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

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

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

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TEAMS
Towards Exascale Astrophysics of Mergers and Supernovae