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 atributes and datasets of version-0.00 GSM files are as follows:

Variable	Object name	(A)ttribute / (D)ataset	Object datatype	Definition
n	`n`	A	`H5T_STD_I64LE`	Number of grid points
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 ($\mathrm{erg\,s^{-1}}$)
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 ($\mathrm{erg\,s^{-1}}$)
P	`p`	D	`H5T_IEEE_F64LE`	Total pressure ($\mathrm{dyn\,cm^{-2}}$)
ρ	`rho`	D	`H5T_IEEE_F64LE`	Density ($\mathrm{g\,cm^{-3}}$)
T	`T`	D	`H5T_IEEE_F64LE`	Temperature (K)
N^2	`N2`	D	`H5T_IEEE_F64LE`	Brunt-Väisälä frequency squared ($\mathrm{s^{-2}}$)
Γ_1	`Gamma_1`	D	`H5T_IEEE_F64LE`	$(\partial \ln P/\partial \ln \rho)_{\mathrm{ad}}$
∇_{ad}	`nabla_ad`	D	`H5T_IEEE_F64LE`	$(\mathrm{d} \ln T/\mathrm{d} \ln P)_{\mathrm{ad}}$
δ	`delta`	D	`H5T_IEEE_F64LE`	$-(\partial \ln \rho/\partial \ln T)_P$
∇	`nabla`	D	`H5T_IEEE_F64LE`	$\mathrm{d} \ln T/\mathrm{d} \ln P$
κ	`kappa`	D	`H5T_IEEE_F64LE`	Opacity ($\mathrm{cm^2\,g^{-1}}$)
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 ($\mathrm{erg\,}s^{-1}\,\mathrm{g^{-1}}$)
$\epsilon\,\epsilon_T$	`epsilon_T`	D	`H5T_IEEE_F64LE`	$(\partial \epsilon/\partial \ln T)_\rho$ ($\mathrm{erg\,}s^{-1}\,\mathrm{g^{-1}}$)
$\epsilon\,\epsilon_\rho$	`epsilon_rho`	D	`H5T_IEEE_F64LE`	$(\partial \epsilon/\partial \ln \rho)_T$ ($\mathrm{erg\,}s^{-1}\,\mathrm{g^{-1}}$)
Ω_{rot}	`Omega_rot`	D	`H5T_IEEE_F64LE`	Rotation angular velocity ($\mathrm{rad\,s^{-1}}$)

Version 1.00

The root group atributes and datasets of version-1.0 GSM files are as follows:

Variable	Object name	(A)ttribute / (D)ataset	Object datatype	Definition
n	`n`	A	`H5T_STD_I64LE`	Number of grid points
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 ($\mathrm{erg\,s^{-1}}$)
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 ($\mathrm{erg\,s^{-1}}$)
P	`P`	D	`H5T_IEEE_F64LE`	Total pressure ($\mathrm{dyn\,cm^{-2}}$)
ρ	`rho`	D	`H5T_IEEE_F64LE`	Density ($\mathrm{g\,cm^{-3}}$)
T	`T`	D	`H5T_IEEE_F64LE`	Temperature (K)
N^2	`N2`	D	`H5T_IEEE_F64LE`	Brunt-Väisälä frequency squared ($\mathrm{s^{-2}}$)
Γ_1	`Gamma_1`	D	`H5T_IEEE_F64LE`	$(\partial \ln P/\partial \ln \rho)_{\rm ad}$
$\nabla_{\rm ad}$	`nabla_ad`	D	`H5T_IEEE_F64LE`	$(\mathrm{d} \ln T/\mathrm{d} \ln P)_{\rm ad}$
δ	`delta`	D	`H5T_IEEE_F64LE`	$-(\partial \ln \rho/\partial \ln T)_P$
∇	`nabla`	D	`H5T_IEEE_F64LE`	$\mathrm{d} \ln T/\mathrm{d} \ln P$
κ	`kap`	D	`H5T_IEEE_F64LE`	Opacity ($\mathrm{cm^2\,g^{-1}}$)
$\kappa\,\kappa_T$	`kap_T`	D	`H5T_IEEE_F64LE`	$(\partial\kappa/\partial \ln T)_\rho$ ($\mathrm{cm^2\,g^{-1}}$)
$\kappa\,\kappa_\rho$	`kap_rho`	D	`H5T_IEEE_F64LE`	$(\partial\kappa/\partial \ln \rho)_T$ ($\mathrm{cm^2\,g^{-1}}$)
ϵ	`eps`	D	`H5T_IEEE_F64LE`	Energy generation rate ($\mathrm{erg\,}s^{-1}\,\mathrm{g^{-1}}$)
$\epsilon\,\epsilon_T$	`eps_T`	D	`H5T_IEEE_F64LE`	$(\partial\epsilon/\partial \ln T)_\rho$ ($\mathrm{erg\,}s^{-1}\,\mathrm{g^{-1}}$)
$\epsilon\,\epsilon_\rho$	`eps_rho`	D	`H5T_IEEE_F64LE`	$(\partial\epsilon/\partial \ln \rho)_T$ ($\mathrm{erg\,}s^{-1}\,\mathrm{g^{-1}}$)
$\Omega_{\rm rot}$	`Omega_rot`	D	`H5T_IEEE_F64LE`	Rotation angular velocity ($\mathrm{rad\,s^{-1}}$)

Note that the definitions of the `kap_T` and `kap_rho` datasets are slightly different than in previous versions.

Version 1.10

The root group atributes and datasets of version-1.1 GSM files are as follows:

Variable	Object name	(A)ttribute / (D)ataset	Object datatype	Definition
n	`n`	A	`H5T_STD_I64LE`	Number of grid points
version $\times 100$	`version`	A	`H5T_STD_I32LE`	110
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 ($\mathrm{erg\,s^{-1}}$)
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 ($\mathrm{erg\,s^{-1}}$)
P	`P`	D	`H5T_IEEE_F64LE`	Total pressure ($\mathrm{dyn\,cm^{-2}}$)
ρ	`rho`	D	`H5T_IEEE_F64LE`	Density ($\mathrm{g\,cm^{-3}}$)
T	`T`	D	`H5T_IEEE_F64LE`	Temperature (K)
N^2	`N2`	D	`H5T_IEEE_F64LE`	Brunt-Väisälä frequency squared ($\mathrm{s^{-2}}$)
Γ_1	`Gamma_1`	D	`H5T_IEEE_F64LE`	$(\partial \ln P/\partial \ln \rho)_{\mathrm{ad}}$
∇_{ad}	`nabla_ad`	D	`H5T_IEEE_F64LE`	$(\mathrm{d} \ln T/\mathrm{d} \ln P)_{\mathrm{ad}}$
δ	`delta`	D	`H5T_IEEE_F64LE`	$-(\partial \ln \rho/\partial \ln T)_P$
∇	`nabla`	D	`H5T_IEEE_F64LE`	$\mathrm{d} \ln T/\mathrm{d} \ln P$
κ	`kap`	D	`H5T_IEEE_F64LE`	Opacity ($\mathrm{cm^2\,g^{-1}}$)
$\kappa\,\kappa_T$	`kap_kap_T`	D	`H5T_IEEE_F64LE`	$(\partial \kappa/\partial \ln T)_\rho$ ($\mathrm{cm^2\,g^{-1}}$)
$\kappa\,\kappa_\rho$	`kap_kap_rho`	D	`H5T_IEEE_F64LE`	$(\partial \kappa/\partial \ln \rho)_T$ ($\mathrm{cm^2\,g^{-1}}$)
ϵ	`eps`	D	`H5T_IEEE_F64LE`	Energy generation rate ($\mathrm{erg}\,s^{-1}\,\mathrm{g^{-1}}$)
$\epsilon\,\epsilon_T$	`eps_eps_T`	D	`H5T_IEEE_F64LE`	$(\partial \epsilon/\partial \ln T)_\rho$ ($\mathrm{erg}\,s^{-1}\,\mathrm{g^{-1}}$)
$\epsilon\,\epsilon_\rho$	`eps_eps_rho`	D	`H5T_IEEE_F64LE`	$(\partial \epsilon/\partial \ln \rho)_T$ ($\mathrm{erg}\,s^{-1}\,\mathrm{g^{-1}}$)
Ω_{rot}	`Omega_rot`	D	`H5T_IEEE_F64LE`	Rotation angular velocity ($\mathrm{rad\,s^{-1}}$)

Note that the definitions of the `kap_T` and `kap_rho` datasets are slightly different than in previous versions.