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Exploring dark matter-baryon interactions from the survival of neutron star

Neutron stars (NS), characterized by strong gravity and extreme density, provide a lucrative place to explore the properties of dark matter (DM) particles. We investigate the DM capture inside the neutron star and report that the DM capture rate enhanced for velocity and momentum-dependent DM-baryon interactions. The accreted DM particles get thermalized, form a gravitationally bound core, and eventually lead to a black hole formation inside the NS. After accreting the surrounding material, the black hole can destroy the host neutron star. Utilizing the existing pulsar data J0437-4715 and J2124-3858, we derive the stringent constraints on the DM-nucleon scattering cross-section across a broad range of DM masses.

Field of contribution

Theory

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