

SPHERLSgen

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Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

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Chapter 2

File Index

2.1 File List

Here is a list of all documented files with brief descriptions:

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/home/cgeroux/WORK/SPHERLS/src/ xmlFunctions.h	??

Chapter 3

Class Documentation

3.1 eos Class Reference

```
#include <eos.h>
```

Public Member Functions

- `eos` ()
- `eos` (int `nNumT`, int `nNumRho`)
- `eos` (const `eos` &ref)
- `~eos` ()
- `eos` & `operator=` (const `eos` &eosRightSide)
- void `readAscii` (std::string sFileName)
- void `readBobsAscii` (std::string sFileName)
- void `writeAscii` (std::string sFileName)
- void `readBin` (std::string sFileName) throw (exception2)
- void `writeBin` (std::string sFileName)
- double `dGetPressure` (double dT, double dRho)
- double `dGetEnergy` (double dT, double dRho)
- double `dGetOpacity` (double dT, double dRho)
- double `dDRhoDP` (double dT, double dRho)
- double `dSoundSpeed` (double dT, double dRho)
- void `getEKappa` (double dT, double dRho, double &dE, double &dKappa)
- void `getPEKappa` (double dT, double dRho, double &dP, double &dE, double &dKappa)
- void `getPEKappaGamma` (double dT, double dRho, double &dP, double &dE, double &dKappa, double &dGamma)
- void `getPEKappaGammaCp` (double dT, double dRho, double &dP, double &dE, double &dKappa, double &dGamma, double &dCp)
- void `getPKappaGamma` (double dT, double dRho, double &dP, double &dKappa, double &dGamma)
- void `gamma1DelAdC_v` (double dT, double dRho, double &dGamma1, double &dDelAd, double &dC_v)
- void `getPAndDRhoDP` (double dT, double dRho, double &dP, double &dDRhoDP)

- void [getEAndDTDE](#) (double dT, double dRho, double &dE, double &dDTDE)
- void [getDlnPDlnTDlnPDlnPDEDT](#) (double dT, double dRho, double &dDlnPDlnT, double &dDlnPDlnRho, double &dDEDT)

Public Attributes

- int [nNumRho](#)
- int [nNumT](#)
- double [dXMassFrac](#)
- double [dYMassFrac](#)
- double [dLogRhoMin](#)
- double [dLogRhoDelta](#)
- double [dLogTMin](#)
- double [dLogTDelta](#)
- double ** [dLogP](#)
- double ** [dLogE](#)
- double ** [dLogKappa](#)

3.1.1 Detailed Description

This class holds an equation of state as well as many functions useful for manipulating it

3.1.2 Constructor & Destructor Documentation

3.1.2.1 `eos::eos ()`

Constructor, doesn't really do anything

References [dLogE](#), [dLogKappa](#), [dLogP](#), [nNumRho](#), and [nNumT](#).

3.1.2.2 `eos::eos (int nNumT, int nNumRho)`

Constructor, allocates memory for the 2D arrays

Parameters:

- ← *nNumT* number of temperatures in the equaiton of state table
- ← *nNumRho* number of densities in the equaiton of state table

3.1.2.3 `eos::eos (const eos & ref)`

Copy constructor, simply constructs a new [eos](#) object from another [eos](#) object

References [dLogE](#), [dLogKappa](#), [dLogP](#), [dLogRhoDelta](#), [dLogRhoMin](#), [dLogTDelta](#), [dLogTMin](#), [dXMassFrac](#), [dYMassFrac](#), [nNumRho](#), and [nNumT](#).

3.1.2.4 eos::~~eos ()

Destructor, deletes dynamic arrays

References dLogE, dLogKappa, dLogP, and nNumRho.

3.1.3 Member Function Documentation

3.1.3.1 eos & eos::operator= (const eos & *eosRightSide*)

Assignment operator, assigns one eos object to another.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.2 void eos::readAscii (std::string *sFileName*)

This fuction reads in an ascii file and stores it in the current object.

Parameters:

← *sFileName* name of the equation of state file to read from.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, dXMassFrac, dYMassFrac, nNumRho, and nNumT.

3.1.3.3 void eos::readBobsAscii (std::string *sFileName*)

This fuction reads in an ascii file and stores it in the current object. The ascii file is in Bob's format.

Parameters:

← *sFileName* name of the equation of state file to read from.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, dXMassFrac, dYMassFrac, nNumRho, and nNumT.

3.1.3.4 void eos::writeAscii (std::string *sFileName*)

This fuction writes the equation of state stored in the current object to an ascii file.

Parameters:

← *sFileName* name of the file to write the equation of state to.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, dXMassFrac, dYMassFrac, nNumRho, and nNumT.

3.1.3.5 void eos::readBin (std::string *sFileName*) throw (exception2)

This fuction reads in a binary file and stores it in the current object.

Parameters:

← *sFileName* name of the equation of state file to read from.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, dXMassFrac, dYMassFrac, nNumRho, and nNumT.

3.1.3.6 void eos::writeBin (std::string *sFileName*)

This fuction writes the equation of state stored in the current object to a binary file.

Parameters:

← *sFileName* name of the file to write the equaiton of state to.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, dXMassFrac, dYMassFrac, nNumRho, and nNumT.

3.1.3.7 double eos::dGetPressure (double *dT*, double *dRho*)

This function linearly interpolates the pressure to a given temperature and density. Note that both *dT* and *dRho* are not in log space.

Parameters:

← *dT* temperature to interpolate to.

← *dRho* density to interpolate to.

Returns:

the interpolated pressure.

References dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.8 double eos::dGetEnergy (double *dT*, double *dRho*)

This function linearly interpolates the energy to a given temperature and and density. Note that both *dT* and *dRho* are not in log space.

Parameters:

← *dT* temperature to interpolate to.

← *dRho* density to interpolate to.

Returns:

the interpolated energy.

References dLogE, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.9 double eos::dGetOpacity (double dT , double $dRho$)

This function linearly interpolates the opacity to a given temperature and density. Note that both dT and $dRho$ are not in log space.

Parameters:

- ← dT temperature to interpolate to.
- ← $dRho$ density to interpolate to.

Returns:

the interpolated opacity.

References dLogKappa, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.10 double eos::dDRhoDP (double dT , double $dRho$)

This function calculates the partial derivative of density w.r.t. pressure

Parameters:

- ← dT temperature at which the derivative is to be computed
- ← $dRho$ density at which the derivative is to be computed

Returns:

the partial derivative of density w.r.t. pressure.

References dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.11 double eos::dSoundSpeed (double dT , double $dRho$)

This function calculates the adiabatic sound speed

Parameters:

- ← dT temperature at which the derivative is to be computed
- ← $dRho$ density at which the derivative is to be computed

Returns:

the sound speed.

References dLogE, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.12 void eos::getEKappa (double dT , double $dRho$, double & dE , double & $dKappa$)

This function linearly interpolates the three dependent quantities (Pressure, Energy, Opacity) to a given temperature and density. Note that both dT and $dRho$ are not in log space.

Parameters:

- ← ***dT*** temperature to interpolate to.
- ← ***dRho*** density to interpolate to.
- ***dE*** energy at dT and dRho.
- ***dKappa*** opacity at dT and dRho.

References dLogE, dLogKappa, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.13 void eos::getPEKappa (double *dT*, double *dRho*, double & *dP*, double & *dE*, double & *dKappa*)

This function linearly interpolates the three dependent quantities (Pressure, Energy , Opacity) to a given temperature and density. Note that both *dT* and *dRho* are not in log space.

Parameters:

- ← ***dT*** temperature to interpolate to.
- ← ***dRho*** density to interpolate to.
- ***dP*** pressure at dT and dRho.
- ***dE*** energy at dT and dRho.
- ***dKappa*** opacity at dT and dRho.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.14 void eos::getPEKappaGamma (double *dT*, double *dRho*, double & *dP*, double & *dE*, double & *dKappa*, double & *dGamma*)

This function linearly interpolates the energy and opacity to a given temperature and density. Note that both *dT* and *dRho* are not in log space.

Parameters:

- ← ***dT*** temperature to interpolate to.
- ← ***dRho*** density to interpolate to.
- ***dP*** pressure at dT and dRho.
- ***dE*** energy at dT and dRho.
- ***dKappa*** opacity at dT and dRho.
- ***dGamma*** adiabatic index at dT and dRho.

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.15 `void eos::getPEKappaGammaCp (double dT, double dRho, double & dP, double & dE, double & dKappa, double & dGamma, double & dCp)`

This function linearly interpolates the energy and opacity to a given temperature and density. Note that both *dT* and *dRho* are not in log space.

Parameters:

- ← *dT* temperature to interpolate to.
- ← *dRho* density to interpolate to.
- *dP* pressure at *dT* and *dRho*.
- *dE* energy at *dT* and *dRho*.
- *dKappa* opacity at *dT* and *dRho*.
- *dGamma* adiabatic index at *dT* and *dRho*.
- *dCp* specific heat at constant pressure at *dT* and *dRho*.

References *dLogE*, *dLogKappa*, *dLogP*, *dLogRhoDelta*, *dLogRhoMin*, *dLogTDelta*, *dLogTMin*, *nNumRho*, and *nNumT*.

3.1.3.16 `void eos::getPKappaGamma (double dT, double dRho, double & dP, double & dKappa, double & dGamma)`

This function linearly interpolates the energy and opacity to a given temperature and density. Note that both *dT* and *dRho* are not in log space.

Parameters:

- ← *dT* temperature to interpolate to.
- ← *dRho* density to interpolate to.
- *dP* pressure at *dT* and *dRho*.
- *dKappa* opacity at *dT* and *dRho*.
- *dGamma* adiabatic index at *dT* and *dRho*.

References *dLogE*, *dLogKappa*, *dLogP*, *dLogRhoDelta*, *dLogRhoMin*, *dLogTDelta*, *dLogTMin*, *nNumRho*, and *nNumT*.

3.1.3.17 `void eos::gamma1DelAdC_v (double dT, double dRho, double & dGamma1, double & dDelAd, double & dC_v)`

This function calculates *gamma1* and the adiabatic gradient

Parameters:

- ← *dT* temperature at which the derivative is to be computed
- ← *dRho* density at which the derivative is to be computed
- *dGamma1* *gamma1*
- *dDelAd* adiabatic gradient
- *dC_v* specific heat at constant volume

References *dLogE*, *dLogP*, *dLogRhoDelta*, *dLogRhoMin*, *dLogTDelta*, *dLogTMin*, *nNumRho*, and *nNumT*.

3.1.3.18 void eos::getPAndDRhoDP (double *dT*, double *dRho*, double & *dP*, double & *dDRhoDP*)

This function calculates the partial derivative of density w.r.t. pressure and the pressure

Parameters:

- ← *dT* temperature at which the derivative is to be computed
- ← *dRho* density at which the derivative is to be computed
- *dP* pressure at dT and dRho
- *dDRhoDP* derivative of density w.r.t. pressure at conatant temperature

References dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.19 void eos::getEAndDTDE (double *dT*, double *dRho*, double & *dE*, double & *dDTDE*)

This function calculates the partial derivative of temperature w.r.t. energy and the energy

Parameters:

- ← *dT* temperature at which the derivative is to be computed
- ← *dRho* density at which the derivative is to be computed
- *dE* energy at dT and dRho
- *dDTDE* derivative of temperature w.r.t. energy at constant density

References dLogE, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.3.20 void eos::getDlnPDlnTDlnPDlnPDEDT (double *dT*, double *dRho*, double & *dDlnPDlnT*, double & *dDlnPDlnRho*, double & *dDEDT*)

This function calculates various partial derivatives

Parameters:

- ← *dT* temperature at which the derivative is to be computed
- ← *dRho* density at which the derivative is to be computed
- *dDlnPDlnT* derivative of ln(P) w.r.t. ln(T)
- *dDlnPDlnRho* derivative of ln(P) w.r.t. ln(Rho)
- *dDEDT* derivative of temperature w.r.t. energy at constant density

References dLogE, dLogKappa, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, nNumRho, and nNumT.

3.1.4 Member Data Documentation

3.1.4.1 int eos::nNumRho

Number of densities in the equation of state table

Referenced by dDRhoDP(), dGetEnergy(), dGetOpacity(), dGetPressure(), dSoundSpeed(), eos(), gamma1DelAdC_v(), getDlnPDlnTDlnPDlnPDEDT(), getEAndDTDE(), getEKappa(), getPAndDRhoDP(), getPEKappa(), getPEKappaGamma(), getPEKappaGammaCp(), getPKappaGamma(), operator=(), readAscii(), readBin(), readBobsAscii(), writeAscii(), writeBin(), and ~eos().

3.1.4.2 int eos::nNumT

Number of temperatures in the equation of state table

Referenced by dDRhoDP(), dGetEnergy(), dGetOpacity(), dGetPressure(), dSoundSpeed(), eos(), gamma1DelAdC_v(), getDlnPDlnTDlnPDlnPDEDT(), getEAndDTDE(), getEKappa(), getPAndDRhoDP(), getPEKappa(), getPEKappaGamma(), getPEKappaGammaCp(), getPKappaGamma(), operator=(), readAscii(), readBin(), readBobsAscii(), writeAscii(), and writeBin().

3.1.4.3 double eos::dXMassFrac

Hydrogen mass fraction of the composition used to generate the equation of state table.

Referenced by eos(), readAscii(), readBin(), readBobsAscii(), writeAscii(), and writeBin().

3.1.4.4 double eos::dYMassFrac

Helium mass fraction of the composition used to generate the equation of state table.

Referenced by eos(), readAscii(), readBin(), readBobsAscii(), writeAscii(), and writeBin().

3.1.4.5 double eos::dLogRhoMin

Minimum density of the table in log10.

Referenced by dDRhoDP(), dGetEnergy(), dGetOpacity(), dGetPressure(), dSoundSpeed(), eos(), gamma1DelAdC_v(), getDlnPDlnTDlnPDlnPDEDT(), getEAndDTDE(), getEKappa(), getPAndDRhoDP(), getPEKappa(), getPEKappaGamma(), getPEKappaGammaCp(), getPKappaGamma(), operator=(), readAscii(), readBin(), readBobsAscii(), writeAscii(), and writeBin().

3.1.4.6 double eos::dLogRhoDelta

Increment of the density between table entries in log10.

Referenced by dDRhoDP(), dGetEnergy(), dGetOpacity(), dGetPressure(), dSoundSpeed(), eos(), gamma1DelAdC_v(), getDlnPDlnTDlnPDlnPDEDT(), getEAndDTDE(), getEKappa(), getPAndDRhoDP(), getPEKappa(), getPEKappaGamma(), getPEKappaGammaCp(), getPKappaGamma(), operator=(), readAscii(), readBin(), readBobsAscii(), writeAscii(), and writeBin().

3.1.4.7 double eos::dLogTMin

Minimum temperature of the table in log10.

Referenced by `dDRhoDP()`, `dGetEnergy()`, `dGetOpacity()`, `dGetPressure()`, `dSoundSpeed()`, `eos()`, `gamma1DelAdC_v()`, `getDlnPDlnTDlnPDlnPDEDt()`, `getEAndDTDE()`, `getEKappa()`, `getPAndDRhoDP()`, `getPEKappa()`, `getPEKappaGamma()`, `getPEKappaGammaCp()`, `getPKappaGamma()`, `operator=()`, `readAscii()`, `readBin()`, `readBobsAscii()`, `writeAscii()`, and `writeBin()`.

3.1.4.8 double eos::dLogTDelta

Increment of the temperature between table entries in log10.

Referenced by `dDRhoDP()`, `dGetEnergy()`, `dGetOpacity()`, `dGetPressure()`, `dSoundSpeed()`, `eos()`, `gamma1DelAdC_v()`, `getDlnPDlnTDlnPDlnPDEDt()`, `getEAndDTDE()`, `getEKappa()`, `getPAndDRhoDP()`, `getPEKappa()`, `getPEKappaGamma()`, `getPEKappaGammaCp()`, `getPKappaGamma()`, `operator=()`, `readAscii()`, `readBin()`, `readBobsAscii()`, `writeAscii()`, and `writeBin()`.

3.1.4.9 double** eos::dLogP

2D array of log10 pressures. `dLogP[i][j]` gives the log10 pressure at log10 density of `eos::dLogRhoDelta*i+eos::dLogRhoMin`, and at log10 temperature of `eos::dLogTDelta*j+eos::dLogTMin`.

Referenced by `dDRhoDP()`, `dGetPressure()`, `dSoundSpeed()`, `eos()`, `gamma1DelAdC_v()`, `getDlnPDlnTDlnPDlnPDEDt()`, `getPAndDRhoDP()`, `getPEKappa()`, `getPEKappaGamma()`, `getPEKappaGammaCp()`, `getPKappaGamma()`, `operator=()`, `readAscii()`, `readBin()`, `readBobsAscii()`, `writeAscii()`, `writeBin()`, and `~eos()`.

3.1.4.10 double** eos::dLogE

2D array of log10 energies. `dLogE[i][j]` gives the log10 energy at log10 density of `eos::dLogRhoDelta*i+eos::dLogRhoMin`, and at log10 temperature of `eos::dLogTDelta*j+eos::dLogTMin`.

Referenced by `dGetEnergy()`, `dSoundSpeed()`, `eos()`, `gamma1DelAdC_v()`, `getDlnPDlnTDlnPDlnPDEDt()`, `getEAndDTDE()`, `getEKappa()`, `getPEKappa()`, `getPEKappaGamma()`, `getPEKappaGammaCp()`, `getPKappaGamma()`, `operator=()`, `readAscii()`, `readBin()`, `readBobsAscii()`, `writeAscii()`, `writeBin()`, and `~eos()`.

3.1.4.11 double** eos::dLogKappa

2D array of log10 opacities. `dLogKappa[i][j]` gives the log10 opacity at log10 density of `eos::dLogRhoDelta*i+eos::dLogRhoMin`, and at log10 temperature of `eos::dLogTDelta*j+eos::dLogTMin`.

Referenced by `dGetOpacity()`, `eos()`, `getDlnPDlnTDlnPDlnPDEDt()`, `getEKappa()`, `getPEKappa()`, `getPEKappaGamma()`, `getPEKappaGammaCp()`, `getPKappaGamma()`, `operator=()`, `readAscii()`, `readBin()`, `readBobsAscii()`, `writeAscii()`, `writeBin()`, and `~eos()`.

The documentation for this class was generated from the following files:

- `/home/cgeroux/WORK/SPHERLS/src/eos.h`
- `/home/cgeroux/WORK/SPHERLS/src/eos.cpp`

Chapter 4

File Documentation

4.1 `/home/cgeroux/WORK/SPHERLS/src/eos.cpp` File Reference

```
#include <string>
#include <fstream>
#include <sstream>
#include <iostream>
#include <cmath>
#include "eos.h"
#include "exception2.h"
```

4.1.1 Detailed Description

Implements the [eos](#) (equation of state) class defined in [eos.h](#)

4.2 /home/cgeroux/WORK/SPHERLS/src/eos.h File Reference

```
#include <string>
#include "exception2.h"
```

Classes

- class [eos](#)

4.2.1 Detailed Description

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