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Recalibrating the NJL Model to Neutron Star Observations[1]
GEMA P. VILLEGAS, Florida International University, ANDREW W. STEINER, University of Tennessee — Dense quark matter in neutron stars is often described by the Nambu—Jona-Lasinio (NJL) model. The NJL model parameters are often determined by ensuring that the vacuum properties of the model (e.g. the mass of the pion) match with experiments. In this work, we re-envision the NJL model as a purely phenomenological model designed to describe quark matter at high densities. We calibrate the model with neutron star observations, rather than the properties of matter in a vacuum. This allows us to explore a large range of possible descriptions of dense quark matter, while still retaining the underlying symmetries of quantum chromodynamics (QCD). We construct a Gibbs phase transition between the NJL model and a Skyrme model for the equation of state of nucleons. Additionally, we describe the set of NJL parameters that lead to neutron star mass-radius curves that match recent gravitational wave and photon-based neutron star observations.

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