Charmonium state near the deconfinement transition on an anisotropic lattice

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In order to understand the properties of quark gluon plasma (QGP) in heavy ion collision experiments, theoretical prospects are important, since such processes include complicated interactions among large number of particles. Changes of charmonium states have been regarded as one of the most important probes of plasma formation. In fact there are some potential model prediction such as the mass shift of charmonium near T_c [1], and J/ψ suppression above T_c [2]. However, lattice QCD simulations have indicated that the thermal properties of hadronic correlators are more compricated rather than a naive picture of QGP [3]. Recent studies of spectral functions of charmonium suggest that a hadronic excitation of c-$\bar{c}$ system may survives above T_c [4, 5, 6]. This seems to conflict with the predictions of potential model approaches and a naive picture of QGP.

In order to discuss the above disagreement between the spectral function analysis and the potential model, we extract the information of the spectral function from the temporal charmonium correlator and also extract the static quark potentials from the color singlet Polyakov loop correlation and Wilson loop. The result of potential model calculation using the latter is compared with the former.

Our results indicate that the disagreement between the results of spectral function analysis and the potential model is qualitatively absent if one uses the color singlet free energy as the static quark potential. This is the same conclusion as the Bielefeld group [7]. Detailed analysis of the quark potential indicated that the potential from the Wilson loop most well reproduces the result of spectral function analysis below T_c.

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