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Lattice study of the QCD phase diagram in (B, T, μ) space

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Using numerical simulations of lattice QCD with physical quark masses, we study the influence of magnetic-field background on chiral and deconfinement crossovers in finite-temperature QCD at low baryonic density. We show that the quadratic curvature of the chiral transition temperature in the temperature-chemical potential plane depends rather weakly on the strength of the background magnetic field. At weak magnetic fields, the thermal width of the chiral crossover gets narrower as the density of the baryon matter increases, possibly indicating a proximity to a real thermodynamic phase transition. Remarkably, the curvature of the chiral thermal width flips its sign at $eB_{\rm fl} \simeq 0.6\,{\rm GeV}^2$, so that above the flipping point $B > B_{\rm fl}$, the chiral width gets wider as the baryon density increases. Approximately at the same strength of magnetic field, the chiral and deconfining crossovers merge together at $T \approx 140\,{\rm MeV}$. The phase diagram in the parameter space temperature-chemical potential-magnetic field is outlined.

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