GRDF2(DD2)

EoS Submission Details

EoS name	GRDF2(DD2)
category	hadronic
submitted by	Stefan Typel
affiliation	IKP, Technische Universität Darmstadt
e-mail contact	s.typel(at)gsi.de
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Abstract

This hadronic EoS table is calculated with a generalized relativistic density fuctional (GRDF) based on a relativistic mean-field model of nuclear matter with density dependent nucleon-meson couplings using the functional dependence introduced in [5] and the parametrisation DD2 [3]. See [1,2,3,4] for details of the EoS model. Besides nucleons, electrons and muons with experimental masses, photons and nuclei are included as degrees of freedom. Two-nucleon correlations in the continuum are considered as effective resonances with medium dependent properties [6]. The dissolution of nuclei is described with the help of medium dependent mass shifts with a modified parametrization as compared to the GRDF1(DD2) model. Masses of nuclei are taken from the 2016 Atomic mass evaluation [7] if available. For other nuclei the predictions of the DZ31 model [8] are used.

References to the original work

1. S. Typel,
   J. Phys. G **45** (2018) 11400.
   doi:10.1088/1361-6471/aadea5

2. H. Pais and S. Typel,
   Comparison of equation of state models with different cluster dissolution mechanisms, in *Nuclear Particle Correlations and Cluster Physics*, edited by W. U. Schröder (World Scientific, Singapore) 2017, pp. 95-132.
   doi:10.1142/9789813209350_0004

3. S. Typel, G. Röpke, T. Klähn, D. Blaschke, and H. H. Wolter,
   Phys. Rev. C **81** (2010) 015803.
   doi:10.1103/PhysRevC.81.015803

4. S. Typel S., H. H. Wolter, G. Röpke, and D. Blaschke,
   Eur. Phys. J. A **50** (2014) 17.
   doi:10.1140/epja/i2014-14017-x

Further References

5. S. Typel and H. H. Wolter,
   Nucl. Phys. A **656** (1999) 331.
   doi:10.1016/S0375-9474(99)00310-3

6. M. D. Voskresenskaya and S. Typel,
   Nucl. Phys. A **887** (2012) 42.
   doi:10.1016/j.nuclphysa.2012.05.006

7. M. Wang, G. Audi, F. G. Kondev, W. J. Huang, S. Naimi, and X. Xu,
   Chinese Physics C **41** (2017) 030003.

8. J. Duflo and A. P. Zuker,
   Phys. Rev. C **52** (1995) R23.
   doi:10.1103/PhysRevC.52.R23

Nuclear Matter Properties[1]

	Quantity	Unit	
n_S	saturation density in symmetric matter	fm^{-3}	0.149
E_0	binding energy per baryon at saturation	MeV	16.02
K	incompressibility	MeV	242.7
Q	skewness	MeV	168.8
J	symmetry energy	MeV	31.67
L	symmetry energy slope parameter	MeV	55.04
K_{sym}	symmetry incompressibility	MeV	-93.23

Neutron Star Properties[1]

	Quantity	Unit	
M_{max}	maximum mass	M_{sun}	2.42
$M_{DU,e}$	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	13.19
$\tilde{\Lambda}$	tidal deformability GW170817 at $q = M_1/M_2 = 0.8$		789

[1] 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	1830080

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.1	100	76
n_b	Baryon Number Density	fm^{-3}	1.E-012	1.0	301
Y_q	Charge Fraction		0.01	0.80	80

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
0	e^-
1	μ^-
10	n
11	p
700	nn($^1S_0$) continuum correlations
701	np($^1S_0$) continuum correlations
702	pp($^1S_0$) continuum correlations
2001	$^1_2$H
3001	$^1_3$H
3002	$^2_3$He
4002	$^2_4$He
	- end of table -

The tabulated particle number fractions of nucleons and leptons are net quantities, i.e., they are given by the difference of the corresponding particle and anti-particle fractions. The ^{2}H fraction includes contributions from the deuteron bound state and continuum correlations in the np($^3S_1$) channel. A further particle set is defined. One set of quadruples gives the properties of a average heavy nucleus.

index	particle
0	set of all nuclei except those listed in the table above
	- end of table -

eos.micro: available

index	quantity	particle
10051	relativistic vector self-energy V_i [MeV]	n
10052	relativistic scalar self-energy S_i [MeV]	n
11051	relativistic vector self-energy V_i [MeV]	p
11052	relativistic scalar self-energy S_i [MeV]	p
	- end of table -	

Description of Phases

The table contains the locally calculated EoS data without performing a phase transition construction.

phase index	description
0	mixture of all particles