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Third family of compact stars within a nonlocal chiral quark model equation of state

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We suggest a class of hybrid compact star equations of state which support the existence of a third family of compact stars composed of a core of two-flavor
quark matter and a shell of hadronic matter described within a relativistic meanfield model with excluded nucleon volume.
The quark matter equation of state is based on a nonlocal covariant chiral quark model with vector meson and diquark condensate.
A twofold interpolation method is realized which implements both, the density dependence of a confining bag pressure at the onset of the hadron-to-quark matter transitiona as well as the stiffening of quark matter at higher densities by a density dependent vector meson coupling.
For three parametrizations of this class of hybrid equation of state the properties of corresponding compact star sequances are presented, including mass twins of neutron and hybrid stars at 2.00, 1.39 and 1.20 $M_{\odot}$, respectively and the compact hybrid star (third) families. It is demonstrated that this advanced description of hybrid satr matter allows to interpret GW170817 as a merger not only of two neutron stars but also of a neutron star with a hybrid star or of two hybrid stars. The latter two scenarios are in accordance with the constraints on compactness from GW170817 when a binary neutron star merger with a too stiff hadronic equation of state would be ruled out.

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