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Nature of phase transitions in finite temperature and density QCD with many-flavors

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We investigate the phase structure of (2+Nf)-flavor QCD, where two light flavors and Nf massive flavors exist, to discuss the feasibility of the electroweak baryogenesis in realistic technicolor scenario and to understand properties of finite density QCD.
Because an appearance of a first order phase transition at finite temperature is a necessary condition for the baryogenesis, it is important to study the nature of finite temperature phase transition.
Applying the reweighting method, the probability distribution function of the plaquette is calculated in the many-flavor QCD.
Through the shape of the distribution function, we determine the critical mass of heavy flavors terminating the first order region, and find it to become larger with Nf.
We then study the critical line at finite density and the first order region is found to become wider as increasing the chemical potential.
We discuss how the properties of real (2+1)-flavor QCD at finite temperature and density can be understand from simulations of many-flavor QCD.

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