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Nearly model-independent constraints on dense matter equation of state in a Bayesian approach

We apply the Bayesian approach to construct a large number of minimally constrained equations of state (EOSs) and study their correlations with a few selected properties of a neutron star (NS). Our set of minimal constraints includes a few basic properties of saturated nuclear matter and low-density pure neutron matter EOS, which is obtained from a precise next-to-next-to-next-to-leading-order (N^3LO) calculation in chiral effective field theory. The tidal deformability and radius of NS with mass $1 - 2M_\odot$ are found to be strongly correlated with the pressure of β-equilibrated matter at densities higher than the saturation density ($\rho_0 = 0.16\,\mathrm{fm}^{-3}$) in a nearly model-independent manner. These correlations are employed to parametrize the pressure for β-equilibrated matter, around $2\rho_0$, as a function of neutron star mass and the corresponding tidal deformability. The maximum mass of a neutron star is also found to be strongly correlated with the pressure of β-equilibrated matter at densities $\sim 4.5\rho_0$.

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