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Reconciling multi-messenger constraints with chiral symmetry restoration

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In this talk, we analyze the recent astrophysical constraints in the context of a hadronic equation of state (EoS), in which the baryonic matter is subject to chiral symmetry restoration. We show that it is possible to reconcile the modern constraints on the neutron star (NS) radius and tidal deformability (TD). We find that the softening of the EoS (required by the TD constraint) followed by a subsequent stiffening (required by the 2 $M_\odot$ constraint) is driven by the appearance of Δ matter due to partial restoration of chiral symmetry. Sufficiently early onset of Δ matter lifts the tension with TD from GW170817. We argue that a purely hadronic EoS that accounts for the fundamental properties of quantum chromodynamics (QCD) linked to the dynamical emergence of parity doubling with degenerate masses can be fully consistent with the nuclear and astrophysical constraints. Therefore, the conclusion about the existence of quark matter in the stellar core may be premature.

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