Analytical representations of unified and modern equations of state

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Equations of state of dense matter play a key role in neutron star modelling. Well constructed equations of state must be constrained by nuclear physics experiments, and multi-messenger observations. But they must also be designed with the same nuclear model for the high density, and the low density part of the star. Yet, non-unified equations of state can be abundantly found in the literature and in many simulations.

In this study, we show that one of the most commonly used analytical representation of cold and catalyzed equations of state is based on non-unified constructions, and leads to errors on macroscopic parameter modelling. In the spirit of Read et al. 2009, we provide piecewise polytropic fits for a set of 50 equations of state which are unified, and well calibrated by nuclear physics and astrophysics data.

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