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Density functional theory of renormalization group in nuclear matter

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The density functional renormalization group (density-fRG) is proposed to investigate the density fluctuations within the functional renormalization group approach, which allows us to quantify the medium effect and study physics of high densities. The density-fRG is applied to the nucleon-meson effective field theory, also known as the Walecka model, to study the properties of nuclear matter at high baryon densities. It is found that both the attractive and repulsive nucleon meson interactions are screened by the high density medium, which results in a stiffer equation of state (EoS) of nuclear matter in the regime of ρ_0
$lesssim\rho$
$lesssim 2.5\rho_0$, then a softer EoS when ρ
$gtrsim 2.5\rho_0$. Furthermore, a new phenomenon called the locking of Fermi surface is found. In the locking of Fermi surface the effective energy of quasi-nucleon is always close to the Fermi surface, which are both running with the renormalization group scale.

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