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NNLO classical solutions for Lipatov's effective action for reggeized gluons

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We use the effective action for reggeized gluons exploring ideas of \cite{LipatovEff}. Using light-cone gauge, we consider a problem with
only one longitudinal gluon field in the equations of motion included. With the two reggeon fields presented in the approach,
the first reggeon field is defined as a LO value of the corresponding gluon field, whereas the second reggeon field
arises as a source term in the Lagrangian. In this formulation
the effective action framework becomes similar to the light-cone Color Glass Condensate (CGC) approach. The form of the effective
currents, arising in the equations of motion, therefore, can be obtained either directly from the effective action expression from \cite{LipatovEff} or
from the self-consistency conditions for the solution of the equations of motion, in both cases we obtain the same structure of the current.

The Lipatov effective action, see \cite{LipatovEff}, is a non-linear gauge invariant action which is assumed to be local in rapidity, that is,
all real and virtual particles in the direct channels split into groups in correspondence with their rapidities $y = \frac{1}{2} ln\left(\frac{p_+}{p_-}\right)$ and the
classical Lagrangian describes only interactions within one group whereas the interaction between groups with essentially different rapidities is realized by reggeon
exchange.

We have already obtained LO and NLO solutions, which are especially important for the construction of QCD based Regge Field Theory (RFT) calculus. These solutions were not considered in the CGC framework and it can be important as some source of corrections in this framework. In the next paper we will present NNLO solutions,
that will be useful for calculations with the greater number of loops.

There are the following important applications: it can be used for the calculation of
production amplitudes in different scattering processes and calculation of sub-leading, unitarizing corrections to the
amplitudes and production vertices. The last task can be considered as a construction of the RFT based on the interaction of the fields of reggeized gluons, where different vertices of
the interactions are introduced and calculated.
We have calculated one-loop effective action for reggeized gluons using classical
solutions from \cite{Our1} and calculated a propagator for A_+ and A_- reggeon fields in \cite{Our2}. This calculation can be considered as the check of the self-consistency of the approach and also as the explanation of the methods
of the calculation of
small-x BFKL based vertices in framework of the approach. There are other important vertices which can be similarly calculated.
These verices are important ingredients of the unitary corrections to different production and interaction amplitudes of the processes at high energies
and they will be considered in separate publications.

\begin{thebibliography}{99}

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