

# DDME2

## EoS Submission Details

|                     |                       |
|---------------------|-----------------------|
| EoS name            | DDME2                 |
| category            | Inner crust           |
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| sheet creation date | April 26, 2023        |

## Abstract

This inner crust EoS, including nonspherical pasta phases, was calculated within a self-consistent Thomas-Fermi approach [1] for  $\beta$ -equilibrium matter at zero temperature. This EoS was published in Ref.[1]. The EoS parameterisation used was the density-dependent RMF DDME2 model [2]. Matched to model BsK22 [3] for the description of the outer crust below  $n_B = 2 \times 10^{-3} \text{ fm}^{-3}$ .

## References to the original work

1. F. Grill. H. Pais, C. Providência, I. Vidaña, and S. Avancini, Phys. Rev. C **90**, 045803 (2014).
2. G. A. Lalazissis, T. Niksić, D. Vretenar, and P. Ring, Phys. Rev. C **71**, 024312 (2005).
3. J. M. Pearson, N. Chamel, A. Y. Potekhin, A. F. Fantina, C. Ducoin, A. K. Dutta, and S. Goriely, MNRAS **481**, 2994 (2018); <https://compose.obspm.fr/eos/210>

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

|           | Quantity                                | Unit             |        |
|-----------|-----------------------------------------|------------------|--------|
| $n_S$     | saturation density in symmetric matter  | $\text{fm}^{-3}$ | 0.152  |
| $E_0$     | binding energy per baryon at saturation | MeV              | -16.14 |
| $K$       | incompressibility                       | MeV              | 251    |
| $K'$      | skewness                                | MeV              | 479    |
| $J$       | symmetry energy                         | MeV              | 32.3   |
| $L$       | symmetry energy slope parameter         | MeV              | 51     |
| $K_{sym}$ | symmetry incompressibility              | MeV              | -87.2  |

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

|                   | Quantity                                                      | Unit             |        |
|-------------------|---------------------------------------------------------------|------------------|--------|
| $M_{max}$         | maximum mass                                                  | $M_{\text{sun}}$ | 2.488  |
| $M_{DU,e}$        | mass at DUrca threshold (1/9) w/o $\mu^-$                     | $M_{\text{sun}}$ | 0      |
| $R_{M_{max}}$     | radius at maximum NS mass                                     | km               | 12.15  |
| $R_{1.4}$         | radius at 1.4 $M_{\text{sun}}$ NS mass                        | km               | 13.23  |
| $\tilde{\Lambda}$ | tidal deformability for GW170817 at a mass ratio of $q = 0.8$ | -                | 802.46 |

## 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    288

Range and density (#) of the grid parameters:

|       | Quantity          | Unit             | min                       | max                   | #   |
|-------|-------------------|------------------|---------------------------|-----------------------|-----|
| T     | Temperature       | MeV              | 0                         | 0                     | 1   |
| $n_b$ | Baryon Nr Density | $\text{fm}^{-3}$ | $0.467962 \times 10^{-9}$ | $0.72 \times 10^{-1}$ | 288 |
| $Y_q$ | Charge Fraction   |                  | 0                         | 0                     | 1   |

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

<sup>1</sup>0-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 BsK22 outer crust.

**eos.compo** : available  
4 particle pairs (neutrons, protons, electrons, muons) and one quadruple for heavy nucleus.

Phase index # 0: outer crust

Phase index # 7: inner crust

Phase index # 6: homogeneous matter

**eos.micro** : not available