Bottomonium suppression in an open quantum system using the quantum trajectories method

Quarkonia Meet Dark Matter: Poster Shot Presentation

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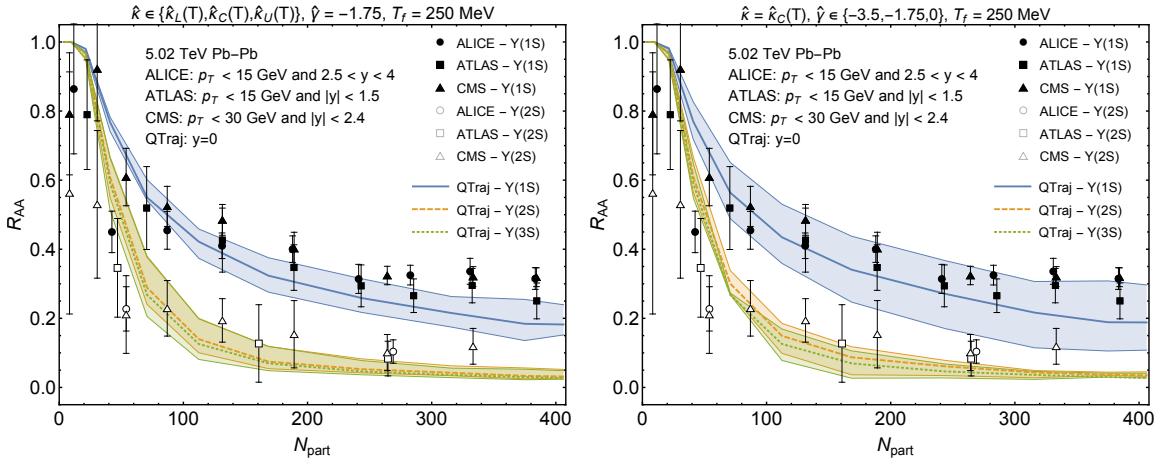
Heavy Quarkonium in Medium

- heavy quarkonium states exhibit an inherent hierarchy of scales making them ideal probes of the medium formed in heavy ion collisions
- naturally described using the effective field theory **potential nonrelativistic QCD** and the formalism of **open quantum systems**
- in a strongly coupled medium, evolution of the density matrix describing a bottomonium state takes the form of a Lindblad equation:

$$\frac{d\rho}{dt} = -i[H,\rho] + \sum_n \left(C_n \rho C_n^\dagger - \frac{1}{2}\{C_n^\dagger C_n, \rho\} \right),$$

where H is the quarkonium Hamiltonian and C_n are related to interactions with the medium (Phys. Rev. D 97, 074009 (2018))



Nuclear modification factor R_{AA} of the $\Upsilon(1S)$, $\Upsilon(2S)$, and $\Upsilon(3S)$ using the `QTraj` code implementing the quantum trajectories method; bands represent uncertainties in lattice extractions of transport coefficients occurring in evolution equations (JHEP 05 (2021) 136).

- the **quantum trajectories method** allows for a probabilistic solution to the Lindblad equation using Monte Carlo methods
- code developed to implement the quantum trajectories algorithm and used to solve the Lindblad equation describing in medium heavy quarkonia and extract experimental observables (JHEP 05 (2021) 136)
  - denoted `QTraj`
  - to be released publicly