

## Shen TM1e zero temperature

### EoS Submission Details

EoS name	Shen TM1e zero temperature
category	hadronic
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### Abstract

This table contains the zero-temperature version of the EoS of H. Shen, F. Ji, J. Hu and K. Sumiyoshi [1,2] using a non-linear relativistic mean-field model with the TM1 parametrization [3,4] of the effective interaction. Compared with the original version [5,6], a density dependent symmetry energy has been introduced [4]. Non-uniform nuclear matter is calculated in the single-nucleus Thomas-Fermi approximation with parametrized density distributions in spherical Wigner-Seitz cells. Only neutrons, protons,  $\alpha$  particles and a single heavy nucleus are considered. The present table was taken from the website <http://user.numazu-ct.ac.jp/~sumi/eos/> of K. Sumiyoshi.

### References to the original work

1. H. Shen, F. Ji, J. Hu, K. Sumiyoshi, submitted to *Astrophys. J.*, arXiv:2001.10143
2. K. Sumiyoshi, K. Nakazato, H. Suzuki, J. Hu, H. Shen, *Astrophys. J.* 887 (2019) 110
3. Y. Sugahara, H. Toki, *Nucl. Phys. A* 579 (1994) 557
4. S. S. Bao, J. N. Hu, Z. W. Zhang, and H. Shen, *Phys. Rev. C* 90 (2014) 045802
5. H. Shen, H. Toki, K. Oyamatsu, K. Sumiyoshi, *Prog. Theor. Phys.* 100 (1998) 1013
6. H. Shen, H. Toki, K. Oyamatsu, K. Sumiyoshi, *Nucl. Phys. A* 637 (1998) 435

## Nuclear Matter Properties<sup>1</sup>

	Quantity	Unit	
$n_S$	saturation density in symmetric matter	$\text{fm}^{-3}$	0.145
$E_0$	binding energy per baryon at saturation	MeV	16.3
$K$	incompressibility	MeV	281
$K'$	skewness	MeV	-285
$J$	symmetry energy	MeV	31.38
$L$	symmetry energy slope parameter	MeV	40.
$K_{sym}$	symmetry incompressibility	MeV	3.57

## Neutron Star Properties<sup>1</sup>

	Quantity	Unit	
$M_{max}$	maximum mass	$M_{sun}$	2.12
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o $\mu^-$	$M_{sun}$	2.06
$R_{M_{max}}$	radius at maximum NS mass	km	11.8
$R_{1.4}$	radius at 1.4 $M_{sun}$ NS mass	km	13.1
$\tilde{\Lambda}$	tidal deformability GW170817 at $q = M_1/M_2 = 0.8$		740

<sup>1</sup>0-values indicate, that the corresponding data is not provided.

## **eos.thermo**

eos.thermo and the three grid defining files are CompOSE standard data files and by definition available. eos.thermo does not necessarily provide all possible data.

table dimension            3  
table type                 1  
total number of grid points   7150

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.	0.	1
$n_b$	Baryon Nr Density	$\text{fm}^{-3}$	0.75814210E-10	0.60221370E+01	110
$Y_q$	Charge Fraction		0.10000000E-01	0.65000000E+00	65

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

## **additional quantities in eos.thermo**

none defined

## **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	n
11	p
4002	${}^4_2\text{He}$
	- end of table -

Further particle sets are defined. One set of quadruples for an average heavy nucleus. See Table 7.2 of the CompOSE manual.

**eos.micro** : available

index	quantity	particle
10041	Dirac effective mass divided by particle mass $m_i^D/m_i$	n
11041	Dirac effective mass divided by particle mass $m_i^D/m_i$	p
	- end of table -	