Contribution ID: **81** Type: **not specified**

How much the Gogny forces can be used in the astrophysical scenari ?

Thursday, December 12, 2024 3:55 PM (25 minutes)

The effective Gogny interactions of the D1 family were established by D. Gogny more than forty years ago to describe simultaneously the mean field and the pairing field corresponding to the nuclear interaction. The most popular Gogny parametrizations, namely D1S, D1N, and D1M, describe accurately the ground-state properties of spherical and deformed finite nuclei all across the mass table obtained with Hartree-Fock-Bogoliubov (HFB) calculations. However, these forces produce a rather soft equation of state (EoS) in neutron matter, which leads to predicting maximum masses of neutron stars well below the observed value of two solar masses. To get rid of this limitation, we have built new Gogny parametrizations by modifying the density dependence of the symmetry energy predicted by the force in such a way that they can be applied to the neutron star domain and can also reproduce the properties of finite nuclei as good as their predecessors. These new parametrizations allow us to obtain stiffer EoSs based on the Gogny interactions, which predict maximum masses of neutron stars around two solar masses. Moreover, other global properties of the star, such as the moment of inertia and the tidal deformability, are in harmony with those obtained with other well tested EoSs based on the SLy4 Skyrme force or the Barcelona-Catania-Paris-Madrid (BCPM) energy density functional. Properties of the core-crust transition predicted by these Gogny EoSs are also analyzed. Using these new Gogny forces, the EoS in the inner crust is obtained with the Wigner-Seitz approximation in the Variational Wigner-Kirkwood approach along with the Strutinsky integral method, which allows one to estimate in a perturbative way the proton shell and pairing corrections. For the outer crust, the EoS is determined basically by the nuclear masses, which are taken from the experiments, wherever they are available, or by HFB calculations performed with these new forces if the experimental masses are not known.

Presenter: Prof. VIÑAS, Xavier (University of Barcelona)

Session Classification: Astrophysics and Nuclear Data