Lattimer-Swesty 220

EoS Submission Details

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

Abstract

This table contains the EoS by Lattimer and Swesty [1] with compression modulus $K = 220$ MeV. The nuclear interaction is an effective non-relativistic Skyrme type model without momentum dependence. Within the inhomogeneous phase at low density, nuclei are supposed to arrange themselves in a body centered cubic lattice which maximizes the separation of ions. According to the Wigner-Seitz approximation, each ion is at the center of a neutral-charged cell, surrounded by a gas of free nucleons, α-particles and electrons. Interactions between the outside gas and the nuclei are taken into account through an excluded volume. Nucleons are treated as non-relativistic particles; α-particles as hard spheres of volume $v_\alpha = 24$ fm^3 forming an ideal Boltzmann gas. As the density increases, nuclei undergo geometrical shape deformations, until they dissolve in favor of homogeneous nuclear matter above approximately saturation density. The formation of non-spherical nuclei is described by modifying the Coulomb and surface energies of nuclei, as discussed in Section 2.8 of Ref. [1]. The transition to bulk nuclear matter is treated by a Maxwell construction. The configuration of matter and the balance between the different phases is given by the thermodynamically most favorable state, i.e. the one which minimizes the Helmholtz free energy of the system. This procedure, minimizing the free energy, guarantees that the LS EOS is thermodynamically consistent. Further details can be found in Ref. [1]. The web page *http://www.astro.sunysb.edu/dswesty/lseos.html* contains additional information as well as the original code for downloading.

References to the original work

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

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	M_{sun}	2.06
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	M_{sun}	1.36
$R_{M_{max}}$	radius at maximum NS mass	km	10.67
$R_{1.4}$	radius at 1.4 M_{sun} NS mass	km	12.71

[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	1363332

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}	0.52233451E-07	0.11937766E+02	164
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^-
	- 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
	- end of table -	

Description of Phases

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