

Functional renormalization group study on the phase structure of the Quark-Meson model with ω meson

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We study the phase diagram of two-flavor massless QCD at finite baryon density by applying the functional renormalization group (FRG) for a quark-meson model with σ , π , and ω mesons. The dynamical fluctuations of quarks, σ , and π are included into the flow equations, while the amplitudes of ω -fields are also allowed to fluctuate. At high temperature the effects of the ω -field on the phase boundary are qualitatively similar to the mean-field results, while the transition line toward the low temperature approaches the FRG results without ω -fields; the order of the phase transition changes from the second to the first order as the temperature is lowered. The critical chemical potential at the tricritical point is affected by the ω -field effects but its critical temperature stays around the similar value. The origin of the first order line in our FRG results is the fluctuation rather than the quark density. Some caveats are given in interpreting our model results in the QCD context.

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