Equation of State Distribution for Simulations

Objectives

Create an equation of state distribution which quantifies the nuclear physics uncertainties without failing to match nuclear experiment, advances in theory, and neutron star observations

Impact

Our work will eventually allow a new generation of simulations which can systematically study the variation with respect to fundamental parameters of the nucleon-nucleon interaction

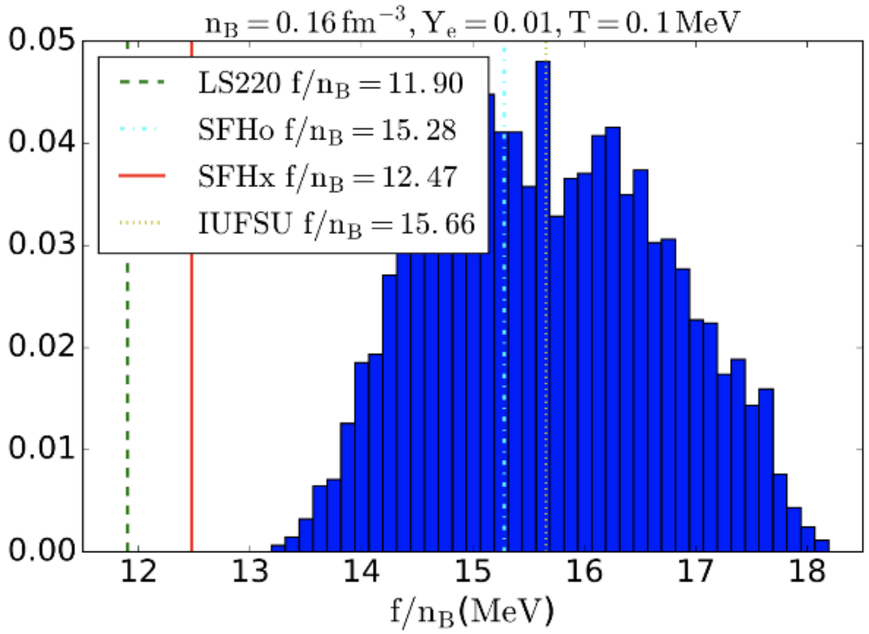

FIG. 4. The probability distribution for the free energy per baryon at $n_B = 0.16\,\mathrm{fm}^{-3}$, $Y_e = 0.01$, and $T = 0.1\,\mathrm{MeV}$.

Accomplishments

- Created a probability distribution of homogeneous matter equations of state
- Low-density limit is consistent with virial approximation for nucleonic matter
- Neutron-rich matter at high densities consistent with neutron star observations
- Isospin-symmetric matter near the saturation density based on a model which matches experimental nuclear structure
- Neutron matter near the saturation density consistent with recent quantum Monte Carlo results

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TEAMS

Towards Exascale Astrophysics of Mergers and Supernovae