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Spin-Induced Interactions and Heavy-Quark Transport in the QGP

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We extend a previously constructed T-matrix approach for heavy quarks in the quark-gluon plasma (QGP) to include inverse-mass (1/M) corrections, i.e. the spin-orbit, spin-spin and tensor forces, between partons. Based on the vacuum Cornell potential as the interaction kernel for the T-matrix equation, we first confirm that the experimental charmonium and bottomonium spectroscopy in vacuum are much improved by employing a confining potential that is a mixture of vector and scalar interactions, rather than a purely scalar one. We then apply the refined potential to calculate the in-medium single-parton spectral functions at finite temperature self-consistently and constrained by various thermal lattice-QCD data. Finally, we study the consequences for the in-medium charm-quark transport coefficients at different temperatures. It turns out that the mixing effect for confining potential significantly enhances the friction coefficient, A(p), for charm quarks in the QGP over previous calculations with a purely scalar potential. Our results may have significant implications for the microscopic description of heavy-flavor transport in heavy-ion collisions at RHIC and the LHC.

Experiment/Theory

Theory/Phenomenology

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