two-dimensional and space-like).

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