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Bayesian analysis of new class of realistic hybrid EoS models based on M-R data

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We performed a Bayesian analysis of a new class realistic models of two-phase equations of state (EoS) for hybrid stars and demonstrated that the observation of such a pair of high-mass twin stars would have a sufficient discriminating power to favor hybrid EoS with a strong first order phase transition over alternative EoS.
The new class of two-phase EoS is characterized by three main features:
(1) stiffening of the nuclear EoS at supersaturation densities due to quark exchange effects (Pauli blocking) between hadrons, modelled by an excluded volume correction,
(2) stiffening of the quark matter EoS at high densities due to multiquark interactions and
(3) possibility for a strong first order phase transition with an early onset and large density jump.
The third feature results from a Maxwell construction for the possible transition from the nuclear to a quark matter phase and its properties depend on the two parameters used for (1) and (2), respectively. Varying these two parameters one obtains a class of hybrid EoS that yields solutions of the Tolman-Oppenheimer-Volkoff (TOV) equations for sequences of hadronic and hybrid stars in the mass-radius diagram which cover the full range of patterns according to the Alford-Han-Prakash classification following which a hybrid star branch can be either absent, connected or disconnected with the hadronic one. The latter case often includes a tiny connected branch. The disconnected hybrid star branch, also called “third family”, corresponds to high-mass twin stars characterized by the same gravitational mass but different radii.

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