Charmonium production off nuclei: from SPS to RHIC

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Abstract

Charmonium suppression in heavy-ion collisions may serve as a probe for new physics only provided that the baseline mechanisms are well understood. The conventional approach used for to analyse data for charmonium suppression at the SPS misses important, well-established physical phenomena, such as formation time effects, excitation of participant nucleons due to multiple collisions, nuclear modification of gluon distributions, initial state energy loss of partons. We study these effects and find some of them to be of great importance at the SPS.

Moreover, in the energy regime of RHIC the coherence length of charmonium production substantially exceeds the nuclear radius and one cannot say anymore that it is produced in a collision of two bound nucleons. Instead, it is a coherent phenomenon involving large ensembles of nucleons. Since no theoretical tool has been yet available to calculate these effects in the RHIC energy regime, we develop a light-cone QCD dipole formalism, incorporating coherence phenomena relevant to charmonium production. This provides the necessary tool for calculations and is valid at any energy.

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