

Lattice results for the speed of sound in dense QCD-like theories

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We review recent works on the Monte Carlo simulations of dense two-color QCD (QCD) by focusing on the phase diagram, the equation of state, and the sound velocity at nonzero quark chemical potential. A possible upper bound of the sound velocity is known as the conformal bound, namely, $cs^2/c^2 < 1/3$. The sound velocity is below the bound at least in the case of finite-temperature QCD. However, our recent works show the breaking of this bound in dense QCD. This phenomenon was previously unknown from any lattice calculations. We also discuss recent related works including lattice studies on QCD at nonzero isospin chemical potential, some effective model analyses, and an analysis based on recent neutron star observations. These works also suggest the breaking of the conformal bound.

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