Towards accuracy at small x

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James Clerk Maxwell Building, King's Buildings, Edinburgh

Book of Abstracts

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Amplitudes in the Regge limit

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Summary:

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BFKL and impact factors at NLO

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Summary:

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Calculations in kT-factorisation

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Summary:

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Collinear resummations for the non-linear evolution in QCD at high-energy

Edmond Iancu[1]

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The next-to-leading order (NLO) Balitsky-Kovchegov (BK) equation describing the high-energy evolution of the scattering between a dilute projectile and a dense target suffers from instabilities unless it is supplemented by a proper resummation of the radiative corrections enhanced by large transverse logarithms. These instabilities are associated with large, anti-collinear, double logarithms which occur when the NLO corrections are computed from the evolution of the dilute projectile. We explain how to rewrite the NLO evolution in terms of the rapidity of the dense target. This avoids the large anti-collinear contributions but introduces new, collinear, instabilities, which are however milder since disfavoured by the typical BK evolution. We propose several prescriptions for resumming these new double logarithms and find only little scheme dependence. The resummed equations are non-local in rapidity and can be extended to full NLO accuracy. We present the first applications of these resummed equations to deep inelastic scattering at small Bjorken x.

Summary:

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Conformal invariance of TMD rapidity evolution

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The most known scheme to regulate the rapidity/UV divergences of the Transverse Momentum Distribution operators due to the infinite light-like gauge links is the Collis Soper Sterman formalism or the Soft Collinear Effective Theory formalism. An alternative choice is provided by the scheme used in the small-x physics. The corresponding evolution equations differ already at leading order. In view of the future Electron-Ion Collider accelerator, which will probe the TMDs at values of the Bjorken x in the region between small-x to $x \sim 1$, the different formalisms need to be reconciled. I will discuss the conformal properties of TMD operators and present the result of the conformal rapidity evolution of TMD operators in the Sudakov region.

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Coulomb gluons and factorization

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Drell-Yan at small-x

Marco Bonvini[None] ; Rhorry Gauld[None] ; Tommaso Giani[None] ; Simone Marzani[None]

We study the formalism to resum differential distributions at small-x in the case of the DY process, extending results previously obtained for Higgs production in gluon fusion. We focus on rapidity and transverse momentum distributions, presenting results for both single and double differential cases. We implement our results in Hell, providing the resummed DY coefficient functions to be used in a global fit.

Summary:

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Effect of Glauber (Coulomb) gluon in parton shower

Zoltan Nagy[1]

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In the first half of this talk I would like to discuss briefly the structure of the parton shower cross sections focusing on the effect of the Glauber gluons.

In the second part I will discuss the implementation of the colour evolution in parton shower and show some results for rapidity gap survival probability.

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Experimental overview

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Forward jet cross sections: from trijet to NLO dijet

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Using the formalism of the light-cone wave function in pQCD together with the hybrid factorization, we compute the cross-section for two and three particle production at forward rapidities in proton-nucleus collisions. We focus on the quark channel, in which the three produced partons – a quark accompanied by a gluon pair, or two quarks plus one antiquark – are all generated via two successive splittings starting with a quark that was originally collinear with the proton. The produced partons are put on-shell by their scattering off the nuclear target, described as a Lorentz-contracted "shock-wave". By using the three-parton component of the quark light-cone wave function, together with the virtual corrections, we can then present our progress on the computation of the next-to-leading order correction to the cross-section for the production of a pair of jets.

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Forward particle production in proton-nucleus collisions at next-to-leading order

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Reaching next-to-leading order accuracy in perturbative calculations of particle production in QCD at high energy is essential for reliable phenomenological applications. In recent years, the Color Glass Condensate effective theory (the natural framework for such calculations) has indeed been promoted to NLO accuracy. However, the first NLO calculation of single-inclusive hadron production met with an unexpected difficulty: the cross-section suddenly turns negative at transverse momenta of the order of a few GeV, in a range where perturbation theory is expected to be reliable. We summarize recent efforts to understand and solve this issue, as well as to develop a running coupling scheme that can be used to consistently describe various processes in this formalism.

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Jets in the BFKL approach

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Jets in the High Energy Limit

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Summary:

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Lipatov's EFT at one loop

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The techniques of loop calculations in Lipatov's gauge-invariant EFT for Multi-Regge Processes in QCD will be reviewed. The main challenges are rapidity divergences in loop integrals and calculation of integrals with several scales of virtuality.
The talk is based on the results of:
https://arxiv.org/abs/1905.01105
https://arxiv.org/abs/1902.11030

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Parton Distribution Functions and LHC phenomenology

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Scattering Amplitudes

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Summary:

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Scattering Amplitudes in the High-Energy Limit of N=4 SYM

Robin Marzucca[1] ; Vittorio Del Duca[2] ; Claude Duhr[3] ; Georgios Papathanasiou[4] ; James Drummond[None] ; Bram Verbeek[None] ; Falko Dulat[None] ; Stefan Druc[None]

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We have developed a new, efficient mathematical framework to perform computations of scattering amplitudes in the multi-Regge limit of N=4 SYM. Using this framework we were able to compute scattering amplitudes to very high perturbative orders as well as high multiplicities. We can further use this formalism to prove the factorization of MHV scattering amplitudes in MRK to all loop orders into a finite number of building blocks in momentum space as well as completely define the function space of scattering amplitudes in the multi-Regge limit of N=4 SYM.

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Theory Overview

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Summary:

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Unintegrated Parton Densities

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Summary: