

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/Documents/WORK/SPHERLS/src/ eos.h	17
/home/cgeroux/Documents/WORK/SPHERLS/src/ exception2.h	??
/home/cgeroux/Documents/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

in	<i>nNumT</i>	number of temperatures in the equaiton of state table
in	<i>nNumRho</i>	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 double eos::dDRhoDP (double dT, double dRho)**

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

Parameters

in	dT	temperature at which the derivative is to be computed
in	$dRho$	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.

3.1.3.2 double eos::dGetEnergy (double dT, double dRho)

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

Parameters

in	dT	temperature to interpolate to.
in	$dRho$	density to interpolate to.

Returns

the interpolated energy.

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

3.1.3.3 `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

<code>in</code>	<code>dT</code>	temperature to interpolate to.
<code>in</code>	<code>dRho</code>	density to interpolate to.

Returns

the interpolated opacity.

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

3.1.3.4 `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

<code>in</code>	<code>dT</code>	temperature to interpolate to.
<code>in</code>	<code>dRho</code>	density to interpolate to.

Returns

the interpolated pressure.

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

3.1.3.5 `double eos::dSoundSpeed (double dT, double dRho)`

This function calculates the adiabatic sound speed

Parameters

<code>in</code>	<code>dT</code>	temperature at which the derivative is to be computed
<code>in</code>	<code>dRho</code>	density at which the derivative is to be computed

Returns

the sound speed.

References dLogE, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, n-NumRho, and nNumT.

3.1.3.6 void eos::gamma1DelAdC_v(double *dT*, double *dRho*, double & *dGamma1*, double & *dDelAd*, double & *dC_v*)

This function calculates gamma1 and the adiabatic gradient

Parameters

in	<i>dT</i>	temperature at which the derivative is to be computed
in	<i>dRho</i>	density at which the derivative is to be computed
out	<i>dGamma1</i>	gamma1
out	<i>dDelAd</i>	adiabatic gradient
out	<i>dC_v</i>	specific heat at constant volume

References dLogE, dLogP, dLogRhoDelta, dLogRhoMin, dLogTDelta, dLogTMin, n-NumRho, and nNumT.

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

This function calculates various partial derivatives

Parameters

in	<i>dT</i>	temperature at which the derivative is to be computed
in	<i>dRho</i>	density at which the derivative is to be computed
out	<i>dDlnPDlnT</i>	derivative of ln(P) w.r.t. ln(T)
out	<i>dDlnPDlnRho</i>	derivative of ln(P) w.r.t. ln(Rho)
out	<i>dDEDT</i>	derivative of temperature w.r.t. energy at constant density

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

3.1.3.8 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

in	<i>dT</i>	temperature at which the derivative is to be computed
in	<i>dRho</i>	density at which the derivative is to be computed

out	dE	energy at dT and $dRho$
out	$dDTDE$	derivative of temperature w.r.t. energy at constant density

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

3.1.3.9 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

in	dT	temperature to interpolate to.
in	$dRho$	density to interpolate to.
out	dE	energy at dT and $dRho$.
out	$dKappa$	opacity at dT and $dRho$.

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

3.1.3.10 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

in	dT	temperature at which the derivative is to be computed
in	$dRho$	density at which the derivative is to be computed
out	dP	pressure at dT and $dRho$
out	$dDRhoDP$	derivative of density w.r.t. pressure at conatant temperature

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

3.1.3.11 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

in	<i>dT</i>	temperature to interpolate to.
in	<i>dRho</i>	density to interpolate to.
out	<i>dP</i>	pressure at dT and dRho.
out	<i>dE</i>	energy at dT and dRho.
out	<i>dKappa</i>	opacity at dT and dRho.

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

3.1.3.12 `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

in	<i>dT</i>	temperature to interpolate to.
in	<i>dRho</i>	density to interpolate to.
out	<i>dP</i>	pressure at dT and dRho.
out	<i>dE</i>	energy at dT and dRho.
out	<i>dKappa</i>	opacity at dT and dRho.
out	<i>dGamma</i>	adiabatic index at dT and dRho.

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

3.1.3.13 `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

in	<i>dT</i>	temperature to interpolate to.
in	<i>dRho</i>	density to interpolate to.
out	<i>dP</i>	pressure at dT and dRho.
out	<i>dE</i>	energy at dT and dRho.
out	<i>dKappa</i>	opacity at dT and dRho.
out	<i>dGamma</i>	adiabatic index at dT and dRho.
out	<i>dCp</i>	specific heat at constant pressure at dT and dRho.

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

3.1.3.14 `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

in	<i>dT</i>	temperature to interpolate to.
in	<i>dRho</i>	density to interpolate to.
out	<i>dP</i>	pressure at <i>dT</i> and <i>dRho</i> .
out	<i>dKappa</i>	opacity at <i>dT</i> and <i>dRho</i> .
out	<i>dGamma</i>	adiabatic index at <i>dT</i> and <i>dRho</i> .

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

3.1.3.15 `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*.

3.1.3.16 `void eos::readAscii(std::string sFileName)`

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

Parameters

in	<i>sFileName</i>	name of the equation of state file to read from.
----	------------------	--

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

3.1.3.17 `void eos::readBin(std::string sFileName) throw (exception2)`

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

Parameters

in	<i>sFileName</i>	name of the equation of state file to read from.
----	------------------	--

3.1.3.18 `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

in	<i>sFileName</i>	name of the equation of state file to read from.
----	------------------	--

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

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

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

Parameters

in	<i>sFileName</i>	name of the file to write the equation of state to.
----	------------------	---

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

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

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

Parameters

in	<i>sFileName</i>	name of the file to write the equaiton of state to.
----	------------------	---

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

3.1.4 Member Data Documentation

3.1.4.1 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(), getDlnPDlnPDlnPDlnPDEDT(), getEAndDTDE(), getEKappa(), getPEKappa(), getPEKappaGamma(), getPEKappaGammaCp(), getPKappaGamma(), operator=(), readAscii(), readBobsAscii(), writeAscii(), writeBin(), and ~eos().

3.1.4.2 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()`, `readBobsAscii()`, `writeAscii()`, `writeBin()`, and `~eos()`.

3.1.4.3 `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()`, `readBobsAscii()`, `writeAscii()`, `writeBin()`, and `~eos()`.

3.1.4.4 `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()`, `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()`, `readBobsAscii()`, `writeAscii()`, and `writeBin()`.

3.1.4.6 `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()`, `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()`, `readBobsAscii()`, `writeAscii()`, and `writeBin()`.

3.1.4.8 double eos::dXMassFrac

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

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

3.1.4.9 double eos::dYMassFrac

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

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

3.1.4.10 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()`, `readBobsAscii()`, `writeAscii()`, `writeBin()`, and `~eos()`.

3.1.4.11 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()`, `readBobsAscii()`, `writeAscii()`, and `writeBin()`.

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

- [/home/cgeroux/Documents/WORK/SPHERLS/src/eos.h](#)
- [/home/cgeroux/Documents/WORK/SPHERLS/src/eos.cpp](#)

3.2 exception2 Class Reference

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

- `/home/cgeroux/Documents/WORK/SPHERLS/src/exception2.h`
- `/home/cgeroux/Documents/WORK/SPHERLS/src/exception2.cpp`

Chapter 4

File Documentation

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

```
#include <string> #include <fstream> #include <sstream>
#include <iostream> #include <cmath> #include <stdlib.-
h> #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/Documents/WORK/SPHERLS/src/eos.h File - Reference

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

Classes

- class [eos](#)

4.2.1 Detailed Description

Header file for [eos.cpp](#)

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