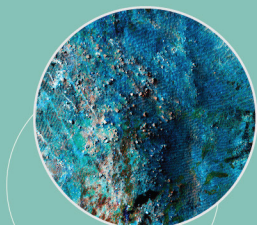




INSTITUTO DE FÍSICA
DE PARTÍCULAS Y DEL COSMOS

IPARCOS



Preprint Series in Particles and Cosmos Physics

n° IPARCOS-UCM-24-041

Testing gravity with the latent heat of neutron star matter

by Pablo Navarro Moreno, Aneta Wojnar,
and Felipe J. Llanes-Estrada

July 2024

Plaza de las Ciencias, 1 28040 Madrid, Spain

www.ucm.es/iparcos/



UNIVERSIDAD
COMPLUTENSE
MADRID



Abstract

The Seidov limit is a bound on the maximum latent heat that a presumed first-order phase transition of neutron-star matter can have before its excess energy density, not compensated by additional pressure, results in gravitational collapse.

Because latent heat forces a nonanalytic behaviour in plots correlating physical quantities (kinks in two-dimensional, ridges in three-dimensional ones), it can be constrained by data.

As the onset of collapse depends on the intensity of gravity, testing for sudden derivative changes and, if they are large, breaching the Seidov limit, would reward with two successive discoveries: such a phase transition in hadron matter, and a modification of General Relativity. We illustrate the point with $f(R) = R + \alpha R^2$ gravity, although the generalized Tolman-Oppenheimer-Volkoff equations here provided allow for tests within broader classes of theories.

