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Chiral and Diquark condensates at large magnetic field in two-flavor superconducting quark matter

Content :

We study the effect of a large magnetic field on the chiral and diquark condensates in a regime of moderately dense quark matter. Our focus is on the inter-dependence of the two condensates through non-perturbative quark mass and strong coupling effects, which we address in a 2-flavor Nambu-Jona-Lasinio (NJL) model. For magnetic fields $eB\lesssim 0.01$ GeV^2 (corresponding to $B\lesssim 10^{18}$G), our results agree qualitatively with the zero-field study of Huang et al., who found a mixed broken phase region where the chiral and superconducting gap are both non-zero. For $eB\gtrsim 0.01$ GeV^2 and moderate diquark-to-scalar coupling ratio G_D/G_S, we find that the chiral and superconducting transitions become weaker but with little change in either transition density. For large G_D/G_S however, such a large magnetic field disrupts the mixed broken phase region and changes a smooth crossover found in the zero-field case to a first-order transition at neutron star interior densities.

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