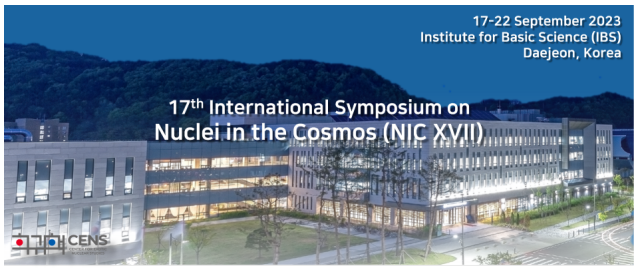

Contribution ID: **72** Type: **Poster**

Non-equilibrium dynamics in the inner crust of a neutron star

Tuesday, 19 September 2023 17:05 (5 minutes)

We analyze the behavior of a nucleus as it moves through a superfluid neutron medium located in the inner crust of a neutron star. One important aspect of studying the behavior of nuclei in neutron stars immersed in superfluid neutrons is understanding how their effective mass is affected by interactions with the surrounding particles. To study it, we utilized the Time-Dependent Hartree-Fock-Bogoliubov framework, which allowed us to systematically extract an effective mass for different densities in the low-velocity limit. We use one of the latest nuclear energy-density functionals from the Brussels-Montreal family, developed specifically for applications to neutron superfluidity in neutron-star crusts.

Through investigating our system with no geometry restrictions, we identified several dissipation mechanisms: the production of phonons, the breaking of Cooper pairs, and the creation of vortex rings. The last channel is present only in some layers, which might have consequences for the details of glitch creation.

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Session Classification: Poster session (High-density matter)

Track Classification: High-density matter