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Nuclear physics inputs for neutron stars and nucleosynthesis simulations

Thursday 19 September 2024 15:00 (15 minutes)

Nuclear physics plays an important role for many astrophysics applications. Nucleosynthesis simulations of heavy elements, for example, require nuclear inputs across the whole nuclear chart, far beyond the region where experimental data is available. Likewise, the description of the extremely dense neutron-rich matter in neutron stars (NS) is a challenge for nuclear physics and astrophysics.
We will present the new family of global nuclear structure models which aims to provide accurate nuclear physics inputs to astrophysical applications. The latest Brussels-Skyrme-on-a-Grid model (BSkG3) [2] greatly improves the infinite nuclear matter properties (INM) as compared to earlier BSkG parametrizations. Compared to its predecessors, BSkG3 offers a more realistic description of matter at the extreme densities relevant to NS and is consistent with observations of heavy pulsars, in contrast to most Skyrme parameterizations. Reconciling the complexity of NS with those of atomic nuclei establishes BSkG3 as a tool of choice for applications in nuclear astrophysics.
We will also present our efforts to create a new model which aims to improve the nuclear inputs to NS mergers simulations, while keeping an accurate description of nuclear structure properties.
[1] G. Grams, et al, EPJA 59, 270 (2023).

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