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(UG*) (POS-18) The Neutrino-Nucleon Transport Scattering Cross-section Explored via Molecular Dynamics Simulations of Neutron star Inner Crust

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Prior research into dense neutron-rich matter reveals an extraordinary revelation: the dynamic interplay between the nuclear strong force and the Coulomb force orchestrates the formation of complex structures referred to as Nuclear Pasta, exhibiting shapes such as spheres, slabs, and rods. This research employs semi-classical molecular dynamic simulations to investigate the response of Nuclear Pasta to an abundance of neutrinos generated in these environments. The diffusion of neutrinos through Nuclear Pasta structures proves pivotal in phenomena like the explosion of stalled core-collapse supernovae (Type II SN) and the cooling of neutron stars. The coherent neutrino-nucleon transport scattering cross-section (σ_t) and the transport mean free path (λ_t), provides valuable insights into the transport properties specific to different pasta shapes. Our exploration enhances our understanding of how neutrino diffusion influences energy loss, potentially re-igniting a Type II SN, and contributes to understanding the cooling time-scales in neutron stars. This endeavour offers a unique glimpse into the behaviour of matter at densities comparable to a nucleus, thereby enriching our understanding of the cosmos.

Keyword-1

Nuclear Pasta

Keyword-2

Neutrino-nucleon cross-section

Keyword-3

neutron star

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