ultrafast Documentation

Release 1

Marcelo J P Alcocer

July 10, 2016

Contents

CHAPTER 1

ultrafast.core module

This module contains the core functionality required for performing ultrafast optics calculations. It currently focusses on providing classes for describing materials commonly employed in ultrafast optics.

class ultrafast.core.**Material**(*n*, *range_*, *name=None*, *references=None*, *comments=None*)

Bases: object

Parameters

- **n** (*callable*) – Dispersion function
- **range** (*tuple*) – Valid range for dispersion function (low,high)
- **name** (*string*) – Material name
- **references** (*string*) – Reference(s) for material properties
- **comments** (*string*) – Comments

Base class describing a (dispersive) material utilized in ultrafast optics.

The dispersion function *n* is a callable which takes one argument, the angular frequency in rad/fs, and returns the refractive index at this angular frequency.

The frequency range *range_* is a tuple of length 2 describing the lower and upper angular frequencies for which *n* is valid.

name = None

Name of the material. This can be used for reference, e.g. in case the instance name is not related to the material

references = None

Reference(s) for material properties, e.g. journal articles

comments = None

range_

Range of angular frequencies (rad/fs) over which dispersion function n is valid. A numeric tuple of the form (low,high).

n

A callable which takes one argument, the angular frequency in rad/fs, and returns the refractive index at this angular frequency.

wavevector(*omega*)

Parameters **omega** (*float*) – Angular frequency in rad/fs

Returns the effective wavevector ($\omega n/c$) at the angular frequency *omega*

brewster(*omega*, *inc_mat=None*)

Parameters

- **omega** (*float*) – Angular frequency in rad/fs
- **inc_mat** (*ultrafast.core.Material*) – Incident material

Returns the Brewster angle for light rays incident from the material *inc_mat*. If None, *inc_mat* is assumed to be *air*.

class ultrafast.core.**RIIDMaterial**(*db*)
Bases: *ultrafast.core.Material*

Parameters **db** (*string*) – Database entry

Class describing a dispersive material catalogued in the RefractiveIndex.info database.

An instance is built from the RefractiveIndex.info database entry *db*. Entries are stored as YAML files. As such, *db* may be a path to a local YAML file, or a URL to a remote YAML file accessible via HTTP.

type_ = None
String describing the dispersion data type as defined in the RefractiveIndex.info database, e.g.: `formula 1`, `tabulated k`, etc

exception ultrafast.core.**UltrafastError**
Bases: Exception

Ultrafast module base exception class

exception ultrafast.core.**RangeError**(*value*, *valid*, *message*)
Bases: *ultrafast.core.UltrafastError*

Parameters

- **value** (*float, int*) – Invalid value
- **valid** (*tuple*) – Valid range
- **message** (*string*) – Error message

Raised when the numeric value *value* is found to be out of the valid range defined by *valid*. *valid* is a tuple of length 2 in the form of (low,high).

exception ultrafast.core.**PropertySetError**(*property_*, *message*)
Bases: *ultrafast.core.UltrafastError*

Parameters

- **property** (*string*) – Property attribute
- **message** (*string*) – Error message

Raised when a attempting to set the property attribute *property_* to an invalid value.

ultrafast.core.**frequency**(*lambda_*)

Parameters **lambda** (*float*) – Wavelength in μm

Wavelength to angular frequency conversion.

Returns the corresponding angular frequency in rad/fs

ultrafast.core.**wavelength**(*omega*)

Parameters **omega** (*float*) – Angular frequency in rad/fs

Angular frequency to wavelength conversion.

Returns the corresponding wavelength in μm

ultrafast.core.**c = 0.29979245800000004**
Speed of light in $\mu m/fs$. Defined for convenience

ultrafast.core.**air = <ultrafast.core.RIIDMaterial object>**
ultrafast.core.RIIDMaterial describing air (Ciddor 1996). Defined for convenience

CHAPTER 2

Overview

ultrafast is a Python package designed to facilitate numerical calculations for ultrafast optics.

CHAPTER 3

Features

- Dispersive material class including parametric dispersion relations
- Interface to RefractiveIndex.info database for quick and simple access to a wide range of materials

CHAPTER 4

Requirements

- Python (tested with 3.4)
- PyYAML (tested with 3.11)
- SciPy (tested with 0.17.1)

CHAPTER 5

License

CHAPTER 6

Indices and tables

- genindex
- modindex
- search

u

A

B

C

F

M

N

P

R

T

U

W