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Exploring the stability of rapidly rotating hybrid stars and their collapse into black holes

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We study rotating neutron stars with a particular emphasis on the effect of fast spin on the deconfinement phase transition in their interiors. We demonstrate the impact of increasing rotational frequencies on the maximum gravitational mass, central energy density, angular momentum, and the rise of the nonaxisymmetric instability. Utilizing observational data from the fastest-spinning millisecond pulsars with measured masses, we have further constrained the properties of the quark phase, the rise of instability against oscillations, and the star's collapse into a black hole. These results have implications for the dense matter equation of state and the boundary between the lower mass gap and massive neutron stars.

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