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Which first order phase transitions to quark matter are possible in neutron stars?

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We examine which first order phase transitions are consistent with today's astrophysical constraints. In particular, we explore how a well-constrained mass-radius data point would restrict the admissible parameter space and to this end, we employ the most likely candidates of the recent NICER limits of PSR J0030+0451. To systematically vary the stiffness of the equation of state, we employ a parameterizable relativistic mean field equation of state, which is in compliance with results from chiral effective field theory. We model phase transitions via Maxwell constructions and parameterize them by means of the transitional pressure p_{trans} and the jump in energy density $\Delta\epsilon$. This provides us with a generic setup that allows for rather general conclusions to be drawn. We outline some regions in the p_{trans}-$\Delta\epsilon$ parameter space that may allow for a phase transition identification in the near future. We also find that a strongly constrained data point, at either exceptionally large or small radii, would reduce the parameter space to such an extent that mass and radius become insufficient indicators of a phase transition.

session

H. Equation of State and Neutron Stars

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