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Many flavor approach to study the critical point in finite density QCD

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We discuss the QCD critical point at finite density through the study of many-flavor QCD, in which two light flavors and N_f massive flavors exist. Performing simulations of QCD with 2 flavors of improved Wilson fermions, we calculate probability distribution functions in many-flavor QCD at finite temperature and density, where the reweighting technique is used to add the dynamical effect of massive flavors and the chemical potential. From the shape of the distribution functions, we determine the critical surface separating the first order transition and crossover regions in the space spanned by the light and massive quark masses and the chemical potentials. It is found that the critical massive quark mass becomes larger as the chemical potential increases in $(2+N_f)$ -flavor QCD. The indication to the $(2+1)$ -flavor QCD is then discussed.

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