PARTICLE MULTIPLICITIES AND NUCLEAR MODIFICATION FACTORS AT THE LHC FROM NON-LINEAR QCD EVOLUTION

Javier L. Albacete

Department of Physics, The Ohio State University,
Columbus, Ohio, 43210, USA, *albacete@mps.ohio-state.edu*

At high energies QCD enters a novel regime, the Color Glass Condensate, characterized by high partonic densities, coherence phenomena and non-linear saturation effects. I will briefly review the recent progress attained in this field after the calculation of running coupling corrections to the kernel of the small-x BK-JIMWLK evolution equations [1,2,3] via all order resummation of $\alpha_s\, N_f$ contributions. Next I will concentrate on the phenomenological applications to the physics of ultra-relativistic heavy ion collisions that arise from our enhanced knowledge of the small-x dynamics, focusing in the expectations for the LHC. I will discuss multiparticle production in A-A collisions: It was shown in [4] that the inclusion of running coupling corrections in the evolution of the unintegrated nuclear gluon distributions suffice to describe the collision energy and pseudorapidity dependence of the multiplicity densities in Au-Au collisions at the highest RHIC energies, yielding the following prediction for midrapidity multiplicities in Pb-Pb collisions at the LHC:

$$\frac{dN_{ch}^{Pb-Pb}}{d\eta}(\sqrt{5.5}\,\mathrm{TeV}, \eta = 0) \approx 1290 \div 1480\,,$$

which is significantly smaller than previous theoretical expectations and closer to the empirical extrapolations from lower energies data.
Finally I will discuss the expectations for the nuclear modification factor, $R_{pPb}(p_t, y)$ in proton-lead collisions at the the LHC, as well as its dependence on rapidity and particle species based on the use of running coupling small-x dynamics and a proper consideration of fragmentation functions [5].

References

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