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Charmonia production with a density operator model

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Quarkonia production in AA collisions has been the subject of vivid discussions since it was proposed as a signature of the quark-gluon plasma formed in these collisions. By now, it seems there is little doubt that both mechanisms of dynamical suppression and recombination are necessary in order to understand the most common observables, the nuclear modification factor RAA of J/Psi as well as its elliptic flow v2. On the level of models, there exist only a few which include these mechanisms and are able to address the comparison with experimental data. While some good agreement has been reached for the RAA, the explanation of the v2 remains problematic. Besides, some quantum features are still lacking proper implementation. From the theory side, a step in the direction of dealing with the formation of charmonia out of a large number of c and cbar quarks has been made recently [1] but still at the price of semi-classical approximations. Besides, to our knowledge, the numerical application to realistic AA collisions has not been achieved yet.

In our contribution, we present the application of a density operator model to charmonia production in AA collisions. The idea of the formalism goes back to the work of Remler, Gyulassy and Frankel [2,3] in which a general scheme connecting composite particle cross section with time-dependent density operators was derived from Von Neumann's equation in the context of deuteron production. The formalism is indeed able to deal with the dynamical coalescence of many particles towards bound states. It inholds a unification of both the suppression and recombination processes, which is aguably an improvement of the existing models. We will present both the fundamental ingredients of the density operator formalism, its concrete implementation in EPOS-HQ and its application to RAA and v2 of J/psi at RHIC and LHC energies.

Bibliography

1. J-P Blaizot and M A Escobedo, JHEP 1806 (2018) 034
2. E.A. Remler, Annals of Physics 136 (1981) 293
3. M. Gyulassy and K. Frankel and E.A. Remler, Nuclear Physics A402 (1983) 596

Collaboration (if applicable)

Track

Heavy Flavor and Quarkonia

Contribution type

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