

Pion condensate versus chiral density wave at zero temperature

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The quark-meson model is often used as an effective low-energy model for QCD to study the chiral transition at finite temperature T , baryon chemical potential μ and isospin chemical potential μ_I . We determine the model parameters to one-loop order and express them in terms of the physical meson and quark masses, as well as the pion decay constant using on-shell renormalization. We study the existence of different phases at zero temperature. In particular, we investigate the competition between an inhomogeneous chiral condensate and a pion condensate. We show that due to our parameter fixing, the onset of pion condensation takes place exactly at $\mu_I = m_\pi/2$ in accordance with exact results. Furthermore the existence of an inhomogeneous phase at large μ in a certain parameter window is shown.

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