

No gapless 2SC color superconducting phase for two flavor quark matter at high density

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The properties of color superconducting cold dense quark matter under compact star conditions are investigated using an SU(2) Nambu Jona-Lasinio (NJL) model in which the divergences are treated using “medium separation scheme” (MSS) as regularization scheme. We compare our results with the usual treatment of the divergent integrals (3D cutoff) that is referred to as the “traditional regularization scheme” (TRS). Our results show that a way of conciliating results for the behavior of the diquark condensates obtained with NJL models and recent lattice results, that show that the diquark condensate always increase with the density. These discrepancies between NJL-type models and the lattice, when we increase the density, might be closely connected on how the UV momentum integrals are treated in these models. These same results also show that one can eliminate this discrepancy by a proper separation of medium effects from the integrand of the divergent integrals that require regularization. All resulting divergent integrals are the same as those that appear in the vacuum, i.e., at $T = 0$ and $\mu = 0$. By this proper separation of medium effects from the divergent vacuum integrals, we have obtained results suppressing the so-called gapless 2SC phase (g-2SC) and favoring the conventional 2SC phase at high density. These changes in the phase diagram of the cold dense quark matter are related that the ultraviolet cutoff Λ , used with a TRS, effectively cuts important degrees of freedom near the Fermi surface leading to an incorrect result for the diquark condensate as a function of the density.

Summary

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