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Towards faster computation of higher order quark number susceptibilities in QCD

Content :

Computing higher order quark number susceptibilities(QNS) is important for the accurate determination of the critical end-point of QCD by Taylor series method. Moreover various diagonal and off-diagonal QNS help us to determine the properties of the quark-gluon plasma. By introducing the chemical potential in the staggered fermion operator as a Lagrange multiplier associated with the point split number density term, we show that the computations of the QNS become faster. Furthermore, the QNS computed in this method are not prescription dependent as seen for the commonly used methods. However, the second order susceptibility has a contribution which diverges in the limit of vanishing lattice spacing, a and corrections of higher orders in a in the higher order QNS. We suggest a prescription to eliminate the divergence in second order susceptibility and the unwanted finite terms in the higher order QNS. We compute the various QNS on the lattice, for two flavour QCD with staggered fermions at $N_T=6$. Our method yields estimates of all the QNS consistent with the values computed using the standard method for the QGP phase, but with considerably less computational effort. We also comment on the possible extension of our method in the confined phase of QCD.

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