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Modeling massive quark stars with repulsive vector couplings

We describe in this work a stellar phase composed of up, down and strange quarks, based on the repulsive vector interaction enhanced MIT bag model (vMIT), a crucial component to describe stable and massive hybrid NS configurations with quark matter cores, in agreement with the recent observations of pulsars with two solar masses. The motivation for this study, based on known theoretical approaches, is to review some of its foundations. Among these, the level of stability of a compact star stands out, in addition to its correlation with the density of quark matter and the value of the bag constant, as well as its impact on stellar rigidity. Through appropriate parameterizations of the vector meson coupling constant, we reevaluate the proposition formulated by Witten, Farhi and Jaffe, which suggests that strange quark matter may actually be more stable than conventional matter. Following the same line of reasoning, we reevaluate the Bodmer-Witten stability assumption for strange stars. To this end, through appropriate choices of coupling constants and mass of the vector meson ratios, alternative stability limits of strange matter were established with structural implications for compact stars. The results presented indicate that the appropriate choices of coupling constants, stellar density, as well as bag constants, modulated by stability conditions are in accordance with observational expectations for massive stars, and may even exceed in some cases 2.0 solar masses.

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