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A new class of quark-hadron hybrid equation of state for astrophysics

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We explore systematically a new class of two-phase equations of state (EoS) for hybrid stars that 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 in high-mass twin stars characterized by the same gravitational mass but different radii. We perform a Bayesian analysis and demonstrate 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 EoSs. The new class of hybrid EoS can be straightforwardly generalized to finite temperatures and proves very interesting for astrophysical applications.

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