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Effect of dark matter on neutron star properties

Dark matter (DM) is a fascinating subject in Astrophysics and Cosmology. While its exact nature remains elusive, its presence in the universe is inferred through various observational evidences such as galaxy rotation curves, velocity dispersions, gravitational lensing etc. Dark matter halos develop in the universe and subsequently facilitate galaxy formation by accumulating protons. Neutron stars (NS) and other compact astrophysical objects are promising candidates for investigating the presence of dark matter due to their dense and highly gravitating environments.
The dense interior of NS, whose density exceeds a few times saturation density, may consist of an admixture of DM along with the normal nuclear matter. In this work, we use the Relativistic Mean Field (RMF) model [1] for constructing the Nuclear Matter Equation of State (EoS) and the standard scalar and vector interactions model for the DM EoS [2-4]. Using the two-fluid approach, where DM interacts with baryonic matter only via gravity, we investigate the influence of dark matter via DM particle mass and DM fraction in NS properties. We observe that EoS of DM admixed NS may soften or stiffen depending on various DM parameters. The nature of EoS can be directly linked to NS observational data of mass, radius, tidal deformability, quasi-normal oscillation frequencies etc. Thus we may further constrain the DM parameters using recently observed structural properties of NS such as mass-radius and tidal deformability values reported by GW170817, NICER and LIGO-VIRGO collaborations.

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Track type

Dark Matter

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