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A new Microscopic Model for J/ψ Production in Heavy Ion Collisions

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The experimental observation ofJ/ψ and Bc mesons multiplicities, distributions and azimuthal flows plays a key role in understanding the properties of the quark gluon plasma (QGP) which is formed in ultra relativistic heavy ion collisions. This is due to the fact that the heavy quarks can come from different vertices in the initial stage and that the J/ψ are not stable when the QGP is produced with a temperature above the J/ψ dissociation temperature while resonant states can be achieved before the transition to the hadronic phase, offering the possibility to probe directly these high temperatures. In our recently developed approach [1], the hidden heavy flavor mesons production rate is described by solving the von Neumann equation of the two body density matrix in the expanding N-body system, following a method introduced by Remler et al. to predict deuteron production in HIC at lower energies [2]. In this formalism, the rate of mesons formation is based on the semi-classical trajectories of c and b quarks, what naturally encodes possible off-equilibrium effects of these quarks.The trajectories are based on the description of the expanding QGP by the EPOS event generator, supplemented by the Nantes energy loss model which have demonstrated successful agreement with the data for open heavy flavor mesons.This allows for the prediction of the hidden heavy flavor observables (J/ψ and Bc) which are confronted with the experimental results on multiplicity, RAA and v2. We discuss what we can learn from the hidden heavy flavor mesons about the expanding QGP, in particular the time at which the mesons appear to be dynamically produced.

[1] Arrebato Villar,D. Thesis, IMT Atlantique, 2021
[2] Gyulassy, M. and Frankel, K. and Remler, E. , Nucl. Phys. A402, 596

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