Lattimer-Swesty 220 with Λ-hyperons

EoS Submission Details

EoS name	Lattimer-Swesty 220 with Λ-hyperons
category	hadronic
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sheet creation date	March 19, 2021

Abstract

This EoS is an extension of the EoS by Lattimer and Swesty [2], including the Λ-hyperon as additional particle [1,5]. The hyperon-nucleon and hyperon-hyperon interaction is taken from the model by Balberg and Gal [6], which is similar to the nucleon-nucleon interaction of Lattimer and Swesty [2], i.e. a momentum-independent Skyrme type non-relativistic effective interaction. Photons and electrons/positrons are included as a free gas. The low density extension, below the validity range of the original Lattimer and Swesty EoS is based on a nuclear statistical equilibrium model, see Ref. [5]. Further details can be found in Refs. [1,3,5]. A first application in the supernova context is described in Ref. [4].

References to the original work

1. F. Gulminelli, A. .R. Raduta, M. Oertel and J. Margueron, Phys. Rev. C **87** (2013) 05580

2. J. M. Lattimer and F. D. Swesty, Nucl. Phys. A **535** (1991) 331.

Further References

3. F. Gulminelli, A. .R. Raduta and M. Oertel, Phys. Rev. C **86** (2012) 025805.

4. B. Peres, M. Oertel and J. Novak, Phys. Rev. D **87** (2013) 043006.

5. M. Oertel, A. F. Fantina and J. Novak, Phys. Rev. C **85** (2012) 055806.

6. S. Balberg and A. Gal, Nucl. Phys. A **625** (1997) 435.

Nuclear Matter Properties[1]

	Quantity	Unit	
n_S	saturation density in symmetric matter	fm^{-3}	0.155
E_0	binding energy per baryon at saturation	MeV	16.0
K	incompressibility	MeV	220
K'	skewness	MeV	411
J	symmetry energy	MeV	29.3
L	symmetry energy slope parameter	MeV	74
K_{sym}	symmetry incompressibility	MeV	-24

Neutron Star Properties[1]

	Quantity	Unit	
M_{max}	maximum mass	$\mathrm{M_{sun}}$	1.91
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	$\mathrm{M_{sun}}$	1.90
$R_{M_{max}}$	radius at maximum NS mass	km	9.28
$R_{1.4}$	radius at 1.4 $\mathrm{M_{sun}}$ NS mass	km	12.41

[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	2128128

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.10471285E+00	0.18197009E+03	163
n_b	Baryon Nr Density	fm^{-3}	0.10000000E-11	0.11937766E+02	256
Y_q	Charge Fraction		0.30000000E-01	0.50000000E+00	51

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

additional quantities in eos.thermo

Sound speed squared in units of c^2

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
0	e^{-}
100	Λ
	- end of table -

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

index	description
	- end of table -

eos.micro : available

index	quantity	particle
10040	Landau effective mass divided by particle mass m_i^L/m_i	n
11040	Landau effective mass divided by particle mass m_i^L/m_i	p
10050	non-relativistic single-particle potential U_i [MeV]	n
11050	non-relativistic single-particle potential U_i [MeV]	p
100050	non-relativistic single-particle potential U_i [MeV]	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 #5:

Phase coexistence region of the transition to hyperonic matter, see Ref. [1,3]. The coexistence region is treated by a Gibbs construction.