Quarkonium melting in the QGP fireball from the stochastic potential
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1. Introduction & Summary
Color screening at high temperature is what makes it possible to form a quark-gluon plasma (QGP). In heavy-ion collisions, it is expected that if the QGP is created, the screened potential results in suppression of quarkonia yield.

In thermal field theory, we can formulate the problem in terms of in-medium potential for a quarkonium. The in-medium potential is complex-valued and describes not only screening (real part) but also decoherence (imaginary part)\(^1\).

We build a model of stochastic potential, motivated by lattice QCD\(^2\) and perturbative results\(^3\), to describe the screening and decoherence. The model is solved in a hydrodynamic background followed by the hadronic feed-down cascade. The result shows nontrivial ratios of Y(nS) yields, indicating the importance of dissipation.

2. The Model
Stochastic interpretation of the in-medium complex potential
\[
\psi(t + dt, r) = \exp \left[ - i dt \left( - \frac{\nabla^2}{M} + V_0(r) + \Theta(t, r) \right) \right] \psi(t, r)
\]
\[
\left\{ \Theta(t, r) = 0, \quad \langle \Theta(t, r) \Theta(t', r') \rangle = \Gamma(r, r') \delta(t - t') \right\}
\]
Unitary stochastic evolution can explain complex potential

3. Simulation
Quarkonium propagation in the 2+1D ideal hydro background\(^4\)
- Classical trajectory for the center-of-mass
- Stochastic potential for relative motion
- Backward propagation method\(^5\)

Why Y(2S)/Y(1S)\(_{\text{initial}}\) > Y(2S)/Y(1S)\(_{\text{freezeout}}\)?
Why Y(2S)/Y(1S)\(_{\text{center}}\) > Y(2S)/Y(1S)\(_{\text{edge}}\)?

[early time decoherence]
Decoherence takes place faster for loosely bound states
→ Y(2S)/Y(1S) decrease at first

[late time overheating]
Stochastic potential drives the system to almost equally occupied state (due to the lack of dissipation)
→ Y(2S)/Y(1S) approaches 1

The result indicates dissipation may be already important