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Quantum vs. semi classical description of in-medium quarkonia

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Heavy quarkonia are considered among the most promising probes of quark gluon plasma (QGP) formed in ultra relativistic heavy ion collisions (URHIC). For a reliable use of such probe, we need a rigorous formalism which could describe the real time and out of equilibrium evolution of in-medium quarkonia while it keeps a full track of the quantum nature of our system, as well, being derived from first principles. In addition, the formalism should consider the static as well dynamical effects of QGP on heavy quarkonia on equal footing. Among the possible formalisms, the open quantum systems outstand due to its simplicity. Within this framework, the evolution of our system is governed by quantum master equation which, by implementing semi classical approximations (SCA), results into the standard and the more simple semi classical transport equations as Boltzmann and Fokker-Planck / Langevin equations. Those last had already shown, prior to the use of open quantum system techniques, a good success in describing in medium quarkonia transport, in spite of their model dependence in considering some QGP effects. Therefore, starting from the fact that the semi classical transport equations are approximates of, the more fundamental, quantum master equations, it is legitimate to wonder about their range of validity and a quantitative comparison between the full quantum and semi classical descriptions become mandatory to put our understanding of in-medium quarkonia transport on stronger ground. In this talk, we review briefly the derivation of quantum master equation in the quantum Brownian regime and its associated semi classical Fokker-Planck / Langevin equation. Then, for the sake of testing the validity of SCA, we discuss some comparative results issued from one dimensional resolution of the two equations and draw some conclusions on SCA validity.

Auteur principal: DADDI HAMMOU, Aoumeur (Subatech)

Co-auteurs: DELORME, Stéphane (Subatech); GOSSIAUX, pol bernard (subatech); GOUSSET, Thierry (Subatech)

Orateur: DADDI HAMMOU, Aoumeur (Subatech)

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