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Connecting compact stars and heavy ion collisions

Commonly used in astrophysics, DD2 is a relativistic mean-field equation of state (EoS) with density-dependent couplings parametrized to nuclei data. It reproduces successfully the properties of nuclear matter up to saturation density as well as neutron star masses observations, chiral effective field theory, and symmetry energy constraints. A known caveat of DD2 is the atypical behavior of finite baryon chemical potential for zero baryon density at finite temperature, which is not appropriate for studying the temperature axis of the QCD phase diagram. With the aim of obtaining a unified equation of state that can be used both in HIC and astrophysics, we intend to develop a new version of the EoS with the proper behavior at zero baryon density while keeping the current good features. As a first approximation to the problem, we modify the density dependent σ coupling so that its derivative at zero density vanishes and obtain a new parameter set by optimizing the difference of the new EoS with respect to the thermodynamic behavior of DD2.

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