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QCD at large isospin density: 6144 pions in a box

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We investigate QCD at large isospin density by computing correlation functions between sources with isospin charge $n = 1, \ldots, 6144$ on two lattice volumes at quark masses corresponding to a pion mass, $m_\pi \sim 170$ MeV. By extracting the energies of the corresponding many-pion systems under the assumption of log-normality of the correlation function distributions, we determine the isospin chemical potential, the speed of sound, and related thermodynamic properties of the dense medium, extending previous work to considerably higher isospin chemical potentials, μ_I. Significant deviations from perturbative QCD are seen until $\mu_I > 10 m_\pi$ and the speed of sound is seen to significantly exceed the expectation from a free gas of quarks over a large range of isospin chemical potentials.

Topical area

QCD at Non-zero Density

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