Nuclear equations of state in explosive astrophysical systems

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The description of matter in explosive astrophysical scenarios such as supernova explosions or neutron star merger poses a challenge to nuclear physics.
From the collpase of the progenitor star to the formation of a neutron star or a black hole, the nuclear equations of state have to cover temperatures in the range of $T \sim 0.1$MeV up to 100MeV, densities from $\rho_b \sim 10^5$g/cm^3 to far above saturation density, and proton fractions from $Y_p \sim 0.6$ down to $Y_p \sim 0.1$.
The calculation of thermodynamic consistent nuclear equations of state for such ranges in T, Y_p, and ρ_b is a difficult task, yet, indispensable for reliable modeling of supernova explosions and predictions of observable signals in neutrino emission or gravitational waves. At the moment only a few equations of state are able to meet these requirements and are widely used in astrophysical simulations, with a growing demand for new models and parameter sets to describe nuclear matter, with special attention on the behavior of the nuclear symmetry energy at high densities.
In this talk I will give an overview of supernova physics and present approaches to the equation of state. I will discuss observed and possible influences of the nuclear equation of state on core collapse supernovae. Hereby, I will adress the properties of hadronic matter as well as approaches to include more exotic nuclear physics such as a quark matter phase transition or the appearance of hyperons.