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# Quark number density at imaginary chemical potential and its extrapolation to large real chemical potential by the effective model

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We evaluate quark number densities at imaginary chemical potential by doing lattice QCD calculations on an 8^2*16*4 lattice with clover-improved Wilson quarks of two flavors. The quark number densities are extrapolated to the small real chemical potential region by assuming some function forms. The extrapolated quark number densities are consistent with those calculated at real chemical potential directly with the Taylor expansion method for the reweighing factors. Further extrapolation is also made to the large real chemical potential with the two-phase model consisting of the Walecka model for the hadron phase and the entanglement-PNJL model for the quark phase. The Walecka model is constructed to reproduce nuclear saturation properties, while the entanglement-PNJL model well account for temperature dependence of two-flavor lattice data for the order parameters such as the Polyakov loop, the thermodynamic quantities and the screening masses. Finally, we explore the hadron-quark phase transition with the two-phase model in the entire region of QCD phase diagram and discuss whether the phase diagram is consistent with two-solar mass observation of neutron stars.

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