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simulation of a neutron star with MDG model

We study the structure of neutron stars within the framework of Minimal Dilatonic Gravity (MDG), a scalar–tensor theory related to Brans–Dicke gravity with $\omega = 0$. Using two realistic unified equations of state (EOS), LOCV1811 and LOCV1815, we analyze stellar configurations for different values of the dilaton field mass $m\Phi$. Our results show that a dilaton halo forms around the neutron star, contributing significantly to the total mass. The halo mass fraction reaches 20–30% in neutron stars with masses greater than $2M_{\odot}$, leading to total masses that exceed those predicted by General Relativity. These results are consistent with mass measurements from recent gravitational wave and NICER observations. We also find that smaller dilaton field masses yield more massive neutron star–halo systems. For high-density stars, the dilaton pressure becomes negative at the center and behaves like dark energy, modifying the radial profile of the dilaton field.
Keywords: Minimal Dilatonic Gravity, neutron stars, LOCV1811, LOCV1815, dilaton field, scalar-tensor theory, dilaton halo

Author: ASADNEZHAD, Maryam (University of zanjan)

Co-author: BIGDELI, Mohsen

Presenter: ASADNEZHAD, Maryam (University of zanjan)