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Charged pion superfluidity and cosmic trajectories within PNJL model

In this talk, we self-consistently explore the possibility of charged pion superfluidity and cosmic trajectories in early Universe under the framework of Polyakov-Nambu-Jona-Lasinio model. By taking the badly constrained lepton flavor asymmetries l_e and l_μ as free parameters, the upper boundaries of pion superfluidity phase are consistently found to be around the pseudocritical temperature at zero chemical potentials. So the results greatly support the choice of $T = 0.16$ GeV as the upper boundary of pion superfluidity in the previous lattice QCD study. Take $l_e + l_\mu = -0.2$ as an example, we demonstrate the features of pion condensation and the associated cosmic trajectories with the evolution of early Universe. While the trajectory of electric chemical potential reacts strongly at both the lower and upper boundaries of reentrant pion superfluidity, the trajectories of other chemical potentials only respond strongly at the upper boundary.

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