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Phase Structure of Spin-Polarized Quark Matter

We study the effects of spin polarization in the two-flavor Entangled Polyakov–Nambu–Jona-Lasinio model at finite temperature within the mean-field approximation. Spin density is incorporated through a new term in the Lagrangian, the spin potential, recently proposed in the context of lattice quantum chromodynamics (LQCD). We investigate how the effective quark masses, as well as the chiral and deconfinement susceptibilities, vary with temperature and spin potential. Increasing lowers the pseudocritical temperature for both the chiral and deconfinement transitions, which are identified as crossovers. For sufficiently large, however, the chiral transition passes through a critical end point, followed by first-order phase transition lines at low temperatures. These results are in qualitative agreement with LQCD for small and reveal notable new features of the phase diagram at high, which are inaccessible to LQCD due to the sign problem.

Authors: LUCIANO SONEGO FARIAS, RICARDO; TAVARES, William R. (UERJ)

Presenter: TAVARES, William R. (UERJ)