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Non-perturbative study of heavy quark anti-quark potential at finite temperature

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For the phenomenology of quarkonia in quark-gluon plasma, a convenient tool is to define an "in-medium potential". Formally, such a potential can be defined through the long-time behavior of a timelike Wilson loop.
A non-perturbative estimate of such a potential from lattice QCD is difficult, as on lattice we can only study Wilson loops in Euclidean time, in the range [0, 1/T) where T is the temperature of the medium. The analytical continuation to real time is involved, and usually relies on Bayesian analysis.
Here we will present a new, more direct method of extraction of the $Q\bar{Q}$ potential from the Euclidean data. Results for the potential in a gluon plasma, extracted from spatially smeared Wilson loops calculated on anisotropic lattices, will be presented. We will also compare these results with those calculated from Coulomb gauge fixed Wilson line correlators.
For quarkonia phenomenology, it is also important to understand the nature of the medium binding for the $Q\bar{Q}$ in an octet state. The octet state on the lattice is not gauge invariant. To make it gauge invariant we have attached a gluonic operator with the link. We will discuss the construction, and present results for the $Q\bar{Q}$ potential in this configuration.

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