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Constraints on the nuclear Equation of State: From terrestrial experiments to neutron star observations

The equation of state (EoS) of asymmetric nuclear matter and its isospin dependence play a fundamental role in nuclear structure, reactions, and decays, as well as in neutron star properties and formation. To constrain the EoS robustly, studies must span extreme densities and pressures across nuclear and astrophysical systems. A well-determined EoS would provide critical insights into ground-state properties of finite nuclei, stability of neutron-rich and superheavy nuclei, heavy-ion collision dynamics, giant monopole resonances and excitation energies, and nuclear surface diffuseness, as well as neutron star structure. Astrophysical observations of neutron stars, particularly their masses, radii, and tidal deformability, serve as key probes of the dense-matter EoS up to several times nuclear saturation density.

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