

Phase diagram of interacting pion matter and isospin charge fluctuations

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Equation of state and electric (isospin) charge fluctuations are studied for matter composed of interacting pions. The pion matter is described by self interacting scalar fields via a $\phi^4 - \phi^6$ type Lagrangian. The mean-field approximation is used and interaction parameters are fixed by fitting lattice QCD results on the isospin density as a function of the isospin chemical potential at zero temperature. Two scenarios for fixing the model parameters - with and without the first order phase transition are considered, both yielding a satisfactory description of the lattice data. Thermodynamic functions and isospin charge fluctuations are studied and systematically compared for these two scenarios, yielding qualitative differences in the behavior of isospin charge susceptibilities. These differences can be probed by lattice simulations at temperatures $T < 100$ MeV.

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