Classical Initial Conditions for Nucleus-Nucleus Collisions

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Abstract

We construct an analytical expression for the distribution of gluons in the state immediately following a heavy ion collision in the quasi-classical limit of QCD given by McLerran-Venugopalan model. The resulting gluon number distribution function includes the effects of all multiple rescatterings of gluons with the nucleons of both colliding nuclei. The typical transverse momentum k of the produced gluons is shown to be of the order of the saturation scale of the nuclei Qs, as predicted by Mueller. We analyze the properties of the obtained distribution and demonstrate that due to multiple rescatterings it remains finite (up to logarithms of k) in the soft transverse momentum limit of $k << Qs$ unlike the usual perturbative initial conditions given by collinear factorization. We calculate the total number of produced gluons and show that it is proportional to the total number of gluons inside the nuclear wave function before the collision with the proportionality coefficient $c = 2 \ln 2$.