



Contribution ID : 33

Type : Poster presentation

Superfluid Band Theory for the Neutron Star Inner Crust

Tuesday, 24 September 2024 17:30 (120)

In the inner crust of neutron stars, a Coulomb lattice of nuclei exists, immersed in a sea of superfluid neutron gas. The interplay between these nuclear crystals and the background neutrons may significantly alter nuclear dynamics, a phenomenon known as the “entrainment” effect, which is crucial for understanding several astronomical phenomena.

In our study, we have developed new self-consistent calculations that fully account for both superfluid effects and band structure effects. We have extracted the “effective mass” of free neutrons through the real-time method.

In this presentation, we will show the formalism and methodology of our calculations, as well as further extensions towards comprehensive simulations of the subnuclear properties of neutron star matter.

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Session Classification : Poster session