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Dense matter equation of state with improved nuclear physics

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I will present a new model for dense matter which combines the knowledge of recent theory predictions from chiral EFT, experimental nuclear masses and astrophysical constrains to construct unified equations of state (EoS) describing dense matter in neutron stars (NS), from the crust to the dense core. Based on a recent meta-model for the nuclear component, it allows us to describe the matter component in terms of neutrons, protons, electrons, muons, as well as phase transitions at high density. A set controlled meta-models are confronted to a representative phenomenological force (SLy4). We show that some crust properties, e.g., energy per particle, pressure, sound speed, are mostly influenced by low-density predictions in neutron matter, where chiral EFT and phenomenological forces substantially differ. Other properties of the crust, e.g. clusters mass, charge, and asymmetry, are mostly determined by symmetric matter properties close to saturation density and are therefore mainly constrained by experimental nuclear masses. Finally, by solving the TOV equations we analyze NS mass-radius relations and tidal deformability, which can be confronted to GW observations.

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