HShen + quarks B165

EoS Submission Details

EoS name	HShen + quarks B165
category	hybrid
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Abstract

This table contains the EoS of H. Shen, F. Yang, H. Toki, K. Oyamatsu, and K. Sumiyoshi [1,2] including a transition to quark matter [3,4,5] using a non-linear relativistic mean-field model with the TM1 parametrization [6] of the effective interaction and a bag model for the quark phase with a bag constant of $B^{1/4} = 165$ MeV and $\alpha_s = 0$. The transition from the hadronic to the quark phase is done via a Gibbs construction. Non-uniform nuclear matter is calculated in the single-nucleus Thomas-Fermi approximation with parametrized density distributions in spherical Wigner-Seitz cells. Only neutrons, protons, α-particles and a single heavy nucleus are considered. The present table was taken from the website `http://pages.iu.edu/isagert/hybrid_eos.dir/` of I. Sagert. Contributions from electrons/positrons and photons have been added to the original table.

References to the original work

1. H. Shen, H. Toki, K. Oyamatsu, K. Sumiyoshi, Prog. Theor. Phys. 100 (1998) 1013.
2. H. Shen, H. Toki, K. Oyamatsu, K. Sumiyoshi, Nucl. Phys. A 637 (1998) 435.
3. I. Sagert, T. Fischer, M. Hempel, G. Pagliara, J. Schaffner-Bielich, A. Mezzacappa, F.-K. Thielemann, M. Liebendörfer Phys. Rev. Lett. 102 (2009) 081101.
4. I. Sagert, T. Fischer, M. Hempel, G. Pagliara, J. Schaffner-Bielich, F.-K. Thielemann, M. Liebendörfer, Journ. of Phys. G 37 (2010) 094064.
5. T. Fischer, I. Sagert, G. Pagliara, M. Hempel, J. Schaffner-Bielich, T. Rauscher, F.-K. Thielemann, R. Käppeli, G. Martnez-Pinedo, M. Liebendörfer, ApJ 194 (2011) 39.

Further References

6. Y. Sugahara, H. Toki, Nucl. Phys. A 579 (1994) 557

Nuclear Matter Properties[1]

	Quantity	Unit	
n_S	saturation density in symmetric matter	fm^{-3}	0.145
E_0	binding energy per baryon at saturation	MeV	16.3
K	incompressibility	MeV	281
K'	skewness	MeV	-285
J	symmetry energy	MeV	36.9
L	symmetry energy slope parameter	MeV	110.8
K_{sym}	symmetry incompressibility	MeV	33.6

Neutron Star Properties[1]

	Quantity	Unit	
M_{max}	maximum mass	$\mathrm{M_{sun}}$	1.51
$M_{DU,e}$	mass at DUrca threshold (1/9) w/o μ^-	$\mathrm{M_{sun}}$	0
$R_{M_{max}}$	radius at maximum NS mass	km	8.86
$R_{1.4}$	radius at 1.4 $\mathrm{M_{sun}}$ NS mass	km	9.06

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	3
total number of grid points	674310

Range and density (#) of the grid parameters:

	Quantity	Unit	min	max	#
T	Temperature	MeV	0.1	398.1072	91
n_b	Baryon Nr Density	fm^{-3}	7.581391E-11	15.12693	114
Y_q	Charge Fraction		0.01	0.65	65

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

[1] 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
0	e^-
500	up quarks
501	down quarks
502	strange quarks
	- end of table -

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

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
	- end of table -	

Description of Phases

PHASE INDEX #5:

Phase coexistence region of the transition to quark matter, see Ref. [3-5]. The coexistence region is treated by a Gibbs construction. The phase index is 0 for the hadronic phase, 1 in the pure quark phase and 2 in the coexistence region.