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All-loop amplitudes of the Reggeon Field Theory via the stochastic model

The reaction-diffusion (or stochastic) approach is applied to the computation of amplitudes of the Reggeon Field Theory to all orders in the number of Pomeron loops. We develop the numerical calculation technique and use it for computing total, elastic and diffractive proton-proton cross sections for the energies up to the energies of the LHC.

Summary

The phenomenological Reggeon Field Theory (or Reggeon Calculus) was introduced by Gribov in 1968. It is based on very general properties of the elastic amplitude such as analiticity and t-channel unitarity. It still remains one of the few aproaches with a predictive power when one speaks about total, elastic and diffractive hadronic cross sections at high energies. The RFT is formulated in terms of two Pomeron fields in 2 transverse and 1 "time" dimension which corresponds to the total rapidity of the interaction. Importance of the Pomerons interactions and Pomeron loops has been recognized long ago especially in connection with the diffractive events (events with rapidity gaps).

Subsequently it was shown that evolution of a particular stochastic system of classical particles ("partons") allows a field-theoretical description corresponding to the RFT Lagrangian. The s-parton inclusive distributions in the 2-dimensional plane as functions of evolution time coincide with the exact s-point Green functions of the Reggeon Field Theory up to a constant dimentional factor. The exact amplitude is obtained via convolution of projectile- and target-associated Green function sets.

Following these principles we developed a numerical calculation technique which we use to compute the elastic amplitude and consequently elastic and total, via the Optical theorem, cross section. With slight modifications this technique can be also used for computing the diffractive cross sections.

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