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Warming Nuclear Pasta with Dark Matter: Kinetic and Annihilation Heating of Neutron Star Crusts

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Neutron stars serve as excellent next-generation thermal detectors of dark matter, heated by the scattering and annihilation of dark matter falling into them. However, the composition and dynamics of neutron star cores are uncertain, making it difficult at present to unequivocally compute dark matter scattering in this region. On the other hand, the crust of a neutron star is more robustly understood. Dark matter scattering solely with the low-density crust can still kinetically heat neutron stars to infrared temperatures detectable by forthcoming telescopes, providing low cross-section sensitivities in a wide dark matter mass range, with the best sensitivity arising from dark matter scattering with a crust constituent called nuclear pasta. I discuss how these detection prospects are obtained for both spin-independent and spin-dependent scattering with the crust constituents, as well as the effects of dark matter annihilation in the case the dark matter particles are captured and thermalized by the crust alone.

email address

17jfa1@queensu.ca

Please select: Experiment or Theory

Theory

Primary author(s) : FERNANDEZ ACEVEDO, Javier (Queen's University)

Presenter(s) : FERNANDEZ ACEVEDO, Javier (Queen's University)