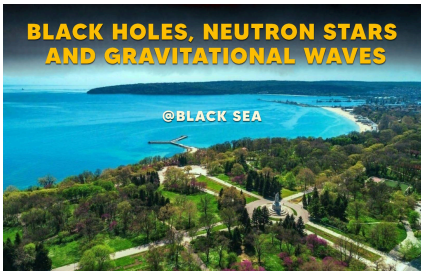

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Fastest spinning millisecond pulsars: indicators for quark matter in neutron stars?

Monday 16 June 2025 17:05 (15 minutes)

We study rotating hybrid stars, with a particular emphasis on the effect of a deconfinement phase transition on their properties at high spin. Our analysis is based on a hybrid equation of state with a phase transition from hypernuclear matter to color-superconducting quark matter, where both phases are described within a relativistic density functional approach. By varying the vector meson and diquark couplings in the quark matter phase, we obtain different hybrid star sequences with varying extensions of the quark matter core, ensuring consistency with astrophysical constraints from mass, radius, and tidal deformability measurements. We test whether the early deconfinement phase transition is consistent with the present observational data. We show how the fastest spinning pulsars and the appearance of the quasi-radial oscillations and non-axisymmetric instabilities constrain the strongly interacting matter equation of state at zero temperature. Our findings reveal that incorporating the hybrid equation of state into the analysis of pulsars has significant implications for the constraints on the properties of strongly interacting matter and neutron stars which is of the high interest for the future SKA observations.

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