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Chiral Properties of (2+1)-Flavor QCD in Strong Magnetic Fields at Zero Temperature

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We present a lattice QCD study of chiral condensates, light and strange pseudoscalar meson masses and decay constants in the presence of strong background magnetic fields. Our simulations employ (2+1)-flavor ensembles with physical quark masses, generated using the highly improved staggered quark (HISQ) action. To enable a controlled continuum extrapolation, we employ four lattice spacings ($a \approx 0.056, 0.067, 0.084, 0.112$ fm). Seven different magnetic field strengths are considered, reaching up to $\sim 1.22\mathrm{GeV}^2 (\sim 66 M_\pi^2)$ in the vacuum. Meson masses and decay constants are extracted from the exponential decay and amplitudes of two-point correlation functions. We analyze their dependence on the magnetic field and discuss the implications for chiral symmetry breaking and the internal structure of mesons in strong magnetic backgrounds.

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