

GYRE Stellar Model (GSM) Format

GSM-format files store data describing a stellar model in an HDF5 file. There are a number of variants of this format, which can be distinguished by the presence and/or value of the **version** attribute.

Version 0.00

The root group attributes and datasets of version-0.00 GSM files are as follows:

| Variable | Object name | (A)tttribute / (D)ataset | Object datatype | Definition |
|-----------------------|-------------|-----------------------------|-----------------|---|
| R_* | R_star | A | H5T_IEEE_F64LE | Stellar radius (cm) |
| M_* | M_star | A | H5T_IEEE_F64LE | Stellar mass (g) |
| L_* | L_star | A | H5T_IEEE_F64LE | Stellar luminosity (erg s^{-1}) |
| n | n | A | H5T_STD_I64LE | Number of grid points |
| r | r | D | H5T_IEEE_F64LE | Radius (cm) |
| w | w | D | H5T_IEEE_F64LE | $M_r/(M_* - M_r)$ |
| L_r | L_r | D | H5T_IEEE_F64LE | Luminosity (erg s^{-1}) |
| p | p | D | H5T_IEEE_F64LE | Total pressure (dyn cm^{-2}) |
| T | T | D | H5T_IEEE_F64LE | Temperature (K) |
| ρ | rho | D | H5T_IEEE_F64LE | Density (g cm^{-3}) |
| N^2 | N2 | D | H5T_IEEE_F64LE | Brunt-Väisälä frequency squared (s^{-2}) |
| Γ_1 | Gamma_1 | D | H5T_IEEE_F64LE | $(\partial \ln p / \partial \ln \rho)_{\text{ad}}$ |
| ∇_{ad} | nabla_ad | D | H5T_IEEE_F64LE | $(d \ln T / d \ln p)_{\text{ad}}$ |
| δ | delta | D | H5T_IEEE_F64LE | $-(\partial \ln \rho / \partial \ln T)_p$ |
| ∇ | nabla | D | H5T_IEEE_F64LE | $d \ln T / d \ln p$ |
| κ | kappa | D | H5T_IEEE_F64LE | Opacity ($\text{cm}^2 \text{g}^{-1}$) |
| κ_T | kappa_T | D | H5T_IEEE_F64LE | $(\partial \ln \kappa / \partial \ln T)_\rho$ |
| κ_ρ | kappa_rho | D | H5T_IEEE_F64LE | $(\partial \ln \kappa / \partial \ln \rho)_T$ |
| ϵ | epsilon | D | H5T_IEEE_F64LE | Energy generation rate ($\text{erg s}^{-1} \text{g}^{-1}$) |
| ϵ_T | epsilon_T | D | H5T_IEEE_F64LE | $(\partial \epsilon / \partial \ln T)_\rho$ ($\text{erg s}^{-1} \text{g}^{-1}$) |
| ϵ_ρ | epsilon_rho | D | H5T_IEEE_F64LE | $(\partial \epsilon / \partial \ln \rho)_T$ ($\text{erg s}^{-1} \text{g}^{-1}$) |
| Ω_{rot} | Omega_rot | D | H5T_IEEE_F64LE | Rotation angular velocity (rad s^{-1}) |

Version 1.00

The root group attributes and datasets of version-1.00 GSM files are as follows:

Note that the definitions of κ_T and κ_ρ are slightly different than in previous versions.

| Variable | Object name | (A)tttribute / (D)ataset | Object datatype | Definition |
|-----------------------|-------------|-----------------------------|-----------------|---|
| version $\times 100$ | version | A | H5T_STD_I32LE | 100 |
| R_* | R_star | A | H5T_IEEE_F64LE | Stellar radius (cm) |
| M_* | M_star | A | H5T_IEEE_F64LE | Stellar mass (g) |
| L_* | L_star | A | H5T_IEEE_F64LE | Stellar luminosity (erg s^{-1}) |
| n | n | A | H5T_STD_I64LE | Number of grid points |
| r | r | D | H5T_IEEE_F64LE | Radius (cm) |
| M_r | M_r | D | H5T_IEEE_F64LE | Interior mass (g) |
| L_r | L_r | D | H5T_IEEE_F64LE | Luminosity (erg s^{-1}) |
| p | p | D | H5T_IEEE_F64LE | Total pressure (dyn cm^{-2}) |
| T | T | D | H5T_IEEE_F64LE | Temperature (K) |
| ρ | rho | D | H5T_IEEE_F64LE | Density (g cm^{-3}) |
| N^2 | N2 | D | H5T_IEEE_F64LE | Brunt-Väisälä frequency squared (s^{-2}) |
| Γ_1 | Gamma_1 | D | H5T_IEEE_F64LE | $(\partial \ln p / \partial \ln \rho)_{\text{ad}}$ |
| ∇_{ad} | nabla_ad | D | H5T_IEEE_F64LE | $(\text{d} \ln T / \text{d} \ln p)_{\text{ad}}$ |
| δ | delta | D | H5T_IEEE_F64LE | $-(\partial \ln \rho / \partial \ln T)_p$ |
| ∇ | nabla | D | H5T_IEEE_F64LE | $\text{d} \ln T / \text{d} \ln p$ |
| κ | kappa | D | H5T_IEEE_F64LE | Opacity ($\text{cm}^2 \text{g}^{-1}$) |
| κ_T | kappa_T | D | H5T_IEEE_F64LE | $(\partial \kappa / \partial \ln T)_\rho$ ($\text{cm}^2 \text{g}^{-1}$) |
| κ_ρ | kappa_rho | D | H5T_IEEE_F64LE | $(\partial \kappa / \partial \ln \rho)_T$ ($\text{cm}^2 \text{g}^{-1}$) |
| ϵ | epsilon | D | H5T_IEEE_F64LE | Energy generation rate ($\text{erg s}^{-1} \text{g}^{-1}$) |
| ϵ_T | epsilon_T | D | H5T_IEEE_F64LE | $(\partial \epsilon / \partial \ln T)_\rho$ ($\text{erg s}^{-1} \text{g}^{-1}$) |
| ϵ_ρ | epsilon_rho | D | H5T_IEEE_F64LE | $(\partial \epsilon / \partial \ln \rho)_T$ ($\text{erg s}^{-1} \text{g}^{-1}$) |
| Ω_{rot} | Omega_rot | D | H5T_IEEE_F64LE | Rotation angular velocity (rad s^{-1}) |