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Bayesian inference on quark matter from observations of neutron stars

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The existence of quark matter inside the cores of massive neutron stars can be probed by modern astrophysical observations. We model these hybrid stars using an (axial)vector meson extended quark-meson model to describe their quark cores, together with various hadronic models. We show that crossover phase transitions between the hadronic and quark phases can naturally create equations of state that are stiffer than both the hadronic and quark ones, enabling more massive neutron stars. We also show that the properties of the maximum mass hybrid star can be used to constrain the parameters of the quark model, while radius limits from GW170817 also give restraints on them. We combine gravitational wave and NICER measurements in our Bayesian analysis to determine the properties of quark matter and the hadron-quark phase transition.

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