Heavy quark potential as a function of shear viscosity-to-entropy ratio: A measure of the fluidity of the medium

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Introduction

Following the idea of Matsui and Satz[1], the properties of heavy quarkonium bound states in a medium render it sensitive to the details of (de)-confined status of the medium. In addition, we use it here as a handle to decipher the extent to which the medium produced in the ultra-relativistic heavy ion collisions (uRHIC) is strongly interacting.

For this purpose we have explored how the properties of heavy quark bound states change in a medium as a function of shear viscosity-to-entropy density ratio (η/s).

For that, using the Keyldesh representation in real-time formalism used in our earlier works [2], we have first derived the real part of the potential, $V(r; \eta/s, T)$, where we found that the screening decreases rapidly with the increasing η/s ratio, which also agrees with AdS/CFT results [3]. Thereafter we solve the Schrödinger equation to obtain the temperature and η/s -dependent binding energies, which will further give dissociation temperatures of the quarkonium states. It is noticed that the dissociation temperatures are increased due to the increasing values of η/s.

In this way our calculation, perhaps for the first time (apart from some result in AdS/CFT[3]) indirectly probes the fluidity of the medium produced in uRHIC.
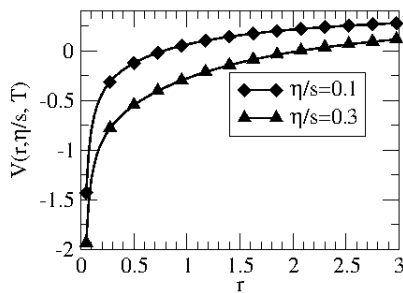

FIG. 1: Variation of $V(r; \eta/s, T)$ with r for different values of η/s.

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References

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