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## Science of the Cosmos

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## Equation of State for Dense Matter from QCD Sum Rules: Implications for Hybrid Star

In this work, we employ coupling constants derived from non-perturbative QCD Sum Rules in conjunction with the relativistic mean field (RMF) framework to construct the equation of state (EoS) for beta-stable baryonic matter. Utilizing this EoS, we systematically investigate the structure of hyperonic and hybrid stars, including the Hyperon-Quark phase transition , modeled via conventional approaches such as the MIT Bag model. Our results demonstrate that, with an appropriate selection of QCD Sum Rules-based coupling constants available in the literature, the existence of hybrid stars with masses exceeding two solar masses can be theoretically justified. Additionally, we compute key astrophysical observables, including tidal deformability, and show that the proposed approach effectively reproduces constraints derived from recent neutron star observations.

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