Variational equation of state with realistic nuclear forces

EoS Submission Details

EoS name	Variational equation of state with realistic nuclear forces
category	nuclear
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Abstract

Equation of state (EoS) based on the variational many-body theory with realistic nuclear forces is provided. For uniform matter, the EoS is constructed with the cluster variational method starting from the Argonne v18 two-body nuclear potential and the Urbana IX three-body nuclear potential. Non-uniform nuclear matter is treated in the Thomas-Fermi approximation. Alpha particle mixing is also taken into account, see Ref. [1] for details.

References to the original work

1. *Nuclear equation of state for core-collapse supernova simulations with realistic nuclear forces*, H. Togashi, K. Nakazato, Y. Takehara, S. Yamamuro, H. Suzuki and M. Takano, Nucl. Phys. A 961 (2017) 78, arXiv:1702.05324 [nucl-th]

Nuclear Matter Properties[1]

	Quantity	Unit	
n_S	saturation density in symmetric matter	fm^{-3}	0.16
E_0	binding energy per baryon at saturation	MeV	-16.09
K	incompressibility	MeV	245
K'	skewness	MeV	0
J	symmetry energy	MeV	30.0
L	symmetry energy slope parameter	MeV	35
K_{sym}	symmetry incompressibility	MeV	0

	Quantity	Unit	
M_{max}	maximum mass	M_{sun}	2.21
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	M_{sun}	-
$R_{M_{max}}$	radius at maximum NS mass	km	10.19
$R_{1.4}$	radius at 1.4 M_{sun} NS mass	km	11.54

Neutron Star Properties[1]

eos.thermo

eos.thermo and the three grid defining files are CompOSE standard data files and by definition available.

table dimension	3
table type	1
total number of grid points	650650

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.1	398.1072	91
n_b	Baryon Nr Density	fm^{-3}	7.581427E-011	6.022141	110
Y_q	Charge Fraction		0.01	0.65	65

T, n_b, and Y_q are stored in eos.t, eos.nb, and eos.yq, respectively.

Further Available Data Files

Files and quantities listed in the following are provided beyond CompOSE's core requirements as outlined in Sec.4.2. of the CompOSE manual.

eos.compo : available

index	particle
10	neutron
	- end of table -

In addition data for one average heavy nucleus are provided.

[1] 0-values indicate, that the corresponding data is not provided.