# Tsiopelas-Sedrakian-Oertel/DDLS(30)-Y

## EoS Submission Details

| | |
|---|---|
| EoS name | Tsiopelas-Sedrakian-Oertel |
| EoS short name | DDLS(30)-Y |
| category | Hadronic |
| submitted by | Stefanos Tsiopelas |
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## Abstract

This general-purpose hadronic EoS table, based on the work of Ref. [1], is generated by following the covariant density functional (CDF) approach. The high-density phase includes the full $J^P = 1/2^+$ baryon octet, in which the coupling constants of the baryons are density-dependent (DD), selected appropriately so that the slope of the symmetry energy is $L_{\rm sym} = 30$ MeV and the skewness equals $Q_{\rm sat} = 400$ MeV, using the DDLS family of parametrizations [2]. The extension to lower densities was done by matching to the low-density HS(DD2) model [3], which is developed through an improved nuclear statistical equilibrium among nucleons and nuclear clusters.

## References to the original work

1. S. Tsiopelas, A. Sedrakian, M. Oertel, Eur. Phys. J. A **60**, 127 (2024).

## Further References

2. J.-J. Li and A. Sedrakian, Astrophys. J. **957**, 41 (2023).

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

## Nuclear Matter Properties[1]

| | Quantity | Unit | |
|---|---|---|---|
| $n_S$ | saturation density in symmetric matter | $\mathrm{fm}^{-3}$ | 0.152 |
| $E_0$ | binding energy per baryon at saturation | MeV | 16.14 |
| $K$ | incompressibility | MeV | 251 |
| $K'$ | skewness | MeV | 400 |
| $J$ | symmetry energy | MeV | 30.10 |
| $L$ | symmetry energy slope parameter | MeV | 30 |
| $K_{sym}$ | symmetry incompressibility | MeV | 0 |

## Neutron Star Properties[1]

| | Quantity | Unit | |
|---|---|---|---|
| $M_{max}$ | maximum mass | $\mathrm{M}_{sun}$ | 2.02 |
| $M_{DU,e}$ | mass at DUrca threshold (1/9) w/o $\mu^-$ | $\mathrm{M}_{sun}$ | 0 |
| $R_{M_{max}}$ | radius at maximum NS mass | km | 11.82 |
| $R_{1.4}$ | radius at 1.4 $\mathrm{M}_{sun}$ NS mass | km | 12.87 |
| $\tilde{\Lambda}$ | tidal deformability for GW170817 at a mass ratio of $q = 0.8$ | | 0 |

[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. *Explain here thermodynamic quantities you provide in eos.thermo which are not obligatory.*

| | |
|---|---|
| table dimension | 3 |
| table type | 1 |
| total number of grid points | 1472580 |

Range and density (#) of the grid parameters:

| | Quantity | Unit | min | max | # |
|---|---|---|---|---|---|
| T | Temperature | MeV | 1.00000000E-01 | 1.58489320E+02 | 81 |
| $n_b$ | Baryon Nr Density | $fm^{-3}$ | 9.99999999E-013 | 1.20226440E+00 | 303 |
| $Y_q$ | Charge Fraction | | 1.00000000E-02 | 6.00000000E-01 | 60 |

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

### 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 |
| 11 | p |
| 100 | $\Lambda$ |
| 110 | $\Sigma^-$ |
| 111 | $\Sigma^0$ |
| 112 | $\Sigma^+$ |
| 120 | $\Xi^-$ |
| 121 | $\Xi^0$ |
| 2001 | $^2_1$H |
| 3001 | $^3_1$H |
| 3002 | $^3_2$He |
| 4002 | $^4_2$He |
| - end of table - | |

One further set of quadruples for an average "heavy" nucleus has been defined.

| index | particle |
|---|---|
| 999 | group of all other nuclei 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 $m_i^D/m_i$ | $\Lambda$ |
| 110041 | Dirac effective mass divided by particle mass $m_i^D/m_i$ | $\Sigma^-$ |
| 111041 | Dirac effective mass divided by particle mass $m_i^D/m_i$ | $\Sigma^0$ |
| 112041 | Dirac effective mass divided by particle mass $m_i^D/m_i$ | $\Sigma^+$ |
| 120041 | Dirac effective mass divided by particle mass $m_i^D/m_i$ | $\Xi^-$ |
| 121041 | Dirac effective mass divided by particle mass $m_i^D/m_i$ | $\Xi^0$ |
| | - end of table - | |