Hadron correlators at finite temperature in quenched lattice QCD

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We study hadron correlators at finite temperature in quenched lattice QCD simulation by analyzing the spectral functions of the correlators. Anisotropic lattices are used in order to have sufficient numbers of degrees of freedom in the Euclidean temporal direction. In this year we have performed two subjects: (a) extended study of charmonium correlators, and (b) light meson correlators.

(a) Charmonium correlators [1, 2]. We focus on the low energy structure of the spectral function, corresponding to the ground state in the hadron phase, by applying the smearing technique which enhances the contribution of low energy region to the correlator. Two analysis procedures are employed: (i) the maximum entropy method (MEM) for the extraction of the spectral function without assuming a specific form, and (ii) the standard χ^2 fit analysis or constrained curve fitting using presumable forms in accordance with the result of MEM, for a more quantitative evaluation. We first examine applicability of these procedures at zero temperature by shortening the t-interval used for the analysis (a situation inevitable at $T > 0$), and find that the reliability of MEM for point correlators is lost, while it subsists for smeared correlators. Then the smeared correlators at $T \simeq 0.9$–$1.6\ T_c$ are analyzed. Below T_c, the position of the ground state peak is almost unchanged from $T \simeq 0$ with the width consistent with zero. Above T_c, we find that the strong peak structure still persists at almost the same place as below T_c, but with a finite width of a few hundred MeV. This result indicates that the correlators possess a nontrivial structure even in the deconfined phase.

(b) Light meson correlators [3]. Applying the same analysis as the charmonium, we investigate the light hadron correlators near the deconfining transition using the the same lattice setup for the former. A check of reliability of the procedures is performed by examining how the results for the correlators below T_c ($T \simeq 0.9$) changes under variation of input parameters such as the smearing function. Input parameter dependence is rather severe and some improved approach should be developed towards applications to the plasma phase.

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References

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