

XNLO - UPPE

1.3.0

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# Chapter 1

## Class Index

### 1.1 Class List

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## Chapter 2

# File Index

### 2.1 File List

Here is a list of all files with brief descriptions:

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## Chapter 3

# Class Documentation

### 3.1 capillary\_fibre Class Reference

```
#include <capillary_fibre.hpp>
```

#### Public Member Functions

- [capillary\\_fibre](#) (double *Z\_*, [grid\\_rkr](#) &*rkr\_*, [grid\\_tw](#) &*tw\_*, [physics\\_textbook](#) &*physics\_*, [maths\\_textbook](#) &*maths\_*)

#### Public Attributes

- ArrayXXcd [gamma](#)
- double [Z](#)
- double [R](#)
- double [n\\_glass](#)

#### 3.1.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "capillary\_fibre" describes the dimensions and dispersion properties of a dielectric capillary type fibre.

#### 3.1.2 Constructor & Destructor Documentation

##### 3.1.2.1 capillary\_fibre()

```
capillary_fibre::capillary_fibre (
    double Z_,
    grid\_rkr & rkr_,
    grid\_tw & tw_,
    physics\_textbook & physics_,
    maths\_textbook & maths_ )
```

Constructor

### 3.1.3 Member Data Documentation

#### 3.1.3.1 gamma

```
ArrayXXcd capillary_fibre::gamma
```

#### 3.1.3.2 n\_glass

```
double capillary_fibre::n_glass
```

#### 3.1.3.3 R

```
double capillary_fibre::R
```

#### 3.1.3.4 Z

```
double capillary_fibre::Z
```

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

- [/home/sam/Project/XNLO/UPPE/src/capillary\\_fibre.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/capillary\\_fibre.cpp](#)

## 3.2 Config\_Settings Class Reference

```
#include <config_settings.hpp>
```

## Public Member Functions

- [Config\\_Settings](#) ()
- void [read\\_in](#) (std::string, bool print\_to\_screen=true)
- void [check\\_paths](#) (bool print\_to\_screen=true)
- void [step\\_path](#) (int step)
- void [print](#) ()
- void [print](#) (std::string)
- int [n\\_z](#) ()
- void [n\\_z\\_set](#) (int)
- std::string [n\\_z\\_description](#) ()
- void [n\\_z\\_description\\_set](#) (std::string)
- int [n\\_r](#) ()
- void [n\\_r\\_set](#) (int)
- std::string [n\\_r\\_description](#) ()
- void [n\\_r\\_description\\_set](#) (std::string)
- int [n\\_m](#) ()
- void [n\\_m\\_set](#) (int)
- std::string [n\\_m\\_description](#) ()
- void [n\\_m\\_description\\_set](#) (std::string)
- int [n\\_t](#) ()
- void [n\\_t\\_set](#) (int)
- std::string [n\\_t\\_description](#) ()
- void [n\\_t\\_description\\_set](#) (std::string)
- double [T](#) ()
- void [T\\_set](#) (double)
- std::string [T\\_description](#) ()
- void [T\\_description\\_set](#) (std::string)
- double [w\\_active\\_min](#) ()
- void [w\\_active\\_min\\_set](#) (double)
- std::string [w\\_active\\_min\\_description](#) ()
- void [w\\_active\\_min\\_description\\_set](#) (std::string)
- double [w\\_active\\_max](#) ()
- void [w\\_active\\_max\\_set](#) (double)
- std::string [w\\_active\\_max\\_description](#) ()
- void [w\\_active\\_max\\_description\\_set](#) (std::string)
- double [Z](#) ()
- void [Z\\_set](#) (double)
- std::string [Z\\_description](#) ()
- void [Z\\_description\\_set](#) (std::string)
- double [R](#) ()
- void [R\\_set](#) (double)
- std::string [R\\_description](#) ()
- void [R\\_description\\_set](#) (std::string)
- double [press](#) ()
- void [press\\_set](#) (double)
- std::string [press\\_description](#) ()
- void [press\\_description\\_set](#) (std::string)
- double [p\\_av](#) ()
- void [p\\_av\\_set](#) (double)
- std::string [p\\_av\\_description](#) ()
- void [p\\_av\\_description\\_set](#) (std::string)
- double [rep](#) ()
- void [rep\\_set](#) (double)
- std::string [rep\\_description](#) ()

- void [rep\\_description\\_set](#) (std::string)
- double [fwhm](#) ()
- void [fwhm\\_set](#) (double)
- std::string [fwhm\\_description](#) ()
- void [fwhm\\_description\\_set](#) (std::string)
- double [l\\_0](#) ()
- void [l\\_0\\_set](#) (double)
- std::string [l\\_0\\_description](#) ()
- void [l\\_0\\_description\\_set](#) (std::string)
- double [ceo](#) ()
- void [ceo\\_set](#) (double)
- std::string [ceo\\_description](#) ()
- void [ceo\\_description\\_set](#) (std::string)
- double [waist](#) ()
- void [waist\\_set](#) (double)
- std::string [waist\\_description](#) ()
- void [waist\\_description\\_set](#) (std::string)
- std::string [pend\\_path](#) ()
- void [pend\\_path\\_set](#) (std::string)
- std::string [pend\\_path\\_description](#) ()
- void [pend\\_path\\_description\\_set](#) (std::string)
- std::string [path\\_input\\_j0](#) ()
- void [path\\_input\\_j0\\_set](#) (std::string)
- std::string [path\\_input\\_j0\\_description](#) ()
- void [path\\_input\\_j0\\_description\\_set](#) (std::string)
- std::string [path\\_A\\_w\\_R](#) ()
- void [path\\_A\\_w\\_R\\_set](#) (std::string)
- std::string [path\\_A\\_w\\_R\\_description](#) ()
- void [path\\_A\\_w\\_R\\_description\\_set](#) (std::string)
- std::string [path\\_A\\_w\\_I](#) ()
- void [path\\_A\\_w\\_I\\_set](#) (std::string)
- std::string [path\\_A\\_w\\_I\\_description](#) ()
- void [path\\_A\\_w\\_I\\_description\\_set](#) (std::string)
- std::string [path\\_w\\_active](#) ()
- void [path\\_w\\_active\\_set](#) (std::string)
- std::string [path\\_w\\_active\\_description](#) ()
- void [path\\_w\\_active\\_description\\_set](#) (std::string)
- std::string [path\\_electron\\_density](#) ()
- void [path\\_electron\\_density\\_set](#) (std::string)
- std::string [path\\_electron\\_density\\_description](#) ()
- void [path\\_electron\\_density\\_description\\_set](#) (std::string)
- std::string [path\\_HHG\\_R](#) ()
- void [path\\_HHG\\_R\\_set](#) (std::string)
- std::string [path\\_HHG\\_R\\_description](#) ()
- void [path\\_HHG\\_R\\_description\\_set](#) (std::string)
- std::string [path\\_HHG\\_I](#) ()
- void [path\\_HHG\\_I\\_set](#) (std::string)
- std::string [path\\_HHG\\_I\\_description](#) ()
- void [path\\_HHG\\_I\\_description\\_set](#) (std::string)
- std::string [path\\_HHG\\_w](#) ()
- void [path\\_HHG\\_w\\_set](#) (std::string)
- std::string [path\\_HHG\\_w\\_description](#) ()
- void [path\\_HHG\\_w\\_description\\_set](#) (std::string)
- std::string [path\\_HHG\\_E](#) ()
- void [path\\_HHG\\_E\\_set](#) (std::string)

- std::string [path\\_HHG\\_E\\_description](#) ()
- void [path\\_HHG\\_E\\_description\\_set](#) (std::string)
- std::string [path\\_config\\_file](#) ()
- void [path\\_config\\_file\\_set](#) (std::string)
- std::string [path\\_config\\_file\\_description](#) ()
- void [path\\_config\\_file\\_description\\_set](#) (std::string)
- std::string [path\\_config\\_log](#) ()
- void [path\\_config\\_log\\_set](#) (std::string)
- std::string [path\\_config\\_log\\_description](#) ()
- void [path\\_config\\_log\\_description\\_set](#) (std::string)

### Private Types

- enum [SN](#) {  
[SN::n\\_z](#) = 0, [SN::n\\_r](#), [SN::n\\_m](#), [SN::n\\_t](#),  
[SN::T](#), [SN::w\\_active\\_min](#), [SN::w\\_active\\_max](#), [SN::Z](#),  
[SN::R](#), [SN::press](#), [SN::p\\_av](#), [SN::rep](#),  
[SN::fwhm](#), [SN::l\\_0](#), [SN::ceo](#), [SN::waist](#),  
[SN::pend\\_path](#), [SN::path\\_input\\_j0](#), [SN::path\\_A\\_w\\_R](#), [SN::path\\_A\\_w\\_I](#),  
[SN::path\\_w\\_active](#), [SN::path\\_HHG\\_R](#), [SN::path\\_HHG\\_I](#), [SN::path\\_HHG\\_w](#),  
[SN::path\\_HHG\\_E](#), [SN::path\\_config\\_file](#), [SN::path\\_config\\_log](#), [SN::LAST\\_SN\\_ENTRY](#) }

### Private Member Functions

- void [set\\_variable](#) (std::string &, std::string &, std::string &, bool print\_to\_screen=true)
- std::string [set\\_path](#) (std::string, std::string, std::string pend="")
- std::string [set\\_pre\\_path](#) (std::string, std::string)
- std::string [set\\_post\\_path](#) (std::string, std::string)

### Private Attributes

- int [n\\_z](#) = 50
- int [n\\_r](#) = 20
- int [n\\_m](#) = 20
- int [n\\_t](#) = 4096
- double [T](#) = 500.0e-15
- double [w\\_active\\_min](#) = 2.0e14
- double [w\\_active\\_max](#) = 8.0e15
- double [Z](#) = 5.0e-3
- double [R](#) = 75.0e-6
- double [press](#) = 100.0e-3
- double [p\\_av](#) = 1.0
- double [rep](#) = 1.0e3
- double [fwhm](#) = 40e-15
- double [l\\_0](#) = 800e-9
- double [ceo](#) = 0.0
- double [waist](#) = 48.0e-6
- std::string [path\\_input\\_j0](#) = "../input/J0\_zeros.bin"
- std::string [path\\_A\\_w\\_R](#) = "../output/A\_w\_R.bin"
- std::string [path\\_A\\_w\\_I](#) = "../output/A\_w\_I.bin"
- std::string [path\\_w\\_active](#) = "../output/w\_active.bin"
- std::string [path\\_electron\\_density](#) = "../output/electron\_density.bin"

- `std::string path_HHG_R_ = "../output/HHG_R.bin"`
- `std::string path_HHG_I_ = "../output/HHG_I.bin"`
- `std::string path_HHG_w_ = "../output/HHG_w.bin"`
- `std::string path_HHG_E_ = "../output/HHG_E.bin"`
- `std::string path_config_file_ = "../config.txt"`
- `std::string path_config_log_ = "../output/config_log.txt"`
- `std::string pend_path_ = "prepend"`
- `std::string n_z_description_ = "(default) (int) Number of steps in Z"`
- `std::string n_r_description_ = "(default) (int) The z_r value"`
- `std::string n_m_description_ = "(default) (int) Number of modes"`
- `std::string n_t_description_ = "(default) (int) The z_t value"`
- `std::string T_description_ = "(default) (double) The T value"`
- `std::string w_active_min_description_ = "(default) (double) Minimum angular frequency"`
- `std::string w_active_max_description_ = "(default) (double) Maximum angular frequency"`
- `std::string Z_description_ = "(default) (double) Length of capillary"`
- `std::string R_description_ = "(default) (double) Radius of capillary"`
- `std::string press_description_ = "(default) (double) Pressure of the gas"`
- `std::string p_av_description_ = "(default) (double) The p_av value"`
- `std::string rep_description_ = "(default) (double) The rep value"`
- `std::string fwhm_description_ = "(default) (double) Full width at half max"`
- `std::string l_0_description_ = "(default) (double) Laser central wavelength"`
- `std::string ceo_description_ = "(default) (double) The ceo value"`
- `std::string waist_description_ = "(default) (double) The waist value"`
- `std::string pend_path_description_ = "(default) (std::string) Pending switch"`
- `std::string path_input_j0_description_ = "(default) (std::string) Path to J0_zeros.bin"`
- `std::string path_A_w_R_description_ = "(default) (std::string) Path of A_w_R"`
- `std::string path_A_w_I_description_ = "(default) (std::string) Path of A_w_I"`
- `std::string path_w_active_description_ = "(default) (std::string) Path of w_active"`
- `std::string path_electron_density_description_ = "(default) (std::string) Path of electron_density"`
- `std::string path_HHG_R_description_ = "(default) (std::string) Path of HHG_R"`
- `std::string path_HHG_I_description_ = "(default) (std::string) Path of HHG_I"`
- `std::string path_HHG_w_description_ = "(default) (std::string) Path of HHG w"`
- `std::string path_HHG_E_description_ = "(default) (std::string) Path of HHG E"`
- `std::string path_config_file_description_ = "(default) (std::string) config.txt path"`
- `std::string path_config_log_description_ = "(default) (std::string) config_log.txt path"`

## Static Private Attributes

- `static const char * setting_name []`

### 3.2.1 Detailed Description

Modified by Samuel Senior on 05/02/2017. Reads in input parameters and settings from a config file.

### 3.2.2 Member Enumeration Documentation

#### 3.2.2.1 SN

```
enum Config_Settings::SN [strong], [private]
```



## Enumerator

n_z	
n_r	
n_m	
n_t	
T	
w_active_min	
w_active_max	
Z	
R	
press	
p_av	
rep	
fwhm	
I_0	
ceo	
waist	
pend_path	
path_input_j0	
path_A_w_R	
path_A_w_I	
path_w_active	
path_HHG_R	
path_HHG_I	
path_HHG_w	
path_HHG_E	
path_config_file	
path_config_log	
LAST_SN_ENTRY	

## 3.2.3 Constructor &amp; Destructor Documentation

## 3.2.3.1 Config\_Settings()

```
Config_Settings::Config_Settings ( )
```

Constructor

## 3.2.4 Member Function Documentation

#### 3.2.4.1 ceo()

```
double Config_Settings::ceo ( )
```

#### 3.2.4.2 ceo\_description()

```
std::string Config_Settings::ceo_description ( )
```

#### 3.2.4.3 ceo\_description\_set()

```
void Config_Settings::ceo_description_set (
    std::string description )
```

#### 3.2.4.4 ceo\_set()

```
void Config_Settings::ceo_set (
    double value )
```

#### 3.2.4.5 check\_paths()

```
void Config_Settings::check_paths (
    bool print_to_screen = true )
```

#### 3.2.4.6 fwhm()

```
double Config_Settings::fwhm ( )
```

#### 3.2.4.7 fwhm\_description()

```
std::string Config_Settings::fwhm_description ( )
```

#### 3.2.4.8 fwhm\_description\_set()

```
void Config_Settings::fwhm_description_set (
    std::string description )
```

#### 3.2.4.9 fwhm\_set()

```
void Config_Settings::fwhm_set (
    double value )
```

#### 3.2.4.10 l\_0()

```
double Config_Settings::l_0 ( )
```

#### 3.2.4.11 l\_0\_description()

```
std::string Config_Settings::l_0_description ( )
```

#### 3.2.4.12 l\_0\_description\_set()

```
void Config_Settings::l_0_description_set (
    std::string description )
```

#### 3.2.4.13 l\_0\_set()

```
void Config_Settings::l_0_set (
    double value )
```

#### 3.2.4.14 n\_m()

```
int Config_Settings::n_m ( )
```

**3.2.4.15 n\_m\_description()**

```
std::string Config_Settings::n_m_description ( )
```

**3.2.4.16 n\_m\_description\_set()**

```
void Config_Settings::n_m_description_set (
    std::string description )
```

**3.2.4.17 n\_m\_set()**

```
void Config_Settings::n_m_set (
    int value )
```

**3.2.4.18 n\_r()**

```
int Config_Settings::n_r ( )
```

**3.2.4.19 n\_r\_description()**

```
std::string Config_Settings::n_r_description ( )
```

**3.2.4.20 n\_r\_description\_set()**

```
void Config_Settings::n_r_description_set (
    std::string description )
```

**3.2.4.21 n\_r\_set()**

```
void Config_Settings::n_r_set (
    int value )
```

**3.2.4.22 n\_t()**

```
int Config_Settings::n_t ( )
```

**3.2.4.23 n\_t\_description()**

```
std::string Config_Settings::n_t_description ( )
```

**3.2.4.24 n\_t\_description\_set()**

```
void Config_Settings::n_t_description_set (
    std::string description )
```

**3.2.4.25 n\_t\_set()**

```
void Config_Settings::n_t_set (
    int value )
```

**3.2.4.26 n\_z()**

```
int Config_Settings::n_z ( )
```

**3.2.4.27 n\_z\_description()**

```
std::string Config_Settings::n_z_description ( )
```

**3.2.4.28 n\_z\_description\_set()**

```
void Config_Settings::n_z_description_set (
    std::string description )
```

**3.2.4.29 n\_z\_set()**

```
void Config_Settings::n_z_set (
    int value )
```

**3.2.4.30 p\_av()**

```
double Config_Settings::p_av ( )
```

**3.2.4.31 p\_av\_description()**

```
std::string Config_Settings::p_av_description ( )
```

**3.2.4.32 p\_av\_description\_set()**

```
void Config_Settings::p_av_description_set (
    std::string description )
```

**3.2.4.33 p\_av\_set()**

```
void Config_Settings::p_av_set (
    double value )
```

**3.2.4.34 path\_A\_w\_I()**

```
std::string Config_Settings::path_A_w_I ( )
```

**3.2.4.35 path\_A\_w\_I\_description()**

```
std::string Config_Settings::path_A_w_I_description ( )
```

**3.2.4.36 path\_A\_w\_I\_description\_set()**

```
void Config_Settings::path_A_w_I_description_set (
    std::string description )
```

**3.2.4.37 path\_A\_w\_I\_set()**

```
void Config_Settings::path_A_w_I_set (
    std::string value )
```

**3.2.4.38 path\_A\_w\_R()**

```
std::string Config_Settings::path_A_w_R ( )
```

**3.2.4.39 path\_A\_w\_R\_description()**

```
std::string Config_Settings::path_A_w_R_description ( )
```

**3.2.4.40 path\_A\_w\_R\_description\_set()**

```
void Config_Settings::path_A_w_R_description_set (
    std::string description )
```

**3.2.4.41 path\_A\_w\_R\_set()**

```
void Config_Settings::path_A_w_R_set (
    std::string value )
```

**3.2.4.42 path\_config\_file()**

```
std::string Config_Settings::path_config_file ( )
```

**3.2.4.43 path\_config\_file\_description()**

```
std::string Config_Settings::path_config_file_description ( )
```

**3.2.4.44 path\_config\_file\_description\_set()**

```
void Config_Settings::path_config_file_description_set (
    std::string description )
```

**3.2.4.45 path\_config\_file\_set()**

```
void Config_Settings::path_config_file_set (
    std::string value )
```

**3.2.4.46 path\_config\_log()**

```
std::string Config_Settings::path_config_log ( )
```

**3.2.4.47 path\_config\_log\_description()**

```
std::string Config_Settings::path_config_log_description ( )
```

**3.2.4.48 path\_config\_log\_description\_set()**

```
void Config_Settings::path_config_log_description_set (
    std::string description )
```

**3.2.4.49 path\_config\_log\_set()**

```
void Config_Settings::path_config_log_set (
    std::string value )
```



#### 3.2.4.50 path\_electron\_density()

```
std::string Config_Settings::path_electron_density ( )
```

#### 3.2.4.51 path\_electron\_density\_description()

```
std::string Config_Settings::path_electron_density_description ( )
```

#### 3.2.4.52 path\_electron\_density\_description\_set()

```
void Config_Settings::path_electron_density_description_set (
    std::string description )
```

#### 3.2.4.53 path\_electron\_density\_set()

```
void Config_Settings::path_electron_density_set (
    std::string value )
```

#### 3.2.4.54 path\_HHG\_E()

```
std::string Config_Settings::path_HHG_E ( )
```

#### 3.2.4.55 path\_HHG\_E\_description()

```
std::string Config_Settings::path_HHG_E_description ( )
```

#### 3.2.4.56 path\_HHG\_E\_description\_set()

```
void Config_Settings::path_HHG_E_description_set (
    std::string description )
```

**3.2.4.57 path\_HHG\_E\_set()**

```
void Config_Settings::path_HHG_E_set (
    std::string value )
```

**3.2.4.58 path\_HHG\_I()**

```
std::string Config_Settings::path_HHG_I ( )
```

**3.2.4.59 path\_HHG\_I\_description()**

```
std::string Config_Settings::path_HHG_I_description ( )
```

**3.2.4.60 path\_HHG\_I\_description\_set()**

```
void Config_Settings::path_HHG_I_description_set (
    std::string description )
```

**3.2.4.61 path\_HHG\_I\_set()**

```
void Config_Settings::path_HHG_I_set (
    std::string value )
```

**3.2.4.62 path\_HHG\_R()**

```
std::string Config_Settings::path_HHG_R ( )
```

**3.2.4.63 path\_HHG\_R\_description()**

```
std::string Config_Settings::path_HHG_R_description ( )
```

**3.2.4.64 path\_HHG\_R\_description\_set()**

```
void Config_Settings::path_HHG_R_description_set (
    std::string description )
```

**3.2.4.65 path\_HHG\_R\_set()**

```
void Config_Settings::path_HHG_R_set (
    std::string value )
```

**3.2.4.66 path\_HHG\_w()**

```
std::string Config_Settings::path_HHG_w ( )
```

**3.2.4.67 path\_HHG\_w\_description()**

```
std::string Config_Settings::path_HHG_w_description ( )
```

**3.2.4.68 path\_HHG\_w\_description\_set()**

```
void Config_Settings::path_HHG_w_description_set (
    std::string description )
```

**3.2.4.69 path\_HHG\_w\_set()**

```
void Config_Settings::path_HHG_w_set (
    std::string value )
```

**3.2.4.70 path\_input\_j0()**

```
std::string Config_Settings::path_input_j0 ( )
```

**3.2.4.71 path\_input\_j0\_description()**

```
std::string Config_Settings::path_input_j0_description ( )
```

**3.2.4.72 path\_input\_j0\_description\_set()**

```
void Config_Settings::path_input_j0_description_set (
    std::string description )
```

**3.2.4.73 path\_input\_j0\_set()**

```
void Config_Settings::path_input_j0_set (
    std::string value )
```

**3.2.4.74 path\_w\_active()**

```
std::string Config_Settings::path_w_active ( )
```

**3.2.4.75 path\_w\_active\_description()**

```
std::string Config_Settings::path_w_active_description ( )
```

**3.2.4.76 path\_w\_active\_description\_set()**

```
void Config_Settings::path_w_active_description_set (
    std::string description )
```

**3.2.4.77 path\_w\_active\_set()**

```
void Config_Settings::path_w_active_set (
    std::string value )
```

**3.2.4.78 pend\_path()**

```
std::string Config_Settings::pend_path ( )
```

**3.2.4.79 pend\_path\_description()**

```
std::string Config_Settings::pend_path_description ( )
```

**3.2.4.80 pend\_path\_description\_set()**

```
void Config_Settings::pend_path_description_set (
    std::string description )
```

**3.2.4.81 pend\_path\_set()**

```
void Config_Settings::pend_path_set (
    std::string value )
```

**3.2.4.82 press()**

```
double Config_Settings::press ( )
```

**3.2.4.83 press\_description()**

```
std::string Config_Settings::press_description ( )
```

**3.2.4.84 press\_description\_set()**

```
void Config_Settings::press_description_set (
    std::string description )
```

**3.2.4.85 press\_set()**

```
void Config_Settings::press_set (
    double value )
```

**3.2.4.86 print()** [1/2]

```
void Config_Settings::print ( )
```

**3.2.4.87 print()** [2/2]

```
void Config_Settings::print (
    std::string path_ )
```

**3.2.4.88 R()**

```
double Config_Settings::R ( )
```

**3.2.4.89 R\_description()**

```
std::string Config_Settings::R_description ( )
```

**3.2.4.90 R\_description\_set()**

```
void Config_Settings::R_description_set (
    std::string description )
```

**3.2.4.91 R\_set()**

```
void Config_Settings::R_set (
    double value )
```

**3.2.4.92 read\_in()**

```
void Config_Settings::read_in (
    std::string path,
    bool print_to_screen = true )
```

**3.2.4.93 rep()**

```
double Config_Settings::rep ( )
```

**3.2.4.94 rep\_description()**

```
std::string Config_Settings::rep_description ( )
```

**3.2.4.95 rep\_description\_set()**

```
void Config_Settings::rep_description_set (
    std::string description )
```

**3.2.4.96 rep\_set()**

```
void Config_Settings::rep_set (
    double value )
```

**3.2.4.97 set\_path()**

```
std::string Config_Settings::set_path (
    std::string path,
    std::string pending_string,
    std::string pend = "" ) [private]
```

**3.2.4.98 set\_post\_path()**

```
std::string Config_Settings::set_post_path (
    std::string path,
    std::string post_path ) [private]
```

**3.2.4.99 set\_pre\_path()**

```
std::string Config_Settings::set_pre_path (
    std::string pre_path,
    std::string path ) [private]
```

**3.2.4.100 set\_variable()**

```
void Config_Settings::set_variable (
    std::string & variable_name,
    std::string & variable_value_str,
    std::string & input_description_char,
    bool print_to_screen = true ) [private]
```

**3.2.4.101 step\_path()**

```
void Config_Settings::step_path (
    int step )
```

**3.2.4.102 T()**

```
double Config_Settings::T ( )
```

**3.2.4.103 T\_description()**

```
std::string Config_Settings::T_description ( )
```

**3.2.4.104 T\_description\_set()**

```
void Config_Settings::T_description_set (
    std::string description )
```

**3.2.4.105 T\_set()**

```
void Config_Settings::T_set (
    double value )
```



**3.2.4.106 w\_active\_max()**

```
double Config_Settings::w_active_max ( )
```

**3.2.4.107 w\_active\_max\_description()**

```
std::string Config_Settings::w_active_max_description ( )
```

**3.2.4.108 w\_active\_max\_description\_set()**

```
void Config_Settings::w_active_max_description_set (
    std::string description )
```

**3.2.4.109 w\_active\_max\_set()**

```
void Config_Settings::w_active_max_set (
    double value )
```

**3.2.4.110 w\_active\_min()**

```
double Config_Settings::w_active_min ( )
```

**3.2.4.111 w\_active\_min\_description()**

```
std::string Config_Settings::w_active_min_description ( )
```

**3.2.4.112 w\_active\_min\_description\_set()**

```
void Config_Settings::w_active_min_description_set (
    std::string description )
```

**3.2.4.113 w\_active\_min\_set()**

```
void Config_Settings::w_active_min_set (
    double value )
```

**3.2.4.114 waist()**

```
double Config_Settings::waist ( )
```

**3.2.4.115 waist\_description()**

```
std::string Config_Settings::waist_description ( )
```

**3.2.4.116 waist\_description\_set()**

```
void Config_Settings::waist_description_set (
    std::string description )
```

**3.2.4.117 waist\_set()**

```
void Config_Settings::waist_set (
    double value )
```

**3.2.4.118 Z()**

```
double Config_Settings::Z ( )
```

**3.2.4.119 Z\_description()**

```
std::string Config_Settings::Z_description ( )
```

#### 3.2.4.120 Z\_description\_set()

```
void Config_Settings::Z_description_set (
    std::string description )
```

#### 3.2.4.121 Z\_set()

```
void Config_Settings::Z_set (
    double value )
```

### 3.2.5 Member Data Documentation

#### 3.2.5.1 ceo\_

```
double Config_Settings::ceo_ = 0.0 [private]
```

#### 3.2.5.2 ceo\_description\_

```
std::string Config_Settings::ceo_description_ = "(default) (double) The ceo value" [private]
```

#### 3.2.5.3 fwhm\_

```
double Config_Settings::fwhm_ = 40e-15 [private]
```

#### 3.2.5.4 fwhm\_description\_

```
std::string Config_Settings::fwhm_description_ = "(default) (double) Full width at half max"
[private]
```

#### 3.2.5.5 l\_0\_

```
double Config_Settings::l_0_ = 800e-9 [private]
```

#### 3.2.5.6 l\_0\_description\_

```
std::string Config_Settings::l_0_description_ = "(default) (double) Laser central wavelength"
[private]
```

#### 3.2.5.7 n\_m\_

```
int Config_Settings::n_m_ = 20 [private]
```

#### 3.2.5.8 n\_m\_description\_

```
std::string Config_Settings::n_m_description_ = "(default) (int) Number of modes" [private]
```

#### 3.2.5.9 n\_r\_

```
int Config_Settings::n_r_ = 20 [private]
```

#### 3.2.5.10 n\_r\_description\_

```
std::string Config_Settings::n_r_description_ = "(default) (int) The z_r value" [private]
```

#### 3.2.5.11 n\_t\_

```
int Config_Settings::n_t_ = 4096 [private]
```

#### 3.2.5.12 n\_t\_description\_

```
std::string Config_Settings::n_t_description_ = "(default) (int) The z_t value" [private]
```

### 3.2.5.13 n\_z\_

```
int Config_Settings::n_z_ = 50 [private]
```

### 3.2.5.14 n\_z\_description\_

```
std::string Config_Settings::n_z_description_ = "(default) (int) Number of steps in Z" [private]
```

### 3.2.5.15 p\_av\_

```
double Config_Settings::p_av_ = 1.0 [private]
```

### 3.2.5.16 p\_av\_description\_

```
std::string Config_Settings::p_av_description_ = "(default) (double) The p_av value" [private]
```

### 3.2.5.17 path\_A\_w\_I\_

```
std::string Config_Settings::path_A_w_I_ = "../output/A_w_I.bin" [private]
```

### 3.2.5.18 path\_A\_w\_I\_description\_

```
std::string Config_Settings::path_A_w_I_description_ = "(default) (std::string) Path of A_w_I" [private]
```

### 3.2.5.19 path\_A\_w\_R\_

```
std::string Config_Settings::path_A_w_R_ = "../output/A_w_R.bin" [private]
```

### 3.2.5.20 path\_A\_w\_R\_description\_

```
std::string Config_Settings::path_A_w_R_description_ = "(default) (std::string) Path of A_w_R"  
[private]
```

### 3.2.5.21 path\_config\_file\_

```
std::string Config_Settings::path_config_file_ = "./config.txt" [private]
```

### 3.2.5.22 path\_config\_file\_description\_

```
std::string Config_Settings::path_config_file_description_ = "(default) (std::string) config.↵  
txt path" [private]
```

### 3.2.5.23 path\_config\_log\_

```
std::string Config_Settings::path_config_log_ = "../output/config_log.txt" [private]
```

### 3.2.5.24 path\_config\_log\_description\_

```
std::string Config_Settings::path_config_log_description_ = "(default) (std::string) config.↵  
log.txt path" [private]
```

### 3.2.5.25 path\_electron\_density\_

```
std::string Config_Settings::path_electron_density_ = "../output/electron_density.bin" [private]
```

### 3.2.5.26 path\_electron\_density\_description\_

```
std::string Config_Settings::path_electron_density_description_ = "(default) (std::string)  
Path of electron_density" [private]
```

### 3.2.5.27 path\_HHG\_E\_

```
std::string Config_Settings::path_HHG_E_ = "../output/HHG_E.bin" [private]
```

### 3.2.5.28 path\_HHG\_E\_description\_

```
std::string Config_Settings::path_HHG_E_description_ = "(default) (std::string) Path of HHG E" [private]
```

### 3.2.5.29 path\_HHG\_I\_

```
std::string Config_Settings::path_HHG_I_ = "../output/HHG_I.bin" [private]
```

### 3.2.5.30 path\_HHG\_I\_description\_

```
std::string Config_Settings::path_HHG_I_description_ = "(default) (std::string) Path of HHG_I" [private]
```

### 3.2.5.31 path\_HHG\_R\_

```
std::string Config_Settings::path_HHG_R_ = "../output/HHG_R.bin" [private]
```

### 3.2.5.32 path\_HHG\_R\_description\_

```
std::string Config_Settings::path_HHG_R_description_ = "(default) (std::string) Path of HHG_R" [private]
```

### 3.2.5.33 path\_HHG\_w\_

```
std::string Config_Settings::path_HHG_w_ = "../output/HHG_w.bin" [private]
```

#### 3.2.5.34 path\_HHG\_w\_description\_

```
std::string Config_Settings::path_HHG_w_description_ = "(default) (std::string) Path of HHG w"  
[private]
```

#### 3.2.5.35 path\_input\_j0\_

```
std::string Config_Settings::path_input_j0_ = "../input/J0_zeros.bin" [private]
```

#### 3.2.5.36 path\_input\_j0\_description\_

```
std::string Config_Settings::path_input_j0_description_ = "(default) (std::string) Path to  
J0_zeros.bin" [private]
```

#### 3.2.5.37 path\_w\_active\_

```
std::string Config_Settings::path_w_active_ = "../output/w_active.bin" [private]
```

#### 3.2.5.38 path\_w\_active\_description\_

```
std::string Config_Settings::path_w_active_description_ = "(default) (std::string) Path of w←  
_active" [private]
```

#### 3.2.5.39 pend\_path\_

```
std::string Config_Settings::pend_path_ = "prepend" [private]
```

#### 3.2.5.40 pend\_path\_description\_

```
std::string Config_Settings::pend_path_description_ = "(default) (std::string) Pending switch"  
[private]
```



**3.2.5.41 press\_**

```
double Config_Settings::press_ = 100.0e-3 [private]
```

**3.2.5.42 press\_description\_**

```
std::string Config_Settings::press_description_ = "(default) (double) Pressure of the gas"
[private]
```

**3.2.5.43 R\_**

```
double Config_Settings::R_ = 75.0e-6 [private]
```

**3.2.5.44 R\_description\_**

```
std::string Config_Settings::R_description_ = "(default) (double) Radius of capillary" [private]
```

**3.2.5.45 rep\_**

```
double Config_Settings::rep_ = 1.0e3 [private]
```

**3.2.5.46 rep\_description\_**

```
std::string Config_Settings::rep_description_ = "(default) (double) The rep value" [private]
```

**3.2.5.47 setting\_name**

```
const char * Config_Settings::setting_name [static], [private]
```

**Initial value:**

```
= {
    "n_z", "n_r", "n_m",
    "n_t", "T", "w_active_min", "w_active_max",
    "Z", "R",
    "press",
    "p_av", "rep", "fwhm", "l_0", "ceo", "waist",
    "pend_path",
    "path_input_j0",
    "path_A_w_R", "path_A_w_I", "path_w_active",
    "path_HHG_R", "path_HHG_I", "path_HHG_w", "path_HHG_E",
    "path_config_file", "path_config_log"
}
```

#### 3.2.5.48 T\_

```
double Config_Settings::T_ = 500.0e-15 [private]
```

#### 3.2.5.49 T\_description\_

```
std::string Config_Settings::T_description_ = "(default) (double) The T value" [private]
```

#### 3.2.5.50 w\_active\_max\_

```
double Config_Settings::w_active_max_ = 8.0e15 [private]
```

#### 3.2.5.51 w\_active\_max\_description\_

```
std::string Config_Settings::w_active_max_description_ = "(default) (double) Maximum angular frequency" [private]
```

#### 3.2.5.52 w\_active\_min\_

```
double Config_Settings::w_active_min_ = 2.0e14 [private]
```

#### 3.2.5.53 w\_active\_min\_description\_

```
std::string Config_Settings::w_active_min_description_ = "(default) (double) Minimum angular frequency" [private]
```

#### 3.2.5.54 waist\_

```
double Config_Settings::waist_ = 48.0e-6 [private]
```

## 3.2.5.55 waist\_description\_

```
std::string Config_Settings::waist_description_ = "(default) (double) The waist value" [private]
```

## 3.2.5.56 Z\_

```
double Config_Settings::Z_ = 5.0e-3 [private]
```

## 3.2.5.57 Z\_description\_

```
std::string Config_Settings::Z_description_ = "(default) (double) Length of capillary" [private]
```

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

- [/home/sam/Project/XNLO/UPPE/src/config\\_settings.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/config\\_settings.cpp](#)

## 3.3 DHT Class Reference

```
#include <DHT.hpp>
```

### Public Member Functions

- [DHT](#) ()
- [DHT](#) (int n\_r\_, [maths\\_textbook](#) &maths\_)
- Eigen::ArrayXcd [forward](#) (Eigen::ArrayXcd f\_r\_)
- Eigen::ArrayXcd [backward](#) (Eigen::ArrayXcd f\_kr\_)

### Private Attributes

- MatrixXcd [H](#)

### 3.3.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "DHT" evaluates the forward and backward discrete Hankel transform. Based on Fisk, Computer Physics Communications, 43 (1987). Complex datatype used here, should really template/overload.

### 3.3.2 Constructor & Destructor Documentation

### 3.3.2.1 DHT() [1/2]

```
DHT::DHT ( )
```

Default constructor

### 3.3.2.2 DHT() [2/2]

```
DHT::DHT (
    int n_r_,
    maths_textbook & maths_ )
```

Parameterized constructor

## 3.3.3 Member Function Documentation

### 3.3.3.1 backward()

```
Eigen::ArrayXcd DHT::backward (
    Eigen::ArrayXcd f_kr_ )
```

Backward transform

### 3.3.3.2 forward()

```
Eigen::ArrayXcd DHT::forward (
    Eigen::ArrayXcd f_r_ )
```

Forward transform

## 3.3.4 Member Data Documentation

### 3.3.4.1 H

```
MatrixXcd DHT::H [private]
```

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

- [/home/sam/Project/XNLO/UPPE/src/DHT.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/DHT.cpp](#)

## 3.4 grid\_rkr Class Reference

```
#include <grid_rkr.hpp>
```

### Public Member Functions

- [grid\\_rkr](#) ()
- [grid\\_rkr](#) (int n\_r\_, double R\_, int n\_m\_, [maths\\_textbook](#) &maths\_)

### Public Attributes

- [ArrayXd](#) [r](#)
- [ArrayXd](#) [kr](#)
- [int](#) [n\\_r](#)
- [double](#) [R](#)
- [int](#) [n\\_m](#)

### 3.4.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "grid\_rkr" is a non-uniform radial grid. The spectral counterpart of this grid is evaluated and accessible.

### 3.4.2 Constructor & Destructor Documentation

#### 3.4.2.1 [grid\\_rkr\(\)](#) [1/2]

```
grid_rkr::grid_rkr ( )
```

Default constructor

#### 3.4.2.2 [grid\\_rkr\(\)](#) [2/2]

```
grid_rkr::grid_rkr (
    int n_r_,
    double R_,
    int n_m_,
    maths\_textbook & maths_ )
```

Parameterized constructor

### 3.4.3 Member Data Documentation

#### 3.4.3.1 kr

```
ArrayXd grid_rkr::kr
```

#### 3.4.3.2 n\_m

```
int grid_rkr::n_m
```

#### 3.4.3.3 n\_r

```
int grid_rkr::n_r
```

#### 3.4.3.4 r

```
ArrayXd grid_rkr::r
```

#### 3.4.3.5 R

```
double grid_rkr::R
```

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

- [/home/sam/Project/XNLO/UPPE/src/grid\\_rkr.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/grid\\_rkr.cpp](#)

## 3.5 grid\_tw Class Reference

```
#include <grid_tw.hpp>
```

### Public Member Functions

- [grid\\_tw\(\)](#)
- [grid\\_tw\(int N\\_t\\_, double T\\_, double w\\_active\\_min\\_, double w\\_active\\_max\\_, \[maths\\\_textbook\]\(#\) &maths\\_\)](#)

## Public Attributes

- ArrayXd [t](#)
- ArrayXd [w\\_active](#)
- int [n\\_t](#)
- int [n\\_active](#)
- int [w\\_active\\_min\\_index](#)

### 3.5.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "grid\_tw" is a linear temporal grid. The spectral counterpart of this grid is evaluated and made accessible.

### 3.5.2 Constructor & Destructor Documentation

#### 3.5.2.1 `grid_tw()` [1/2]

```
grid_tw::grid_tw ( )
```

#### 3.5.2.2 `grid_tw()` [2/2]

```
grid_tw::grid_tw (
    int n_t_,
    double T_,
    double w_active_min_,
    double w_active_max_,
    maths\_textbook & maths\_ )
```

Parameterized Constructor

### 3.5.3 Member Data Documentation

#### 3.5.3.1 `n_active`

```
int grid_tw::n_active
```

### 3.5.3.2 n\_t

```
int grid_tw::n_t
```

### 3.5.3.3 t

```
ArrayXd grid_tw::t
```

### 3.5.3.4 w\_active

```
ArrayXd grid_tw::w_active
```

### 3.5.3.5 w\_active\_min\_index

```
int grid_tw::w_active_min_index
```

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

- [/home/sam/Project/XNLO/UPPE/src/grid\\_tw.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/grid\\_tw.cpp](#)

## 3.6 IO Class Reference

```
#include <IO.hpp>
```

### Public Member Functions

- [IO](#) ()
- [Array< unsigned short, Dynamic, Dynamic > read\\_uint16](#) (const char \*path\_, int N\_row\_, int N\_col\_)
- [ArrayXXi read\\_int](#) (const char \*path\_, int N\_row\_, int N\_col\_)
- [ArrayXXd read\\_double](#) (const std::string path\_, int N\_row\_, int N\_col\_)
- [ArrayXXd read\\_ascii\\_double](#) (const std::string path\_, int N\_row\_, int N\_col\_)
- [void write\\_double](#) (const std::string path\_, ArrayXXd input\_, int N\_row\_, int N\_col\_, bool print=true)
- [void write\\_header](#) (const std::string path\_, int N\_row\_, int N\_col\_, bool print=true)
- [void overwrite](#) (const std::string path, bool print=true)
- [void write\\_ascii\\_double](#) (ArrayXd data, std::string path, bool print=true)

### 3.6.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "IO" objects enable reading/writing of binary files to/from Eigen arrays.



## 3.6.2 Constructor & Destructor Documentation

### 3.6.2.1 IO()

```
IO::IO ( )
```

Constructor

## 3.6.3 Member Function Documentation

### 3.6.3.1 overwrite()

```
void IO::overwrite (
    const std::string path,
    bool print = true )
```

Overwrites given binary file.

### 3.6.3.2 read\_ascii\_double()

```
ArrayXXd IO::read_ascii_double (
    const std::string path,
    int N_row_,
    int N_col_ )
```

Read double to Eigen array from ascii file

### 3.6.3.3 read\_double()

```
ArrayXXd IO::read_double (
    const std::string path_,
    int N_row_,
    int N_col_ )
```

Read double to Eigen array from binary file

### 3.6.3.4 read\_int()

```
ArrayXXi IO::read_int (
    const char * path_,
    int N_row_,
    int N_col_ )
```

int

**3.6.3.5 read\_uint16()**

```
Array< unsigned short, Dynamic, Dynamic > IO::read_uint16 (
    const char * path_,
    int N_row_,
    int N_col_ )
```

Read from binary file to N\_col\_ by N\_row\_ Eigen array uint16

**3.6.3.6 write\_ascii\_double()**

```
void IO::write_ascii_double (
    ArrayXd data,
    std::string path,
    bool print = true )
```

**3.6.3.7 write\_double()**

```
void IO::write_double (
    const std::string path_,
    ArrayXXd input_,
    int N_row_,
    int N_col_,
    bool print = true )
```

Write to binary file from N\_col\_ by N\_row\_ Eigen array double

**3.6.3.8 write\_header()**

```
void IO::write_header (
    const std::string path_,
    int N_row_,
    int N_col_,
    bool print = true )
```

Write UPPE binary header to given binary file. Header takes the form: Offset Size (Bytes) Type/Contents Description  
0 4 'UPPE' Binary format name 4 4 int Version Number 8 4 int Subversion number 12 4 int Size of header 16 4 int  
N\_row 20 4 int N\_col 24 4 int Total size of data 28 4 int Size of each double in the data

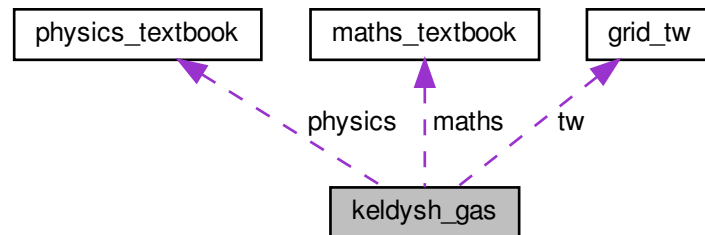
The documentation for this class was generated from the following files:

- [/home/sam/Project/XNLO/UPPE/src/IO.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/IO.cpp](#)

## 3.7 keldysh\_gas Class Reference

```
#include <keldysh_gas.hpp>
```

Collaboration diagram for keldysh\_gas:



### Public Member Functions

- [keldysh\\_gas](#) (double press\_, [grid\\_tw](#) &tw\_, DFTI\_DESCRIPTOR\_HANDLE &ft\_, [maths\\_textbook](#) &maths\_)
- double [atom\\_density](#) (double z)
- ArrayXcd [nl\\_polarization](#) (ArrayXd E\_t\_)
- ArrayXd [ionization\\_rate](#) (ArrayXd E\_t\_)
- ArrayXd [electron\\_density](#) (ArrayXd W\_t\_, double z)
- ArrayXcd [current\\_density](#) (ArrayXd E\_t\_, double z)

### Public Attributes

- double [atom\\_density\\_max](#)
- double [z\\_max](#)
- double [inlet\\_1](#)
- double [inlet\\_2](#)
- double [transitionLength](#)
- double [U](#)
- double [C\\_kl](#)
- double [n\\_star](#)
- double [kappa](#)

### Private Attributes

- [physics\\_textbook](#) [physics](#)
- [maths\\_textbook](#) [maths](#)
- [grid\\_tw](#) [tw](#)
- DFTI\_DESCRIPTOR\_HANDLE [ft](#)

### 3.7.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "keldysh\_gas" contains the medium response model.

### 3.7.2 Constructor & Destructor Documentation

#### 3.7.2.1 keldysh\_gas()

```
keldysh_gas::keldysh_gas (
    double press_,
    grid_tw & tw_,
    DFTI_DESCRIPTOR_HANDLE & ft_,
    maths_textbook & maths_ )
```

Constructor

### 3.7.3 Member Function Documentation

#### 3.7.3.1 atom\_density()

```
double keldysh_gas::atom_density (
    double z )
```

#### 3.7.3.2 current\_density()

```
ArrayXd keldysh_gas::current_density (
    ArrayXd E_t_,
    double z )
```

Evaluate Current density for active frequencies

#### 3.7.3.3 electron\_density()

```
ArrayXd keldysh_gas::electron_density (
    ArrayXd W_t_,
    double z )
```

Calculate free electron density (solve rate equations)

#### 3.7.3.4 ionization\_rate()

```
ArrayXd keldysh_gas::ionization_rate (
    ArrayXd E_t_ )
```

Calculate ionization rate (Popov, 2004)

#### 3.7.3.5 nl\_polarization()

```
ArrayXcd keldysh_gas::nl_polarization (
    ArrayXd E_t_ )
```

Evaluate nonlinear polarization for active frequencies

### 3.7.4 Member Data Documentation

#### 3.7.4.1 atom\_density\_max

```
double keldysh_gas::atom_density_max
```

#### 3.7.4.2 C\_kl

```
double keldysh_gas::C_kl
```

#### 3.7.4.3 ft

```
DFTI_DESCRIPTOR_HANDLE keldysh_gas::ft [private]
```

#### 3.7.4.4 inlet\_1

```
double keldysh_gas::inlet_1
```

#### 3.7.4.5 inlet\_2

```
double keldysh_gas::inlet_2
```

#### 3.7.4.6 kappa

```
double keldysh_gas::kappa
```

#### 3.7.4.7 maths

```
maths_textbook keldysh_gas::maths [private]
```

#### 3.7.4.8 n\_star

```
double keldysh_gas::n_star
```

#### 3.7.4.9 physics

```
physics_textbook keldysh_gas::physics [private]
```

#### 3.7.4.10 transitionLength

```
double keldysh_gas::transitionLength
```

#### 3.7.4.11 tw

```
grid_tw keldysh_gas::tw [private]
```

#### 3.7.4.12 U

```
double keldysh_gas::U
```

## 3.7.4.13 z\_max

```
double keldysh_gas::z_max
```

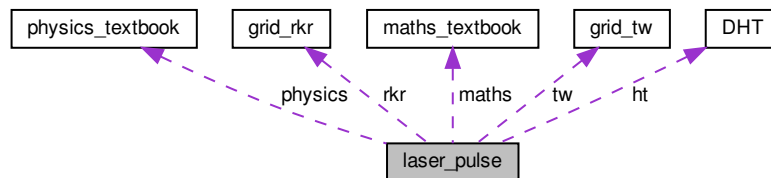
The documentation for this class was generated from the following files:

- [/home/sam/Project/XNLO/UPPE/src/keldysh\\_gas.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/keldysh\\_gas.cpp](#)

## 3.8 laser\_pulse Class Reference

```
#include <laser_pulse.hpp>
```

Collaboration diagram for laser\_pulse:



## Public Member Functions

- [laser\\_pulse](#) (double p\_av\_, double rep\_, double fwhm\_, double l\_0\_, double ceo\_, double waist\_, [grid\\_tw](#) &tw\_, [grid\\_rkr](#) &rkr\_, DFTI\_DESCRIPTOR\_HANDLE &ft\_, [DHT](#) &ht\_, [maths\\_textbook](#) &maths\_)
- void [propagate](#) (double dz\_, [capillary\\_fibre](#) &capillary\_, [keldysh\\_gas](#) &gas\_)

## Public Attributes

- ArrayXXcd [A\\_w\\_active](#)
- ArrayXXcd [P\\_NL\\_r\\_t](#)
- ArrayXXcd [P\\_NL\\_m\\_t](#)
- ArrayXXcd [P\\_NL\\_w](#)
- ArrayXXd [electron\\_density](#)
- double [atom\\_density\\_max](#)
- double [p\\_pk](#)
- double [E\\_pk](#)

## Private Member Functions

- void [RK\\_F\\_45](#) (double dz\_, [capillary\\_fibre](#) &capillary\_, [keldysh\\_gas](#) &gas\_)
- ArrayXXcd [RHS\\_UPPE](#) (double dz\_, ArrayXXcd [A\\_w\\_active](#), [capillary\\_fibre](#) &capillary\_, [keldysh\\_gas](#) &gas\_)

## Private Attributes

- double `p_av`
- double `rep`
- double `fwhm`
- double `l_0`
- double `ceo`
- double `waist`
- `physics_textbook` `physics`
- `maths_textbook` `maths`
- `grid_tw` `tw`
- `grid_rkr` `rkr`
- `DFTI_DESCRIPTOR_HANDLE` `ft`
- `DHT` `ht`
- `ArrayXXcd` `Y_4`
- `ArrayXXcd` `Y_5`
- double `e`
- double `z_position`

### 3.8.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "laser\_pulse" contains the active spectral amplitudes and governs their propagation over longitudinal step `dz`.

### 3.8.2 Constructor & Destructor Documentation

#### 3.8.2.1 `laser_pulse()`

```
laser_pulse::laser_pulse (
    double p_av_,
    double rep_,
    double fwhm_,
    double l_0_,
    double ceo_,
    double waist_,
    grid_tw & tw_,
    grid_rkr & rkr_,
    DFTI_DESCRIPTOR_HANDLE & ft_,
    DHT & ht_,
    maths_textbook & maths_ )
```

Constructor

### 3.8.3 Member Function Documentation



### 3.8.3.1 propagate()

```
void laser_pulse::propagate (
    double dz_,
    capillary_fibre & capillary_,
    keldysh_gas & gas_ )
```

Propagate spectral amplitudes  $A_w$  active over the longitudinal step  $dz$ , based on A. Couairon, et al., Eur. Phys. J. Special Topics, 199, 5 (2011)

### 3.8.3.2 RHS\_UPPE()

```
ArrayXXcd laser_pulse::RHS_UPPE (
    double dz_,
    ArrayXXcd temp_1,
    capillary_fibre & capillary_,
    keldysh_gas & gas_ ) [private]
```

Evaluate RHS of UPPE

### 3.8.3.3 RK\_F\_45()

```
void laser_pulse::RK_F_45 (
    double h_,
    capillary_fibre & capillary_,
    keldysh_gas & gas_ ) [private]
```

Runge-Kutta-Fehlberg 45 ODE solver

## 3.8.4 Member Data Documentation

### 3.8.4.1 A\_w\_active

```
ArrayXXcd laser_pulse::A_w_active
```

Spectral amplitudes

### 3.8.4.2 atom\_density\_max

```
double laser_pulse::atom_density_max
```

### 3.8.4.3 ceo

```
double laser_pulse::ceo [private]
```

### 3.8.4.4 e

```
double laser_pulse::e [private]
```

Error in RKF45 solve

### 3.8.4.5 E\_pk

```
double laser_pulse::E_pk
```

### 3.8.4.6 electron\_density

```
ArrayXXd laser_pulse::electron_density
```

### 3.8.4.7 ft

```
DFTI_DESCRIPTOR_HANDLE laser_pulse::ft [private]
```

Fourier transform

### 3.8.4.8 fwhm

```
double laser_pulse::fwhm [private]
```

### 3.8.4.9 ht

```
DHT laser_pulse::ht [private]
```

Hankel transform

### 3.8.4.10 l\_0

```
double laser_pulse::l_0 [private]
```

#### 3.8.4.11 maths

`maths_textbook` laser\_pulse::maths [private]

Mathematical constants and functions

#### 3.8.4.12 p\_av

`double` laser\_pulse::p\_av [private]

#### 3.8.4.13 P\_NL\_m\_t

`ArrayXXcd` laser\_pulse::P\_NL\_m\_t

#### 3.8.4.14 P\_NL\_r\_t

`ArrayXXcd` laser\_pulse::P\_NL\_r\_t

#### 3.8.4.15 P\_NL\_w

`ArrayXXcd` laser\_pulse::P\_NL\_w

#### 3.8.4.16 p\_pk

`double` laser\_pulse::p\_pk

#### 3.8.4.17 physics

`physics_textbook` laser\_pulse::physics [private]

Physical constants

#### 3.8.4.18 rep

`double` laser\_pulse::rep [private]

#### 3.8.4.19 rkr

```
grid_rkr laser_pulse::rkr [private]
```

Radial grid

#### 3.8.4.20 tw

```
grid_tw laser_pulse::tw [private]
```

Temperal grid

#### 3.8.4.21 waist

```
double laser_pulse::waist [private]
```

#### 3.8.4.22 Y\_4

```
ArrayXXcd laser_pulse::Y_4 [private]
```

RKF 4

#### 3.8.4.23 Y\_5

```
ArrayXXcd laser_pulse::Y_5 [private]
```

RKF 5

#### 3.8.4.24 z\_position

```
double laser_pulse::z_position [private]
```

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

- [/home/sam/Project/XNLO/UPPE/src/laser\\_pulse.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/laser\\_pulse.cpp](#)

## 3.9 maths\_textbook Class Reference

```
#include <maths_textbook.hpp>
```

## Public Member Functions

- [maths\\_textbook](#) (std::string path\_input\_j0\_)
- double [trapz](#) (ArrayXd x\_, ArrayXd y\_)
- ArrayXd [cumtrapz](#) (ArrayXd x\_, ArrayXd y\_)

## Public Attributes

- double [pi](#)
- ArrayXd [J0\\_zeros](#)

## Private Attributes

- std::string [path\\_input\\_j0](#)

### 3.9.1 Detailed Description

Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. "maths\_textbook" is a container for mathematical constants and functions.

### 3.9.2 Constructor & Destructor Documentation

#### 3.9.2.1 maths\_textbook()

```
maths_textbook::maths_textbook (
    std::string path_input_j0_ )
```

Constructor

### 3.9.3 Member Function Documentation

#### 3.9.3.1 cumtrapz()

```
ArrayXd maths_textbook::cumtrapz (
    ArrayXd x_,
    ArrayXd y_ )
```

Cumulative trapezoidal integration

### 3.9.3.2 trapz()

```
double maths_textbook::trapz (
    ArrayXd x_,
    ArrayXd y_ )
```

Trapezoidal integration

## 3.9.4 Member Data Documentation

### 3.9.4.1 J0\_zeros

```
ArrayXd maths_textbook::J0_zeros
```

### 3.9.4.2 path\_input\_j0

```
std::string maths_textbook::path_input_j0 [private]
```

### 3.9.4.3 pi

```
double maths_textbook::pi
```

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

- [/home/sam/Project/XNLO/UPPE/src/maths\\_textbook.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/maths\\_textbook.cpp](#)

## 3.10 physics\_textbook Class Reference

```
#include <physics_textbook.hpp>
```

### Public Member Functions

- [physics\\_textbook \(\)](#)

## Public Attributes

- double [E\\_at](#)
- double [l\\_at](#)
- double [m\\_at](#)
- double [q\\_at](#)
- double [t\\_at](#)
- double [w\\_at](#)
- double [c](#)
- double [eps\\_0](#)
- double [mu\\_0](#)
- double [h\\_bar](#)
- double [k\\_B](#)

### 3.10.1 Detailed Description

Modified by Patrick Anderson on 03/09/2015. "physics\_textbook" is a container for physical constants.

### 3.10.2 Constructor & Destructor Documentation

#### 3.10.2.1 physics\_textbook()

```
physics_textbook::physics_textbook ( )
```

Constructor

### 3.10.3 Member Data Documentation

#### 3.10.3.1 c

```
double physics_textbook::c
```

Speed of light in vacuum

#### 3.10.3.2 E\_at

```
double physics_textbook::E_at
```

### 3.10.3.3 `eps_0`

```
double physics_textbook::eps_0
```

Permittivity of free space

### 3.10.3.4 `h_bar`

```
double physics_textbook::h_bar
```

Reduced Planck constant

### 3.10.3.5 `k_B`

```
double physics_textbook::k_B
```

Boltzmann Constant

### 3.10.3.6 `l_at`

```
double physics_textbook::l_at
```

Bohr radius

### 3.10.3.7 `m_at`

```
double physics_textbook::m_at
```

### 3.10.3.8 `mu_0`

```
double physics_textbook::mu_0
```

Permeability of free space

### 3.10.3.9 `q_at`

```
double physics_textbook::q_at
```

Electron charge

### 3.10.3.10 `t_at`

```
double physics_textbook::t_at
```

### 3.10.3.11 `w_at`

```
double physics_textbook::w_at
```

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

- [/home/sam/Project/XNLO/UPPE/src/physics\\_textbook.hpp](#)
- [/home/sam/Project/XNLO/UPPE/src/physics\\_textbook.cpp](#)



## Chapter 4

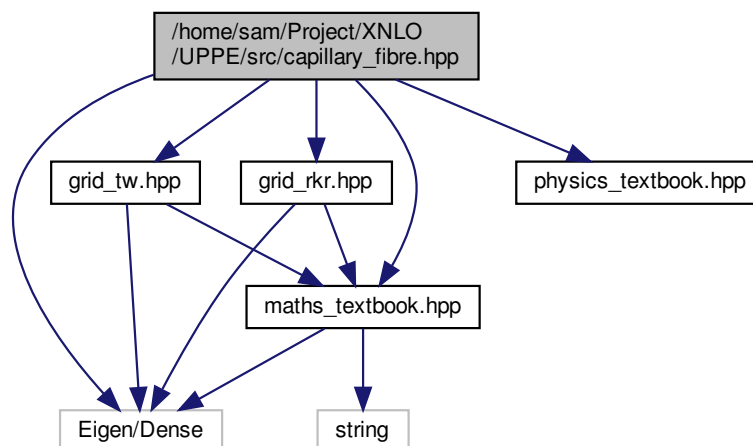
# File Documentation

### 4.1 /home/sam/Project/XNLO/UPPE/src/capillary\_fibre.cpp File Reference

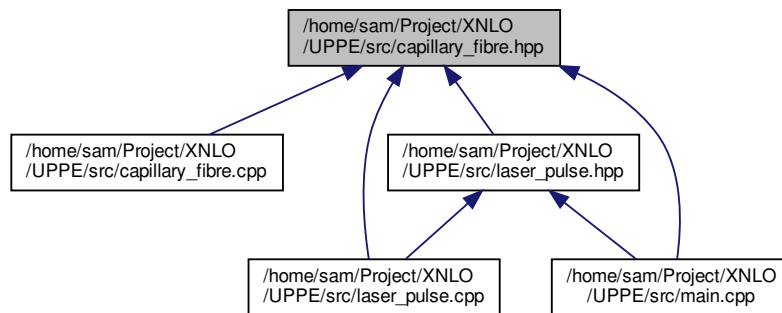
```
#include "capillary_fibre.hpp"  
#include "grid_rkr.hpp"  
#include "grid_tw.hpp"  
#include "physics_textbook.hpp"  
#include "maths_textbook.hpp"  
#include "Eigen/Dense"
```

### 4.2 /home/sam/Project/XNLO/UPPE/src/capillary\_fibre.hpp File Reference

```
#include "Eigen/Dense"  
#include "grid_tw.hpp"  
#include "grid_rkr.hpp"  
#include "physics_textbook.hpp"  
#include "maths_textbook.hpp"  
Include dependency graph for capillary_fibre.hpp:
```



This graph shows which files directly or indirectly include this file:



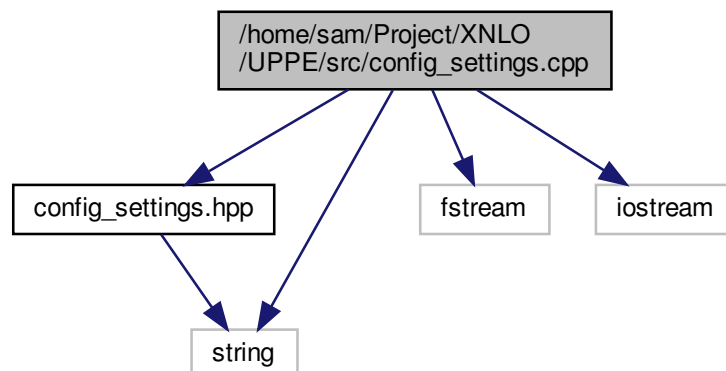
## Classes

- class `capillary_fibre`

## 4.3 /home/sam/Project/XNLO/UPPE/src/config\_settings.cpp File Reference

```
#include "config_settings.hpp"  
#include <fstream>  
#include <iostream>  
#include <string>
```

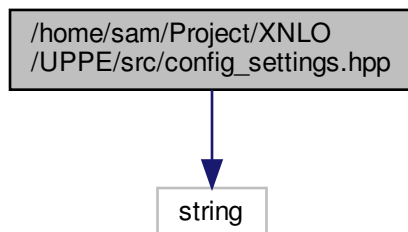
Include dependency graph for `config_settings.cpp`:



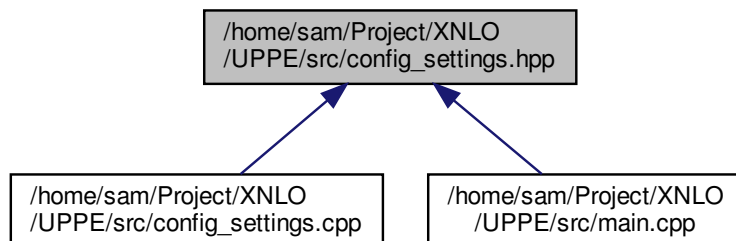
## 4.4 /home/sam/Project/XNLO/UPPE/src/config\_settings.hpp File Reference

```
#include <string>
```

Include dependency graph for config\_settings.hpp:



This graph shows which files directly or indirectly include this file:



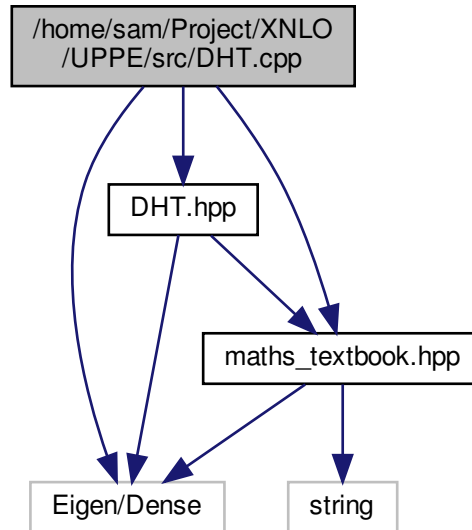
### Classes

- class [Config\\_Settings](#)

## 4.5 /home/sam/Project/XNLO/UPPE/src/DHT.cpp File Reference

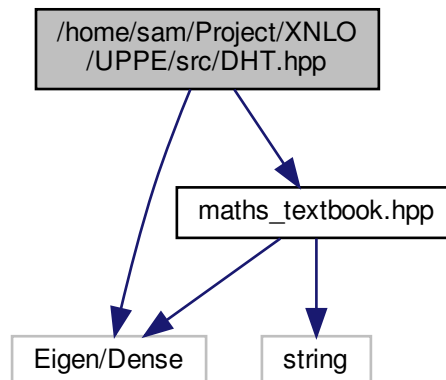
```
#include "DHT.hpp"  
#include "Eigen/Dense"
```

```
#include "maths_textbook.hpp"
Include dependency graph for DHT.cpp:
```

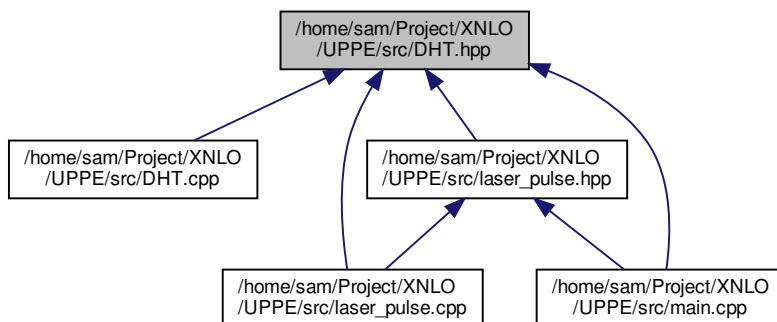


#### 4.6 /home/sam/Project/XNLO/UPPE/src/DHT.hpp File Reference

```
#include "Eigen/Dense"
#include "maths_textbook.hpp"
Include dependency graph for DHT.hpp:
```



This graph shows which files directly or indirectly include this file:

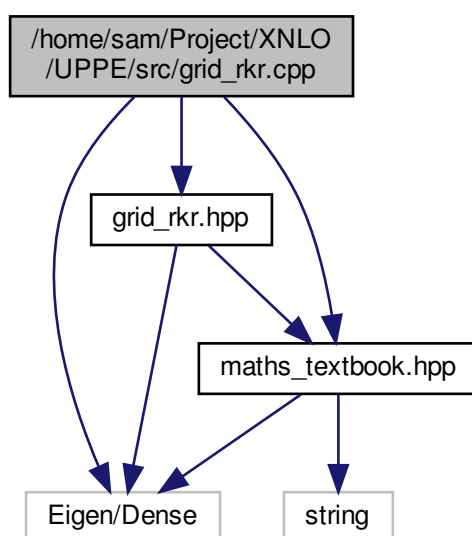


## Classes

- class [DHT](#)

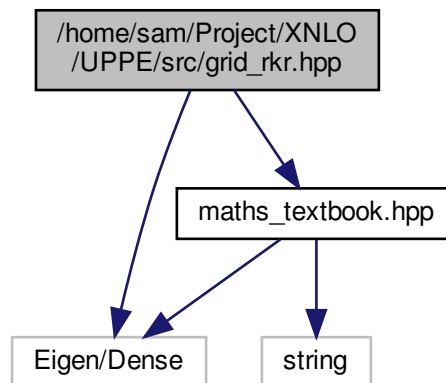
## 4.7 /home/sam/Project/XNLO/UPPE/src/grid\_rkr.cpp File Reference

```
#include "grid_rkr.hpp"
#include "maths_textbook.hpp"
#include "Eigen/Dense"
Include dependency graph for grid_rkr.cpp:
```

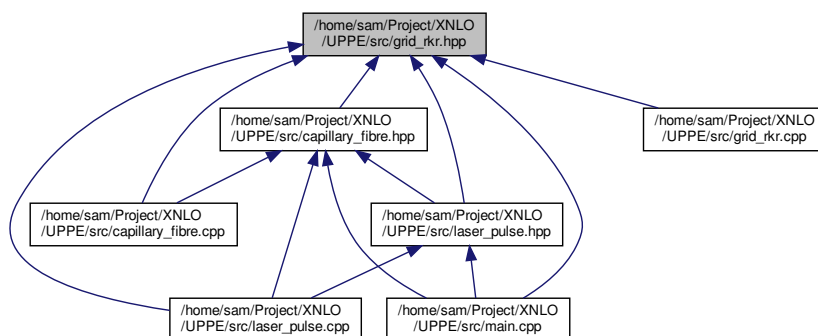


## 4.8 /home/sam/Project/XNLO/UPPE/src/grid\_rkr.hpp File Reference

```
#include "Eigen/Dense"
#include "maths_textbook.hpp"
Include dependency graph for grid_rkr.hpp:
```



This graph shows which files directly or indirectly include this file:



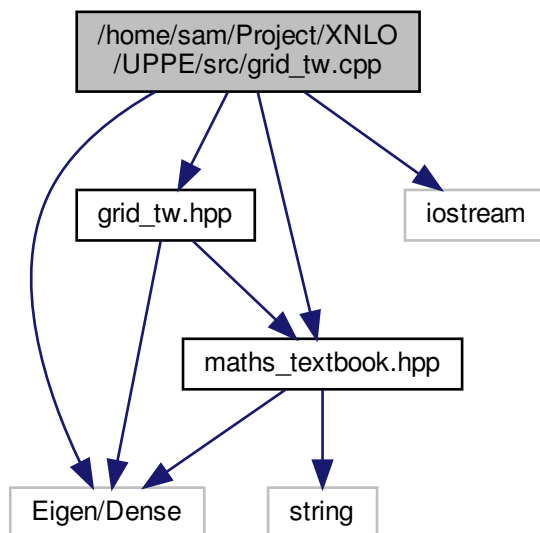
### Classes

- class `grid_rkr`

## 4.9 /home/sam/Project/XNLO/UPPE/src/grid\_tw.cpp File Reference

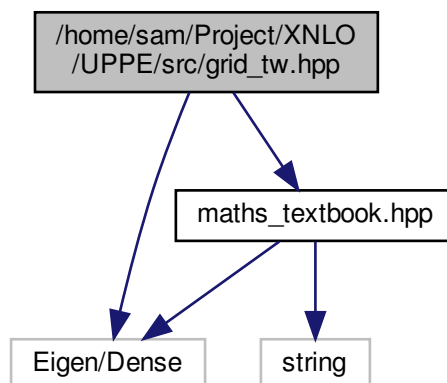
```
#include "grid_tw.hpp"
#include "maths_textbook.hpp"
```

```
#include "Eigen/Dense"  
#include <iostream>  
Include dependency graph for grid_tw.cpp:
```

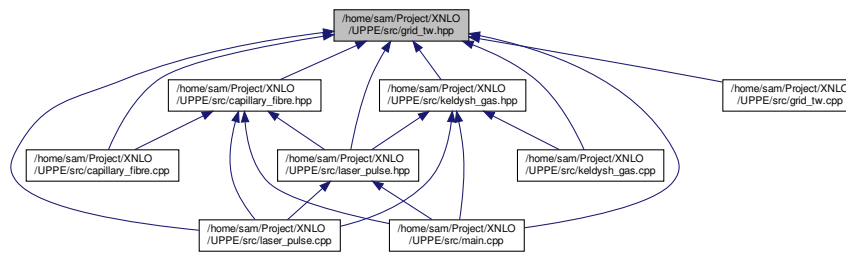


#### 4.10 /home/sam/Project/XNLO/UPPE/src/grid\_tw.hpp File Reference

```
#include "Eigen/Dense"  
#include "maths_textbook.hpp"  
Include dependency graph for grid_tw.hpp:
```



This graph shows which files directly or indirectly include this file:

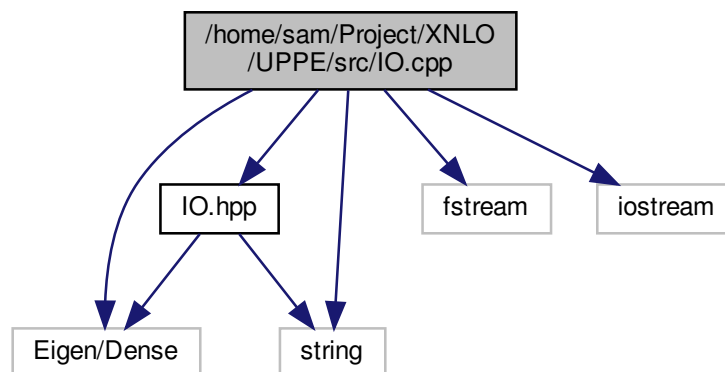


## Classes

- class [grid\\_tw](#)

## 4.11 /home/sam/Project/XNLO/UPPE/src/IO.cpp File Reference

```
#include "IO.hpp"
#include "Eigen/Dense"
#include <fstream>
#include <iostream>
#include <string>
Include dependency graph for IO.cpp:
```

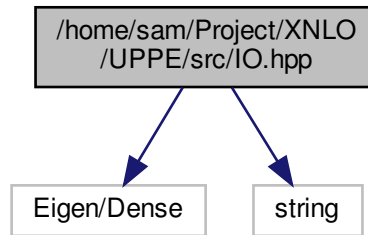


## 4.12 /home/sam/Project/XNLO/UPPE/src/IO.hpp File Reference

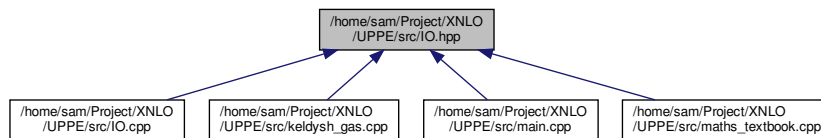
```
#include "Eigen/Dense"
#include <string>
```



Include dependency graph for IO.hpp:



This graph shows which files directly or indirectly include this file:



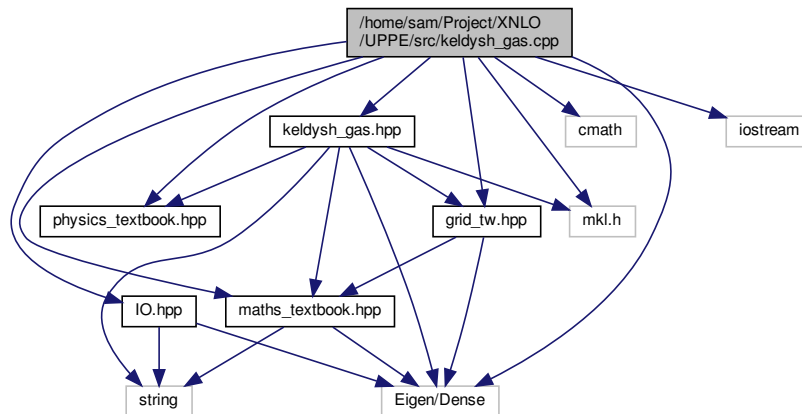
## Classes

- class `IO`

## 4.13 /home/sam/Project/XNLO/UPPE/src/keldysh\_gas.cpp File Reference

```
#include "keldysh_gas.hpp"
#include "physics_textbook.hpp"
#include "grid_tw.hpp"
#include <mkl.h>
#include "Eigen/Dense"
#include "maths_textbook.hpp"
#include <cmath>
#include "IO.hpp"
#include <iostream>
```

Include dependency graph for keldysh\_gas.cpp:



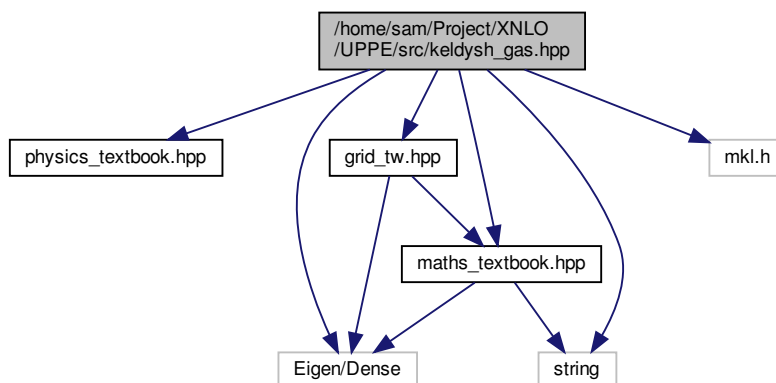
#### 4.14 /home/sam/Project/XNLO/UPPE/src/keldysh\_gas.hpp File Reference

```

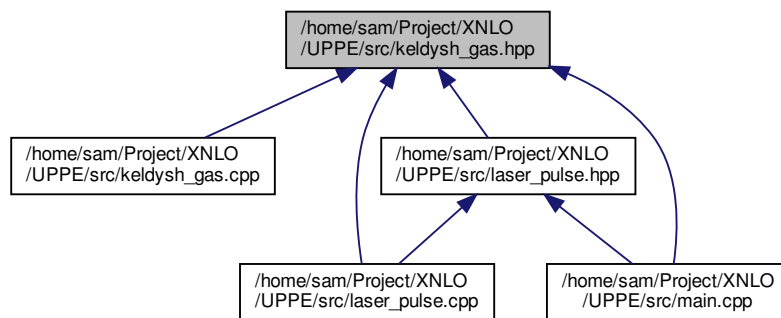
#include "physics_textbook.hpp"
#include "maths_textbook.hpp"
#include "grid_tw.hpp"
#include <mkl.h>
#include "Eigen/Dense"
#include <string>

```

Include dependency graph for keldysh\_gas.hpp:



This graph shows which files directly or indirectly include this file:



## Classes

- class `keldysh_gas`

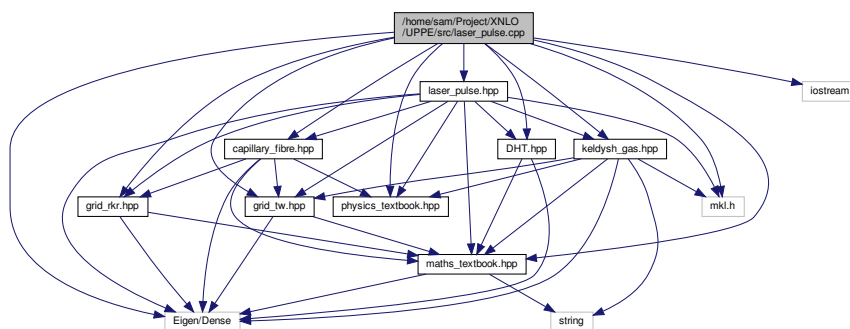
## 4.15 /home/sam/Project/XNLO/UPPE/src/laser\_pulse.cpp File Reference

```

#include "laser_pulse.hpp"
#include "grid_tw.hpp"
#include "grid_rkr.hpp"
#include <mkl.h>
#include "DHT.hpp"
#include "physics_textbook.hpp"
#include "maths_textbook.hpp"
#include "Eigen/Dense"
#include "capillary_fibre.hpp"
#include "keldysh_gas.hpp"
#include <iostream>

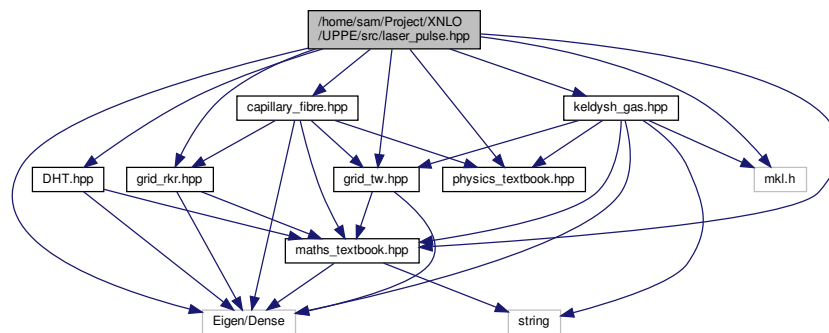
```

Include dependency graph for `laser_pulse.cpp`:

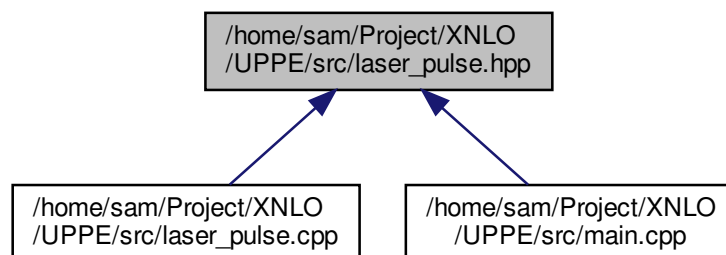


#### 4.16 /home/sam/Project/XNLO/UPPE/src/laser\_pulse.hpp File Reference

```
#include "physics_textbook.hpp"
#include "maths_textbook.hpp"
#include "grid_tw.hpp"
#include "grid_rkr.hpp"
#include <mkl.h>
#include "DHT.hpp"
#include "Eigen/Dense"
#include "capillary_fibre.hpp"
#include "keldysh_gas.hpp"
Include dependency graph for laser_pulse.hpp:
```



This graph shows which files directly or indirectly include this file:



#### Classes

- class [laser\\_pulse](#)

## 4.17 /home/sam/Project/XNLO/UPPE/src/main.cpp File Reference

```
#include <mpi.h>
#include "maths_textbook.hpp"
#include "physics_textbook.hpp"
#include <mkl.h>
#include "DHT.hpp"
#include "grid_rkr.hpp"
#include "grid_tw.hpp"
#include "laser_pulse.hpp"
#include "capillary_fibre.hpp"
#include "keldysh_gas.hpp"
#include "Eigen/Dense"
#include "IO.hpp"
#include "config_settings.hpp"
#include <iostream>
#include <string>
#include "../..//XNLO/lib/XNLO.hpp"
```

### Functions

- `int main` (int argc, char \*\*argv)

#### 4.17.1 Function Documentation

##### 4.17.1.1 main()

```
int main (
    int argc,
    char ** argv )
```

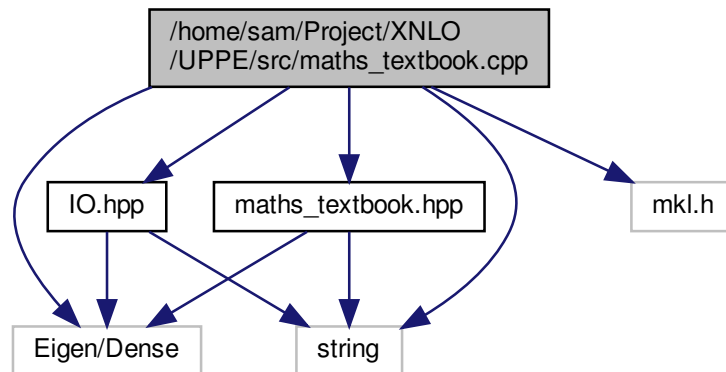
Originally created by Patrick Anderson. Modified by Samuel Senior on 10/03/2017. Test enviroment for UPPE codes.

## 4.18 /home/sam/Project/XNLO/UPPE/src/maths\_textbook.cpp File Reference

```
#include "maths_textbook.hpp"
#include "IO.hpp"
#include "Eigen/Dense"
#include <mkl.h>
```

```
#include <string>
```

Include dependency graph for maths\_textbook.cpp:

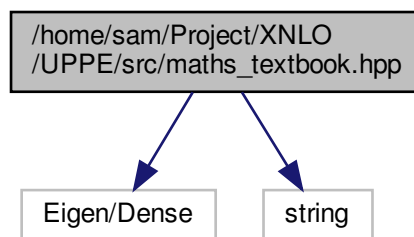


#### 4.19 /home/sam/Project/XNLO/UPPE/src/maths\_textbook.hpp File Reference

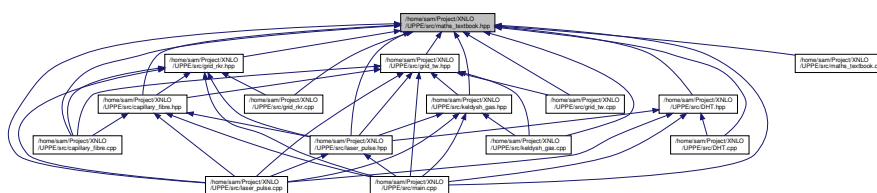
```
#include "Eigen/Dense"
```

```
#include <string>
```

Include dependency graph for maths\_textbook.hpp:



This graph shows which files directly or indirectly include this file:



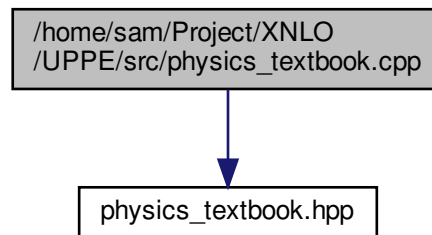
## Classes

- class [maths\\_textbook](#)

## 4.20 /home/sam/Project/XNLO/UPPE/src/physics\_textbook.cpp File Reference

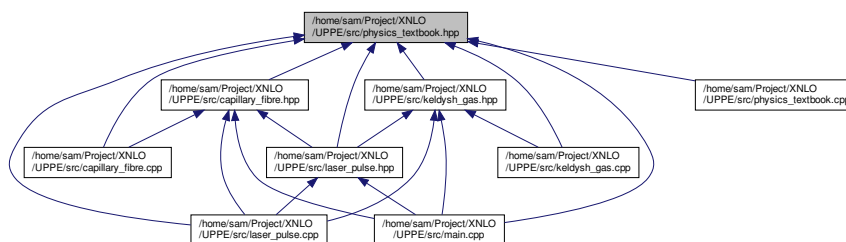
```
#include "physics_textbook.hpp"
```

Include dependency graph for physics\_textbook.cpp:



## 4.21 /home/sam/Project/XNLO/UPPE/src/physics\_textbook.hpp File Reference

This graph shows which files directly or indirectly include this file:



## Classes

- class [physics\\_textbook](#)

## 4.22 /home/sam/Project/XNLO/UPPE/src/version.hpp File Reference

## Macros

- `#define _VERSION_MAJOR 1`
- `#define _VERSION_MINOR 3`
- `#define _VERSION_SUBMINOR 0`

## 4.22.1 Macro Definition Documentation

### 4.22.1.1 `_VERSION_MAJOR`

```
#define _VERSION_MAJOR 1
```

### 4.22.1.2 `_VERSION_MINOR`

```
#define _VERSION_MINOR 3
```

### 4.22.1.3 `_VERSION_SUBMINOR`

```
#define _VERSION_SUBMINOR 0
```



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