Contribution ID: **596** Type: **Contributed Poster Presentation**

Bayesian inference of neutron-skin thickness and neutron-star observables based on effective nuclear interactions

This work has obtained the constraints on the density dependence of the symmetry energy from neutron-skin thickness data of PREX and CREX as well as neutron-star data of GW170817, PSR J0030+0451, and PSR J0740+6620 using a Bayesian approach, based on the standard Skyrme-Hartree Fock (SHF) model and its extension as well as the relativistic mean-field (RMF) model.

While the neutron-skin thickness data (neutron-star observables) mostly constrain the symmetry energy at subsaturation (suprasaturation) densities, they may more or less constrain the behavior of the symmetry energy at suprasaturation (subsaturation) densities, depending on the energy-density functional form. Besides showing the final posterior density dependence of the symmetry energy, we also compare the slope parameters of the symmetry energy at 0.10 \text{fm}^{-3} as well as the values of the symmetry energy at twice saturation density from three effective nuclear interactions.

In addition, we are able to independently change the the nuclear matter equation of state (EOS) parameters and can directly perform Bayesian sampling in the EOS parameter space instead of the model parameter space, which makes Bayesian analysis more efficient.

We change all EOS parameters within a prior range, based on Bayesian methods to obtain parity-violating electron scatterings and neutron-star observables constraints on all EOS parameters and their correlations. The results give new constraints on the equation of state of symmetric nuclear matter and the symmetry energy.

On the one hand, the constraints on the symmetry energy from the neutron-skin thickness data and the neutron-star observables are similar for the three adopted models. On the other hand, some model dependencies do exist, mainly due to the inclusion of higher-order EOS parameters and the difference between relativistic and non-relativistic models.While a model with a smaller number of free parameters is always favored, a more flexible model with more free parameters may be helpful in extracting detailed information of the nuclear interaction, as long as more constraints are incorporated from various observables based on the Bayesian analysis.

The present work serves as a comparison study based on relativistic and non-relativistic energy-density functionals, for constraining the nuclear symmetry energy from low to high densities using a Bayesian approach.

Reference:
1. J. Xu, and P. Papakonstantinou, Phys. Rev. C 105, 044305 (2022), arXiv: 2201.03835.
2. J. Zhou, J. Xu, and P. Papakonstantinou, Phys. Rev. C 107, 055803
(2023), arXiv: 2301.07904.
3. B. A. Li, B. J. Cai, W. J. Xie, and N. B. Zhang, Universe 7, 182 (2021), arXiv: 2105.04629.
4. W. C. Chen and J. Piekarewicz, Phys. Rev. C 90 (2014) 044305, arXiv: 1408.4159.

Primary author: Ms ZHOU, Jia (Institute for Basic Science/Center for Exotic Nuclear Studies)

Co-author: Mr XU, Jun (Tongji University,CHINA)

Presenter: Ms ZHOU, Jia (Institute for Basic Science/Center for Exotic Nuclear Studies)

Session Classification: Poster Session

Track Classification: Hot and Dense Nuclear Matter