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Calibrating global behaviour of equation of state by combining nuclear and astrophysics inputs in a machine learning approach

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Recovering the nuclear matter parameters (NMPs), crucial elements in neutron star equations of state for the nucleonic core configuration, is a significant ongoing task in nuclear astrophysics. This involves utilizing various experimental data and astrophysical observations through a Bayesian approach. However, the conventional method of computing the equation of state (EoS) and solving the Tolman-Oppenheimer-Volkoff (TOV) equations to obtain neutron star (NS) properties is computationally intensive and time-consuming. To address this, we propose a rapid approach, denoted as symbolic regression model (SRM), which provides a preliminary estimation of the underlying NMPs more than 100 times faster than the traditional TOV approach within the same framework. We observe that including constraints from various nuclear experiments and neutron star observations are able reproduce most of the NMPs in a very narrow bounds. Additionally, Our analysis demonstrates that the results obtained using the SRMs closely align with those derived from the actual TOV equations.

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Classification de Session: Combined analysis of nuclear and astrophysics information, Bayesian approach, and machine learning

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