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Droplets in the cold and dense chiral phase transition

The linear sigma model with quarks at very low temperatures provides an effective description for the thermodynamics of the strong interaction in cold and dense matter, being especially useful at densities found in compact stars and protoneutron star matter. Using the MSbar one-loop effective potential, we compute quantities that are relevant in the process of nucleation of droplets of quark matter in this scenario. In particular, we show that the model predicts a surface tension of \Sigma ~ 5-15 MeV/fm^2, rendering nucleation of quark matter possible during the early post-bounce stage of core collapse supernovae. Including temperature effects and vacuum logarithmic corrections, we find a clear competition between these features in characterizing the dynamics of the chiral phase conversion, so that if the temperature is low enough the consistent inclusion of vacuum corrections could help preventing the nucleation of quark matter during the collapse process. We also discuss the first interaction corrections that come about at two-loop order.

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