

Quark Matter 2019 - the XXVIIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions



Contribution ID: 529

Type: **Poster Presentation**

Quantum dissipation in the quarkonium evolution by Lindblad master equation

Monday 4 November 2019 17:40 (20 minutes)

In heavy ion collisions, physical properties of quark-gluon plasma(QGP) have been long studied. In these experiments, survival probability of quarkonia, which are bound states of the heavy quark and antiquark pair, is expected to be a good probe to the formation of the QGP. Their dynamics has been studied to interpret the experimental data.

A quarkonium can be theoretically described by master equation for the density matrix in the framework of open quantum system. It allows us to describe the Langevin dynamics of quarkonia in a quantum mechanical manner. In particular, quantum dissipation as well as decoherence of quarkonia attract much attention recently.

In this study, we consider the relative motion of a heavy quark pair in the QGP. We derive and numerically simulate the master equation in the Lindblad form in one spatial dimension. We analyze the effects of the quantum dissipation to its equilibration. We also discuss whether or not the dissipative process of quarkonium is significant in heavy-ion collisions by simulating in a short-lived Bjorken expanding QGP.

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Presenter: MIURA, Takahiro

Session Classification: Poster Session

Track Classification: Heavy flavor and quarkonium