DD2F-SF quark-hadron model RDF 1.3 without leptons

EoS Submission Details

EoS name	DD2F-SF quark-hadron model RDF 1.3 without leptons
category	hybrid
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Abstract

RDF 1.3 is from a set of equation of state models with a first-order phase transition from hadron to quark matter presented in Ref. [1]. This publication focuses on the super-saturated regime and for the treatment of nuclear clusters below saturation on the nuclear statistical equilibrium with excluded volume approach of Hempel and Schaffner-Bielich [2]. The relativistic density function approach, which is used for the high density regime and in particular the string-flip model for quarks was introduced in Ref. [3] with applications to neutron star configurations. The current extension of this model to finite temperature and arbitrary chargefractions was successfully applied to core-collapse supernova simulations [4] and binary neutron star merger simulations [5-7].

On the website of the author[1] you will find further information about the provided data, and the data in different formats. Please feel free to contact the author, if you run into problems with these tabulations.

[1] https://eos.bastian.science

References to the original work

1. N.-U. F. Bastian, Phys. Rev. D 103.2, p. 023001 (2021).
   doi: 10.1103/PhysRevD.103.023001.

2. M. Hempel and J. Schaffner-Bielich, Nucl. Phys. A 837 (2010) 210.
   doi: 10.1016/j.nuclphysa.2010.02.010

Further References

3. M. A. R. Kaltenborn, N.-U. F. Bastian, and D. B. Blaschke, Phys. Rev. D 96, 056024.
   doi: 10.1103/PhysRevD.96.056024.

4. T. Fischer, N.-U. F. Bastian, M.-R. Wu, P. Baklanov, E. Sorokina, S. Blinnikov, S. Typel, T. Klähn, D. B. Blaschke, Nature Astronomy 2, 980–986 (2018),
   doi: 10.1038/s41550-018-0583-0

5. Andreas Bauswein, Niels-Uwe F. Bastian, David B. Blaschke, Katerina Chatziioannou, James A. Clark, Tobias Fischer, and Micaela Oertel, Phys. Rev. Lett. 122, 061102 (2019),
   doi: 10.1103/PhysRevLett.122.061102

6. Andreas Bauswein, Sebastian Blacker, Vimal Vijayan, Nikolaos Stergioulas, Katerina Chatziioannou, James A. Clark, Niels-Uwe F. Bastian, David B. Blaschke, Mateusz Cierniak, and Tobias Fischer, Phys. Rev. Lett. 125, 141103 (2020),
   doi: 10.1103/PhysRevLett.125.141103

7. Sebastian Blacker, Niels-Uwe F. Bastian, Andreas Bauswein, David B. Blaschke, Tobias Fischer, Micaela Oertel, Theodoros Soultanis, and Stefan Typel, Phys. Rev. D 102, 123023 (2020),
   doi: 10.1103/PhysRevD.102.123023

Nuclear Matter Properties[2]

	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
K'	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[2]

	Quantity	Unit	
M_{max}	maximum mass	M_{sun}	2.02
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	M_{sun}	N/A
$R_{M_{max}}$	radius at maximum NS mass	km	N/A
$R_{1.4}$	radius at 1.4 M_{sun} NS mass	km	N/A

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	1142100

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.1E+00	0.15848932E+03	81
n_b	Baryon Nr Density	fm^{-3}	0.1E-11	0.1E+02	235
Y_q	Charge Fraction		0.10000000E-01	0.60000000E+00	60

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

[2]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
10	n
11	p
4002	${}^{2}_{4}$He
3002	${}^{2}_{3}$He
3001	${}^{1}_{3}$H
2001	${}^{1}_{2}$H
500	u
501	d
	- end of table -

The listed particle number fractions are net fractions, i.e., they are given by the difference between the correspoding particle and anti-particle fractions. Further particle sets are defined.

index	description
999	Average fraction, mass and proton number for all nuclei not listed above
	- end of table -

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
500041	Dirac effective mass divided by particle mass m_i^D/m_i	u
501041	Dirac effective mass divided by particle mass m_i^D/m_i	d
10051	relativistic vector self-energy V_i	n
11051	relativistic vector self-energy V_i	p
500051	relativistic vector self-energy V_i	u
501051	relativistic vector self-energy V_i	d
	- end of table -	