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Flavor correlations and the QCD phase structure

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Modifications in magnitude of fluctuations for different observables are an excellent probe of a phase transition or its remnant. In heavy-ion collision, fluctuations related to conserved charges carried by light and strange quarks play an important role to identify the QCD chiral crossover and deconfinement properties.

Recent Lattice QCD simulations have revealed that the charmed mesons are deconfined together with light-flavor mesons in the temperature range where the chiral symmetry is partially restored. This result strongly suggests that the light-flavor dynamics interferes non-trivially with the heavy flavors.

We show that the heavy quark dynamics is tied to the light flavor physics, and the thermodynamics is strongly dragged by the chiral crossover dominated by the non-strange flavors. Consequently, the fluctuations carried by the states with strangeness can be used to characterize the onset of the chiral symmetry restoration.

We also discuss a possible phase structure of dense QCD matter within a toy model that handles the onset of different Fermionic degrees of freedom, either nucleons or quarks, depepnding on densiy. Selected key quantities, the baryon number and its susceptibility as well as the Polyakov-loop fluctuations, are used to characterize phases at finite density.

Summary

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