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Ridges and latent heat in rotating neutron stars in GR and modified gravity

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We explore “ridges” in the macroscopic properties of rotating neutron stars as potential indicators of first-order phase transitions in their matter. These phase transitions induce non-analytic behavior in observables like angular momentum, moment of inertia, mass, and radii, with the intensity of this behavior directly tied to the latent heat of the transition. Notably, the Seidov limit sets a bound on the maximum latent heat a phase transition can produce before its excess energy density, not compensated by additional pressure, results in gravitational collapse.

Additionally, we investigate how modified gravity theories, such as quadratic f(R) gravity, affect these phenomena. In this context, we find that the Seidov limit undergoes substantial modification compared to General Relativity. Breaching the Seidov limit would lead to two significant discoveries: evidence of a first-order phase transition in neutron star matter and a deviation from General Relativity.

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Abstract

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