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Heavy flavor in medium

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The interactions of heavy quarks in medium are believed to encode valuable information about the properties of the quark–gluon plasma (QGP). Recent experimental results suggest a strong coupling between heavy quarks and the QGP medium which require non-perturbative interactions. Current lattice-QCD provide valuable information but are not easily analytically continued to real-time physics. This leads us to seek for a solvable model that keeps the most relevant features of heavy-quark (HQ) in the QGP that can reveal underlying mechanisms. We first investigate the problem of defining and extracting a static potential HQ potential in QGP from Lattice-QCD computations of the singlet free energy, using the in-medium T-matrix formalism [1]. A main outcome of the approach is a rather long-range force which is larger than one would estimate from both the free and internal energies. As an initial application we utilize the potential to calculate HQ transport coefficients using the 3D relativistic heavy-light T-matrix. A strong coupling at low momentum is found to transition into a weakly coupled regime at high momentum. The implementation of this new HQ transport coefficient with our collaborator into Langevin simulations for heavy quarks in heavy-ion collisions shows interesting connections between the potential and the resulting elliptic flow [2]. Thus our model can effectively establish a relation between the experimental observables and the underlying in-medium color force as extracted from first-principles lattice calculations.

[1] Shuai Liu, Ralf Rapp, NPA941
[2]Min He, Shuai Liu, Ralf Rapp, in prep.

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