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Lattice calculations of the heavy quark potential at non-zero temperature

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For theoretical understanding of quarkonium production in heavy ion collisions it is important to know the potential between the heavy quark and anti-quark at non-zero temperature. This potential is complex and provides an efficient way to calculate quarkonium spectral functions at non-zero temperature and an important input for dynamical models aiming to describe quarkonium production in heavy ion collisions (see e.g. [1]).

I report on the lattice calculations of the heavy quark potential at T>0 in 2+1 flavor QCD at physical quark masses using Highly Improved Staggered Quark formulation. The gauge configurations needed for the high statistics study of the heavy quark potential have been generated by HotQCD and TUMQCD collaborations [2]. In this study lattices with temporal extent $N_t = 12$ and 16 are used and the real and imaginary part of the potential are obtained using the moments of the temporal Wilson loops. I study in detail the systematic effects in the determination of the real and the imaginary parts of the potential when using the moment method. It turns out that below the transition temperature the imaginary part is consistent with zero, while above the transition temperature it increases with increasing temperature and separation between the quark and anti-quark till the signal diminishes.
The real part of the potential is similar to the zero temperature one for distances smaller than 0.8fm and temperatures smaller than 250 MeV. This analysis significantly extends the preliminary work presented in [3].

I will also discuss the implications of these findings for existence of heavy quark bound state in QGP by calculating the corresponding meson spectral functions with the newly determined potential.

References:

[1] P. Petreczky and C. Young, Sequential bottomonium production at high temperatures, arXiv:1606.08421 [nucl-th]

[2] A. Bazavov et al (HotQCD), Phys. Rev. D90 (2014) 094503

[3] A. Bazavov, Y. Burnier and P. Petreczky, Nucl. Phys. A932 (2014) 117

Preferred Track

Quarkonia

Collaboration

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