

---

# **LuxPy Documentation**

***Release 1.9.6***

**Kevin A.G. Smet**

**Jun 23, 2022**



---

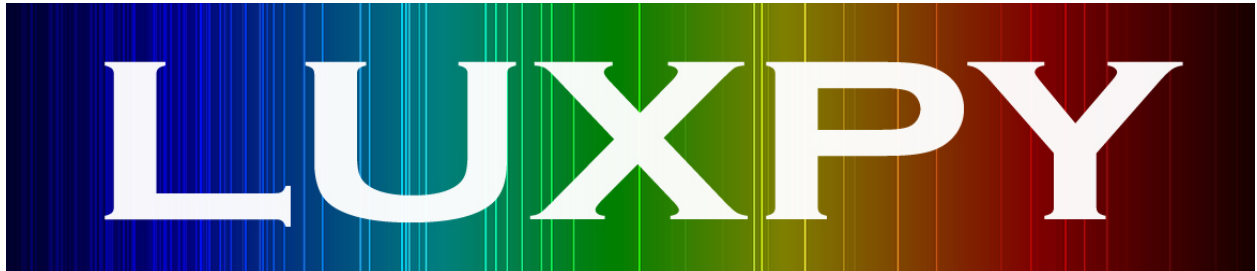
## Contents:

---

<b>1</b>	<b>License: GPLv3</b>	<b>3</b>
<b>2</b>	<b>Installation</b>	<b>5</b>
2.1	Install luxpy . . . . .	5
2.2	Use of LuxPy package in Spyder IDE . . . . .	6
2.3	Use of LuxPy package in Jupyter notebook . . . . .	6
<b>3</b>	<b>Imported (required) packages</b>	<b>7</b>
3.1	Core . . . . .	7
3.2	3e party dependencies (automatic install) . . . . .	8
3.3	3e party dependencies (automatic install on import) . . . . .	8
3.4	3e party dependencies (requiring manual install) . . . . .	8
<b>4</b>	<b>Luxpy package structure</b>	<b>9</b>
4.1	Utils sub-package . . . . .	9
4.2	Math sub-package . . . . .	9
4.2.1	vec3/ . . . . .	9
4.2.2	DEMO/ . . . . .	10
4.3	Spectrum sub-package . . . . .	10
4.3.1	SPD class . . . . .	10
4.4	Color sub-package . . . . .	10
4.4.1	utils/ . . . . .	11
4.4.2	ctf/ . . . . .	11
4.4.3	cct/ . . . . .	11
4.4.4	cat/ . . . . .	11
4.4.5	cam/ . . . . .	11
4.4.6	deltaE/ . . . . .	12
4.4.7	whiteness/ . . . . .	12
4.4.8	cri/ . . . . .	12
4.4.9	cri/VFPX/ . . . . .	13
4.4.10	XYZ,LAB classes . . . . .	13
4.5	Toolboxes . . . . .	14
4.5.1	photbiochem/ . . . . .	14
4.5.2	indvcmf/ . . . . .	14
4.5.3	spdbuild/ . . . . .	14
4.5.4	hypspcim/ . . . . .	14
4.5.5	dispcal/ . . . . .	14

4.5.6	rgb2spec/ . . . . .	15
4.5.7	iolidfiles/ . . . . .	15
4.5.8	spectro/ . . . . .	15
4.5.9	sherbrooke_spectral_indices/ . . . . .	15
4.5.10	spectral_mismatch_and_uncertainty/ . . . . .	15
<b>5</b>	<b>Indices and tables</b>	<b>17</b>

- Author: K.A.G. Smet (ksmet1977 at gmail.com)
- Version: 1.9.6
- Date: February 15, 2022
- License: GPLv3





# CHAPTER 1

---

License: GPLv3

---

Copyright (C) <2017><Kevin A.G. Smet> (ksmet1977 at gmail.com)

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program. If not, see <<http://www.gnu.org/licenses/>>.





### 2.1 Install luxpy

#### 1. Install miniconda

- download the installer from: <https://conda.io/miniconda.html> or <https://repo.continuum.io/miniconda/>)
- e.g. [https://repo.continuum.io/miniconda/Miniconda3-latest-Windows-x86\\_64.exe](https://repo.continuum.io/miniconda/Miniconda3-latest-Windows-x86_64.exe)
- Make sure 'conda.exe' can be found on the windows system path, if necessary do a manual add.

#### 2. Create a virtual environment with full anaconda distribution by typing the following at the commandline:

```
>> conda create --name py36 python=3.6 anaconda
```

#### 3. Activate the virtual environment:

```
>> activate py36
```

#### 4. Install pip to virtual environment (just to ensure any packages to be installed with pip to this virt. env. will be installed here and not globally):

```
>> conda install -n py36 pip
```

#### 5a. Install luxpy package from pypi:

```
>> pip install luxpy
```

#### 5b. Install luxpy package from anaconda:

```
>> conda install -c ksmet1977 luxpy
```

**Note** If any errors show up, try and do a manual install of the dependencies: scipy, numpy, pandas, matplotlib and setuptools, either using e.g. `>> conda install scipy` or `>> pip install scipy`, and try and reinstall luxpy using pip.

## 2.2 Use of LuxPy package in Spyder IDE

6. Install spyder in py36 environment:

```
>> conda install -n py36 spyder
```

7. Run spyder

```
>> spyder
```

8. To import the luxpy package, on Spyder's commandline for the IPython kernel (or in script) type:

```
import luxpy as lx
```

## 2.3 Use of LuxPy package in Jupyter notebook

6. Install jupyter in py36 environment:

```
>> conda install -n py36 jupyter
```

7. Start jupyter notebook:

```
>> jupyter notebook
```

8. **Open an existing or new notebook:** e.g. open “luxpy\_basic\_usage.ipynb” for an overview of how to use the LuxPy package.

9. To import LuxPy package type:

```
import luxpy as lx
```

---

### Imported (required) packages

---

#### 3.1 Core

- `import os`
- `import warnings`
- `import pathlib`
- `import importlib`
- `from collections import OrderedDict as odict`
- `from mpl_toolkits.mplot3d import Axes3D`
- `import colorsys`
- `import itertools`
- `import copy`
- `import time`
- `import tkinter`
- `import ctypes`
- `import platform`
- `import subprocess`
- `import cProfile`
- `import pstats`
- `import io`

## 3.2 3e party dependencies (automatic install)

- `import numpy as np`
- `import pandas as pd`
- `import matplotlib.pyplot as plt`
- `import scipy as sp`
- `import imageio`

## 3.3 3e party dependencies (automatic install on import)

- `import pyswarms` (when importing `particleswarms` from `math`)

## 3.4 3e party dependencies (requiring manual install)

**To control Ocean Optics spectrometers with spectro toolbox:**

- `import seabreeze` (conda install -c poehlmann python-seabreeze)
- `pip install pyusb` (for use with 'pyseabreeze' backend of python-seabreeze)

---

## Luxpy package structure

---

### 4.1 Utils sub-package

```
py
  • __init__.py
  • utilities.py
  • folder_tree.py
namespace luxpy.utils
```

### 4.2 Math sub-package

```
py
  • __init__.py
  • basics.py
  • minimizebnd.py
  • mupolymodel.py
  • Pyswarms_particleswarm.py
  • pymoo_nsga_ii.py
namespace luxpy.math
```

#### 4.2.1 vec3/

```
py
  • __init__.py
```

- vec3.py

**namespace** luxpy.math

#### 4.2.2 DEMO/

**py**

- \_\_init\_\_.py
- DEMO.py
- demo\_opt.py

**namespace** luxpy.math

### 4.3 Spectrum sub-package

**py**

- \_\_init\_\_.py
- spdx\_ietm2714.py
- **basics/**
  - \_\_init\_\_.py
  - cmf.py
  - spectral.py
  - spectral\_databases.py

**namespace** luxpy

#### 4.3.1 SPD class

**py**

- SPD.py

**namespace** luxpy

### 4.4 Color sub-package

**py**

- \_\_init\_\_.py

**namespace** luxpy

#### 4.4.1 utils/

**py**

- `__init__.py`
- `plotters.py`

**namespace** luxpy

#### 4.4.2 ctf/

**py**

- `__init__.py`
- `colortransformations.py`
- `colortf.py`

**namespace** luxpy

#### 4.4.3 cct/

**py**

- `__init__.py`
- `cct.py`
- `cct_legacy.py`
- `cctduv_ohno_CORM2011.py`

**namespace** luxpy

#### 4.4.4 cat/

**py**

- `__init__.py`
- `chromaticadaptation.py`

**namespace** luxpy.cat

#### 4.4.5 cam/

**py**

- `__init__.py`
- `colorappearancemodels.py`
- `helpers.py`
- `utils.py`
- `ciecam02.py`
- `cam02ucs.py`

- ciecaml6.py
- cam16ucs.py
- cam15u
- sww2016.py
- cam18sl.py
- camjabz.py
- zcam.py
- cmf\_translator\_sww2021

**namespace** luxpy.cam

#### 4.4.6 deltaE/

**py**

- \_\_init\_\_.py
- colordifferences.py
- discriminationellipses.py
- frieleellipses.py
- macadamellipses.py

**namespace** luxpy.deltaE

#### 4.4.7 whiteness/

**py**

- \_\_init\_\_.py
- smet\_white\_loci.py

**namespace** luxpy

#### 4.4.8 cri/

**py**

- \_\_init\_\_.py
- colorrendition.py
- /utils/
  - \_\_init\_\_.py
  - init\_cri\_defaults\_database.py
  - DE\_scalers.py
  - helpers.py
  - graphics.py



- **/indices/**
  - `__init__.py`
  - `indices.py`
  - `cie_wrappers.py`
  - `iestm30_wrappers.py`
  - `cri2012.py`
  - `mcri.py`
  - `cqs.py`
  - `fci.py`
  - `thorntoncpi.py`
- **/iestm30/**
  - `__init__.py`
  - `metrics.py`
  - `graphics.py`
  - `metrics_fast.py`
- **/VFPX/**
  - `__inint__.py`
  - `vectorshiftmodel.py`
  - `pixelshiftmodel.py`
  - `VF_PX_models.py`

**namespace** luxpy.cri

#### 4.4.9 cri/VFPX/

**py**

- `__init__.py`
- `VF_PX_models.py`
- `vectorshiftmodel.py`
- `pixelshiftmodel.py`

**namespace** luxpy.cri.VFPX

#### 4.4.10 XYZ,LAB classes

**py**

- `CDATA.py`

**namespace** luxpy

## 4.5 Toolboxes

### 4.5.1 photbiochem/

**py**

- `__init__.py`
- `cie_tn003_2015.py`
- `ASNZS_1680_2_5_1997_COI.py`
- `circadian_CS_CLa_lrc.py`

**namespace** `luxpy.photbiochem`

### 4.5.2 indvcmf/

**py**

- `__init__.py`
- `individual_observer_cmf_model.py`

**namespace** `luxpy.indvcmf`

### 4.5.3 spdbuild/

**py**

- `__init__.py`
- `spdbuilder.py`
- `spdbuilder2020.py`
- `spdoptimizer2020.py`

**namespace** `luxpy.spdbuild/`

### 4.5.4 hypspcim/

**py**

- `__init__.py`
- `hyperspectral_img_simulator.py`

**namespace** `luxpy.hypspcim`

### 4.5.5 dispcal/

**py**

- `__init__.py`
- `displaycalibration.py`

**namespace** `luxpy.dispcal`

#### 4.5.6 rgb2spec/

**py**

- `__init__.py`
- `smits_mitsuba.py`

**namespace** `luxpy.rgb2spec`

#### 4.5.7 iolidfiles/

**py**

- `__init__.py`
- `io_lid_files.py`

**namespace** `luxpy.iolidfiles`

#### 4.5.8 spectro/

**py**

- `__init__.py`
- `spectro.py`

**namespace** `luxpy.spectro`

#### 4.5.9 sherbrooke\_spectral\_indices/

**py**

- `__init__.py`
- `sherbrooke_spectral_indices_2013.py`

**namespace** `luxpy.sherbrooke_spectral_indices`

#### 4.5.10 spectral\_mismatch\_and\_uncertainty/

**py**

- `__init__.py`
- `detector_spectral_mismatch.py`

**namespace** `luxpy.spectral_mismatch_and_uncertainty`



## CHAPTER 5

---

### Indices and tables

---

- `genindex`
- `modindex`
- `search`