

TM1e

EoS Submission Details

EoS name	TM1e
category	Inner crust-core unified EoS
submitted by	Helena Pais
affiliation	University of Coimbra
e-mail contact	hpais@uc.pt
sheet creation date	November 10, 2021

Abstract

This inner crust-core unified EoS for β -equilibrium matter at zero temperature is constructed with a BPS outer crust [1] below $n_B = 2 \times 10^{-3} \text{ fm}^{-3}$, an inner crust EoS, including nonspherical pasta phases, calculated within a self-consistent Thomas-Fermi approach [2], and a homogeneous $npe\mu$ core EoS, above $n_B = 0.89 \times 10^{-1} \text{ fm}^{-3}$. The EoS parameterisation used was the non-linear RMF TM1e model [3].

References to the original work

1. G. Baym, C. Pethick, and P. Sutherland, *Astrophys. J.* **170**, 299 (1971).
2. F. Grill. H. Pais, C. Providência, I. Vidaña, and S. Avancini, *Phys. Rev. C* **90**, 045803 (2014).
3. H. Shen, F. Ji, J. Hu, and K. Sumiyoshi, *Astrophys. J.* **891**, 148 (2020).

Nuclear Matter Properties¹

	Quantity	Unit	
n_S	saturation density in symmetric matter	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	31.4
L	symmetry energy slope parameter	MeV	40
K_{sym}	symmetry incompressibility	MeV	3.57

Neutron Star Properties¹

	Quantity	Unit	
M_{max}	maximum mass	M_{sun}	2.12
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	M_{sun}	0
$R_{M_{max}}$	radius at maximum NS mass	km	11.88
$R_{1.4}$	radius at 1.4 M_{sun} NS mass	km	13.16
$\tilde{\Lambda}$	tidal deformability for GW170817 at a mass ratio of $q = 0.8$	-	770.15

eos.thermo

eos.thermo and the three grid defining files are CompOSE standard data files and by definition available. In eos.thermo, an extra quantity is added (last column). It refers to the geometry of the correspondent pasta phase, represented by an integer, with 0 for the outer crust, and 1 - droplets, 2 - rods, 3 - slabs, 4- tubes, 5- bubbles, and 6 corresponds to the core (homogeneous matter).

table dimension 1
table type 1
total number of grid points 285

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0	0	1
n_b	Baryon Nr Density	fm^{-3}	0.6295×10^{-11}	3.4625	285
Y_q	Charge Fraction		0	0	1

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

¹0-values indicate that the corresponding data is not provided.

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.mr : This file provides the gravitational mass (in solar masses), the radius (in km), and the tidal deformability of a family of stars computed for this unified inner-crust-core RMF EoS model, with the BPS outer crust.

eos.compo : not available

eos.micro : not available