BHBΛ

EoS Submission Details

EoS name	BHBΛ
category	hadronic
submitted by	Matthias Hempel
affiliation	Universität Basel
e-mail contact	matthias.hempel(at)unibas.ch
sheet creation date	April 25, 2014

Abstract

This is the hadronic EOS table of Ref. [1], which is based on the statistical model of Hempel and Schaffner-Bielich [2] with RMF interactions DD2 [3] and which has been extended by lambda hyperons [1]. Contributions of neutrons, anti-neutrons, protons, anti-protons, lambdas, anti-lambdas, nuclei, electrons, positrons, and photons are included. For the masses of nuclei, FRDM [4] was used. The manual from the web page

  `http://phys-merger.physik.unibas.ch/~hempel/eos.html`

gives further information about the EOS table. On this web page, also routines are available which allow to determine the abundances of all nuclei for all conditions.

References to the original work

1. S. Banik, M. Hempel, and D. Bandyopadhyay, (2014), arXiv:1404.6173.

2. M. Hempel and J. Schaffner-Bielich, Nucl. Phys. A **837** (2010) 210.

3. S. Typel, G. Röpke, T. Klähn, D. Blaschke, and H.H. Wolter, Phys. Rev. C **81** (2010) 015803.

4. P. Möller, J.R. Nix, and K.-L. Kratz, Atomic Data and Nuclear Data Tables **66** (1997) 131.

Further References

Nuclear Matter Properties[1]

	Quantity	Unit	
n_S	saturation density in symmetric matter	fm^{-3}	0.1491
E_0	binding energy per baryon at saturation	MeV	16.02
K	incompressibility	MeV	242.7
K'	skewness	MeV	168.7
J	symmetry energy	MeV	31.67
L	symmetry energy slope parameter	MeV	55.03
K_{sym}	symmetry incompressibility	MeV	-93.2

Neutron Star Properties[1]

	Quantity	Unit	
M_{max}	maximum mass	M_{sun}	1.95
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	M_{sun}	0
$R_{M_{max}}$	radius at maximum NS mass	km	11.75
$R_{1.4}$	radius at 1.4 M_{sun} NS mass	km	13.22

---

[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 <u>not</u> necessarily provide all possible data.

table dimension	3
table type	1
total number of grid points	1462860

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.1	158.48932	81
n_b	Baryon Nr Density	fm^{-3}	1.0E-12	1.0	301
Y_q	Charge Fraction		0.01	0.60	60

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^-
10	n
4002	$^4_2$He
11	p
3002	$^3_2$He
3001	$^3_1$H
2001	$^2_1$H
100	Λ
	- end of table -

The listed particle number fractions of electrons, protons, neutrons, and lambdas are net fractions, i.e., they are given by the difference between the corresponding particle and anti-particle number density.

Further particle sets are defined. One set of quadruples for an average "heavy" nucleus, see Table 7.2 of the manual.

index	description
999	group of all other considered nuclei which are not listed above (averaged)
	- 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
100041	Dirac effective mass divided by particle mass m_i^D/m_i	Λ
	- end of table -	

Description of Phases

Fill this part briefly, in particular if several phases occur. In this latter case characterize the transition(s).

PHASE INDEX #1:
NSE phase, i.e., a mixture of nuclei and nucleons

PHASE INDEX #3:
pure RMF, only nucleons, no lambdas

PHASE INDEX #2:
Maxwell transition region between phase 1 and 3, assuming local charge neutrality and locally fixed Y_e.

PHASE INDEX #4:
pure RMF, nucleons and lambdas