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Strange and non-strange quark stars from resummed QCD

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We use the recently developed resummation technique known as renormalization group optimized perturbation theory (RGOPT) to evaluate the equation of state (EoS) describing cold and dense quark matter at next-to-leading order (NLO). The technique is applied to non-strange quark matter ($N_f = 2$) as well as strange quark matter ($N_f = 2 + 1$) while ensuring thermodynamic consistency in both cases. The resulting mass-radius relation are are compared with those from NNLO perturbative QCD (pQCD). We find that the RGOPT considerably reduces the renormalization scale dependence relative to that produced by pQCD. Moreover, for the same value of the renormalization scale, the RGOPT yields lower maximum star masses than those furnished by pQCD. Furthermore, when the renormalization scale is adjusted to produce maximum star masses in the range $M_{\rm max} = 2 - 2.6 M_\odot$, the RGOPT results aligns well with recent observational data.

Authors: RESTREPO MEDINA, Tulio Eduardo (University of Houston); KNEUR, Jean-Loic (Univ. Montpellier); PROVIDÊNCIA, Constança; BENGHI PINTO, marcus

Presenter: RESTREPO MEDINA, Tulio Eduardo (University of Houston)

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