

Stopping Power

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Wed Apr 3 2013 15:51:06

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Chapter 1

Namespace Index

1.1 Namespace List

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Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

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Chapter 3

Class Index

3.1 Class List

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

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Chapter 4

Namespace Documentation

4.1 StopPow Namespace Reference

Physical constants for stopping power calculators.

Classes

- class [StopPow](#)
- class [StopPow_BetheBloch](#)
- class [StopPow_LP](#)
- class [StopPow_SRIM](#)

4.1.1 Detailed Description

Physical constants for stopping power calculators.

Author

Alex Zylstra

Date

2013/04/02

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Class Documentation

Inheritance diagram for StopPow::StopPow:



- ## Static Public Attributes

- ## Protected Attributes

- float **dx**
- int **mode**

5.1.1 Constructor & Destructor Documentation

5.1.1.1 StopPow::StopPow::StopPow ()

Simple constructor for the generic class

5.1.1.2 StopPow::StopPow::StopPow (int *set_mode*) [explicit]

Construct a new [StopPow](#) object given a starting mode

Parameters

| | |
|-----------------|--|
| <i>set_mode</i> | the mode you want to use (defined using class constants) |
|-----------------|--|

5.1.2 Member Function Documentation

5.1.2.1 float StopPow::StopPow::dEdx (float *E*)

Calculate stopping power. Return units depend on mode.

Parameters

| | |
|----------|----------------------------|
| <i>E</i> | the particle energy in MeV |
|----------|----------------------------|

Returns

dE/dx in MeV/um [MeV/(mg/cm2)]

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.1.2.2 float StopPow::StopPow::Ein (float *E*, float *x*)

Get incident energy for a particle.

Parameters

| | |
|----------|--------------------------------------|
| <i>E</i> | the particle energy in MeV |
| <i>x</i> | thickness of material in um [mg/cm2] |

Returns

initial particle energy in MeV

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.1.2.3 float StopPow::StopPow::Eout (float *E*, float *x*)

Get energy downshift for a particle.

Parameters

| | |
|-----|--------------------------------------|
| E | the particle energy in MeV |
| x | thickness of material in um [mg/cm2] |

Returns

final particle energy in MeV

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.1.2.4 float StopPow::StopPow::get_dx ()

Get the current step sized being used for calculations.

Returns

dx the step size in um [mg/cm2]

5.1.2.5 int StopPow::StopPow::get_mode ()

Get the current mode being used for calculations.

Returns

mode Either StopPow.MODE_LENGTH or StopPow.MODE_RHOR

5.1.2.6 void StopPow::StopPow::set_dx (float new_dx)

Set the step size for calculations

Parameters

| | |
|---------------|--|
| <i>new_dx</i> | the new step size to use, in um [mg/cm2] |
|---------------|--|

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.1.2.7 void StopPow::StopPow::set_mode (int new_mode)

Set the mode for calculations

Parameters

| | |
|-----------------|---|
| <i>new_mode</i> | Either StopPow.MODE_LENGTH or StopPow.MODE_RHOR |
|-----------------|---|

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.1.2.8 float StopPow::StopPow::Thickness (float *E1*, float *E2*)

Get thickness of material traversed.

Parameters

| | |
|-----------|------------------------------------|
| <i>E1</i> | the initial particle energy in MeV |
| <i>E2</i> | the final particle energy in MeV |

Returns

material thickness in um [mg/cm2]

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

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

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow.h

5.2 StopPow Class Reference

Generic class for stopping power calculators.

```
#include <StopPow.h>
```

Public Attributes

- const float **r0** = 2.82e-13
- const float **mec2** = 511
- const float **mpc2** = 9.38e5
- const float **c** = 2.997e10
- const float **me** = 9.109e-28
- const float **mp** = 1.6726e-24
- const float **kB** = 1.381e-16
- const float **Na** = 6.022e23
- const float **hbar** = 1.054e-27
- const float **e** = 4.8e-10
- const float **keVtoK** = 1.16e7
- const float **keVtoeV** = 1.602e-9
- const float **M_PI** = 3.1415926

5.2.1 Detailed Description

Generic class for stopping power calculators.

In addition to setting the abstract template for stopping power calculators, this also includes several generic methods. The stopping power utilities here can be called as functions of linear distance or areal density. To specify which, the mode must be set correctly.

Author

Alex Zylstra

Date

2013/04/03

Copyright

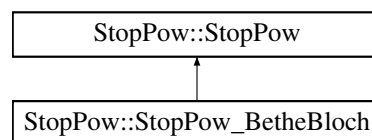
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The documentation for this class was generated from the following files:

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow.h
- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_Constants.h

5.3 StopPow::StopPow_BetheBloch Class Reference

Inheritance diagram for StopPow::StopPow_BetheBloch:



Public Member Functions

- [StopPow_BetheBloch](#) (float *mt*, float *Zt*, std::vector< float > *mf*, std::vector< float > *Zf*, std::vector< float > *nf*)
- float [dEdx_MeV_um](#) (float *E*)
- float [dEdx_MeV_mgcm2](#) (float *E*)
- float [get_Emin](#) ()
- float [get_Emax](#) ()

Additional Inherited Members

5.3.1 Constructor & Destructor Documentation

5.3.1.1 StopPow::StopPow_BetheBloch::StopPow_BetheBloch (float *mt*, float *Zt*, std::vector< float > *mf*, std::vector< float > *Zf*, std::vector< float > *nf*)

Initialize the Bethe-Bloch calculator.

Parameters

| | |
|-----------|--|
| <i>mt</i> | the test particle mass in AMU |
| <i>Zt</i> | the test particle in charge (units of e) |
| <i>mf</i> | vector containing ordered field particle masses in AMU |
| <i>Zf</i> | vector containing ordered field particle charges in units of e |
| <i>nf</i> | vector containing ordered field particle densities in units of 1/cm3 |

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.3.2 Member Function Documentation

5.3.2.1 `float StopPow::StopPow_BetheBloch::dEdx_MeV_mgcm2 (float E) [virtual]`

Calculate the total stopping power

Parameters

| | |
|----------|---------------------------------|
| <i>E</i> | the test particle energy in MeV |
|----------|---------------------------------|

Returns

stopping power in units of MeV/(mg/cm2)

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

Implements [StopPow::StopPow](#).

5.3.2.2 `float StopPow::StopPow_BetheBloch::dEdx_MeV_um (float E) [virtual]`

Calculate the total stopping power

Parameters

| | |
|----------|---------------------------------|
| <i>E</i> | the test particle energy in MeV |
|----------|---------------------------------|

Returns

stopping power in units of MeV/um

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

Implements [StopPow::StopPow](#).

5.3.2.3 `float StopPow::StopPow_BetheBloch::get_Emax () [virtual]`

Get the maximum energy that can be used for dE/dx calculations

Returns

Emax in MeV

Implements [StopPow::StopPow](#).

5.3.2.4 `float StopPow::StopPow_BetheBloch::get_Emin () [virtual]`

Get the minimum energy that can be used for dE/dx calculations

Returns

Emin in MeV

Implements [StopPow::StopPow](#).

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

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_BetheBloch.h

5.4 StopPow_BetheBloch Class Reference

Calculate Bethe-Bloch stopping power.

```
#include <StopPow_BetheBloch.h>
```

5.4.1 Detailed Description

Calculate Bethe-Bloch stopping power.

Implement a stopping-power calculator for arbitrary cold matter, using the simple Bethe-Bloch theory.

Author

Alex Zylstra

Date

2013/04/03

Copyright

MIT / Alex Zylstra

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

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_BetheBloch.h

5.5 StopPow_LP Class Reference

Calculate Li-Petrasso stopping power.

```
#include <StopPow_LP.h>
```

5.5.1 Detailed Description

Calculate Li-Petrasso stopping power.

Implement a stopping-power calculator for plasma, using the Fokker-Planck theory described in Li and Petrasso, PRL 1993.

Author

Alex Zylstra

Date

2013/04/03

Copyright

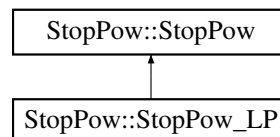
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The documentation for this class was generated from the following file:

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_LP.h

5.6 StopPow::StopPow_LP Class Reference

Inheritance diagram for StopPow::StopPow_LP:



Public Member Functions

- [StopPow_LP](#) (float *mt*, float *Zt*, std::vector< float > *mf*, std::vector< float > *Zf*, std::vector< float > *Tf*, std::vector< float > *nf*)
- float [dEdx_MeV_um](#) (float *E*)
- float [dEdx_MeV_mgcm2](#) (float *E*)
- void [set_collective](#) (bool *set*)
- float [get_Emin](#) ()
- float [get_Emax](#) ()

Additional Inherited Members

5.6.1 Constructor & Destructor Documentation

- 5.6.1.1 StopPow::StopPow_LP::StopPow_LP (float *mt*, float *Zt*, std::vector< float > *mf*, std::vector< float > *Zf*, std::vector< float > *Tf*, std::vector< float > *nf*)

Initialize the Li-Petrasso stopping power.

Parameters

| | |
|-----------|---|
| <i>mt</i> | the test particle mass in AMU |
| <i>Zt</i> | the test particle in charge (units of e) |
| <i>mf</i> | vector containing ordered field particle masses in AMU |
| <i>Zf</i> | vector containing ordered field particle charges in units of e |
| <i>Tf</i> | vector containing ordered field particle temperatures in units of keV |
| <i>nf</i> | vector containing ordered field particle densities in units of 1/cm3 |

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

5.6.2 Member Function Documentation

5.6.2.1 float StopPow::StopPow_LP::dEdx_MeV_mgcm2 (float *E*) [virtual]

Calculate the total stopping power

Parameters

| | |
|----------|---------------------------------|
| <i>E</i> | the test particle energy in MeV |
|----------|---------------------------------|

Returns

stopping power in units of MeV/(mg/cm2)

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

Implements [StopPow::StopPow](#).

5.6.2.2 float StopPow::StopPow_LP::dEdx_MeV_um (float *E*) [virtual]

Calculate the total stopping power

Parameters

| | |
|----------|---------------------------------|
| <i>E</i> | the test particle energy in MeV |
|----------|---------------------------------|

Returns

stopping power in units of MeV/um

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

Implements [StopPow::StopPow](#).

5.6.2.3 float StopPow::StopPow_LP::get_Emax () [virtual]

Get the maximum energy that can be used for dE/dx calculations

Returns

Emax in MeV

Implements [StopPow::StopPow](#).

5.6.2.4 float StopPow::StopPow_LP::get_Emin () [virtual]

Get the minimum energy that can be used for dE/dx calculations

Returns

Emin in MeV

Implements [StopPow::StopPow](#).

5.6.2.5 void StopPow::StopPow_LP::set_collective (bool set)

Turn collective effects on or off.

Parameters

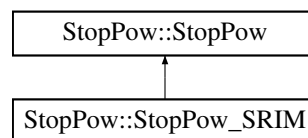
| | |
|------------|---------------------------------------|
| <i>set</i> | if you want to use collective effects |
|------------|---------------------------------------|

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

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_LP.h

5.7 StopPow::StopPow_SRIM Class Reference

Inheritance diagram for StopPow::StopPow_SRIM:



Public Member Functions

- [StopPow_SRIM](#) (std::string fname)
- [~StopPow_SRIM](#) ()
- float [dEdx_MeV_um](#) (float E)
- float [dEdx_MeV_mgcm2](#) (float E)
- float [get_Emin](#) ()
- float [get_Emax](#) ()

Additional Inherited Members

5.7.1 Constructor & Destructor Documentation

5.7.1.1 StopPow::StopPow_SRIM::StopPow_SRIM (std::string *fname*) [explicit]

Constructor for SRIM object. Data file must be in standard SRIM format.

Parameters

| | |
|--------------|---|
| <i>fname</i> | file name (or relative path) for the data |
|--------------|---|

Exceptions

| | |
|--------------------------|--|
| <i>ios_base::failure</i> | |
|--------------------------|--|

5.7.1.2 StopPow::StopPow_SRIM::~~StopPow_SRIM ()

Destructor

5.7.2 Member Function Documentation

5.7.2.1 float StopPow::StopPow_SIRM::dEdx_MeV_mgcm2 (float *E*) [virtual]

Get stopping power from the data.

Parameters

| | |
|----------|----------------------------|
| <i>E</i> | the particle energy in MeV |
|----------|----------------------------|

Returns

dE/dx in MeV/(mg/cm2)

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

Implements [StopPow::StopPow](#).

5.7.2.2 float StopPow::StopPow_SIRM::dEdx_MeV_um (float *E*) [virtual]

Get stopping power from the data.

Parameters

| | |
|----------|----------------------------|
| <i>E</i> | the particle energy in MeV |
|----------|----------------------------|

Returns

dE/dx in MeV/um

Exceptions

| | |
|-------------------------|--|
| <i>invalid_argument</i> | |
|-------------------------|--|

Implements [StopPow::StopPow](#).

5.7.2.3 float StopPow::StopPow_SIRM::get_Emax () [virtual]

Get the maximum energy that can be used for dE/dx calculations

Returns

Emax in MeV

Implements [StopPow::StopPow](#).

5.7.2.4 float StopPow::StopPow_SIRM::get_Emin () [virtual]

Get the minimum energy that can be used for dE/dx calculations

Returns

Emin in MeV

Implements [StopPow::StopPow](#).

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

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_SRIM.h

5.8 StopPow_SRIM Class Reference

Cold-matter tabulated stopping.

```
#include <StopPow_SRIM.h>
```

5.8.1 Detailed Description

Cold-matter tabulated stopping.

A wrapper class for calculating stopping powers using tabulated SRIM data (stored in csv files) Linear interpolation is performed between data points.

Author

Alex Zylstra

Date

2013/04/03

Copyright

MIT / Alex Zylstra

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

- /Users/alex/Dropbox/Research/Code/StopPow/src/StopPow_SRIM.h

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