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Fluctuations and phases in baryonic matter

The phase structure of baryonic matter is investigated with focus on the role of fluctuations beyond the mean-field approximation. The prototype test case studied is the chiral nucleon-meson model, with added comments on the chiral quark-meson model. Applications to nuclear matter include the liquid-gas phase transition. Extensions to high baryon densities are performed for both nuclear and neutron matter. The role of vacuum fluctuations is systematically explored. It is pointed out that such fluctuations tend to stabilize the hadronic phase characterized by spontaneously broken chiral symmetry, shifting the chiral restoration transition to very high densities. This stabilization effect is shown to be further enhanced by additional dynamical fluctuations treated with functional renormalisation group methods.

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