

# BHF calculation with chiral forces with crust EoS

## EoS Submission Details

EoS name	BHF calculation with chiral forces with crust EoS
category	Hadronic
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## Abstract

Microscopic equation of state (EoS) of dense  $\beta$ -stable nuclear matter at zero temperature ( $T=0$ ) obtained using realistic two-body and three-body nuclear interactions derived in the framework of chiral perturbation theory (ChPT) and including the  $\Delta(1232)$  isobar intermediate state. This EoS has been derived using the Brueckner-Bethe-Goldstone quantum many-body theory in the Brueckner-Hartree-Fock approximation with the continuous choice for the auxiliary single particle potential.

The present table is relative to the nuclear interaction model denoted as N3LO $\Delta$  + N2LO $\Delta$ 1 in Ref. [1]. It contains the contributions from electrons and muons in addition to  $\beta$ -stable nuclear matter. Below  $n_B = 0.08 \text{ fm}^{-3}$  the crust from Douchin and Haensel [2] has been added.

## References to the original work

1. I. Bombaci and D. Logoteta, *Astron. and Astrophys.* 609. A128 (2018)
2. F. Douchin, P. Haensel, *Astronomy and Astrophysics* **380**, 151 (2001).

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

	Quantity	Unit	
$n_S$	saturation density in symmetric matter	$\text{fm}^{-3}$	0.171
$E_0$	binding energy per baryon at saturation	MeV	15.23
$K$	incompressibility	MeV	190
$K'$	skewness	MeV	0
$J$	symmetry energy	MeV	35.39
$L$	symmetry energy slope parameter	MeV	76
$K_{sym}$	symmetry incompressibility	MeV	0

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

	Quantity	Unit	
$M_{max}$	maximum mass	$M_{\text{sun}}$	2.08
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o $\mu^-$	$M_{\text{sun}}$	0.961
$R_{M_{max}}$	radius at maximum NS mass	km	10.26
$R_{1.4}$	radius at 1.4 $M_{\text{sun}}$ NS mass	km	12.31
$\tilde{\Lambda}$	tidal deformability GW170817 at $q = M_1/M_2 = 0.8$		466

## eos.thermo

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

```
table dimension      1
table type          1
total number of grid points 214
```

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0	0	1
$n_b$	Baryon Nr Density	$\text{fm}^{-3}$	7.92E-15	1.2943	283
$Y_q$	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.compo** : available

index	particle
0	e
1	$\mu$
10	n
11	p
	- end of table -