

A Neutron Star Hidden Inside a Black Hole

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We investigate dark matter admixed neutron stars in which the neutron star coexists with an anisotropic dark matter halo described by the Einasto density profile, a model recently shown to produce regular, singularity-free black hole solutions-[Phys. Rev. D \textbf{113}, 043011 (2026)].

Solving the modified Tolman–Oppenheimer–Volkoff equations with two different equations of state (BSk19 and SLy4), we find that the dark matter halo significantly alters the neutron star structure.

Furthermore, for a specific range of halo parameters, g_{rr}^{-1} changes sign outside the stellar surface, forming an event horizon with the neutron star persisting as a regular configuration inside it— “neutron stars in black holes”.

This configuration appears in both equations of state and does not depend on a specific choice of the equation of state.

The discovery of this configuration provides a new perspective and a concrete computable instance for the study of what lies inside a black hole.

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