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Description Spectral emission data for some frequently used lamps excluding led emitting diodes (LEDs) available as electronic components. Original spectral irradiance data for incandescent-, LED- and discharge lamps are included. They are complemented by data on the effect of temperature on the emission by fluorescent tubes.

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photobiologyLamps-package

photobiologyLamps: Spectral Irradiance Data for Lamps

Description

Spectral emission data for some frequently used lamps excluding led emitting diodes (LEDs) available as electronic components. Original spectral irradiance data for incandescent-, LED- and discharge lamps are included. They are complemented by data on the effect of temperature on the emission by fluorescent tubes.

Details

This package contains emission spectra for different types of lamps including LED lamps sold as fully assembled light bulbs or luminaires but excluding LEDs sold as components requiring separate electronic driver modules or circuits. Lamps have been measured with an assortment of different instruments over more than 25 years in our lab or by collaborators. Some of the lamp types are no longer in production but the data are relevant for the interpretation of old scientific publications. Data for lamps emitting in the UV and VIS regions of the spectrum are represented in these data sets. In addition a set of spectral emission for UVB lamps exposed to different ambient temperatures is include.

The package contains two collections of spectra for different lamps all of them measured at air temperatures between 20 C and 25 C and a series of vectors to be used as indexes to extract different

subsets of spectra. These spectral data are normalized to spectral energy irradiance equal one at their maximum (strongest emission peak).

Temperature response data is included as a separate collection of spectra both as a `source_mspct` object and as a `source_spct` object.

A third collection of spectra contains data for the 16 different `_colors_` of light emitted by a household four channel LED bulb.

Warning!

None of the spectral data included in this package are based on supplier's specifications and are only for information. The exact emission spectrum depends to some extent on testing conditions, but more importantly among individual lamps. It is not uncommon for suppliers to revise specifications during the lifetime of a product type without changing the product denomination. There can be also some variation from batch to batch. It is also important to make sure that the type considered exactly matches. Frequently variations of a lamp type, with type denomination differing in a single letter or number, have quite different spectral characteristics. In other words, the data provided here are not a substitute for actual measurements of radiation emission and spectrum of the lamps actually used in a given piece of scientific research. For less demanding situations the data are in most cases reliable enough but perfect agreement with measurements on other lamps of the same exact type should not be expected. This is specially true for those data measured more than a few years ago when compared to lamps being currently sold under the same type denomination.

Author(s)

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Other contributors:

- Lasse Ylianttila [contributor]

See Also

Packages [photobiology-package](#) and [ggspectra-package](#).

Examples

```
library(photobiologyLamps)
library(photobiologyWavebands)
# extract one spectrum
lamps.mspct$incandescent.60w
lamps.mspct[["incandescent.60w"]]
# using one spectrum in a calculation
q_ratio(lamps.mspct$incandescent.60w, Blue(), Green())
# extracting all the spectra measured with a given instrument
lamps.mspct[bentham_lamps]
```

`airam_lamps`*Spectral data for lamps supplied by Airam*

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps from Airam Electric Oy Ab. Data are normalized to one at the wavelength of maximum emission.

Usage`airam_lamps`**Format**

A vector of character strings.

References

<https://www.airam.fi/en/>

See Also

[lamps.mspct](#)

Other manufacturers: [aputure_lamps](#), [generic_lamps](#), [osram_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples`osram_lamps`

`aputure_lamps`*Spectral data for lamps supplied by Aputure*

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for photography and video lamps from Aputure. Data are normalized to one at the wavelength of maximum emission.

Usage`aputure_lamps`

Format

A vector of character strings.

References

<https://www.aputure.com/>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [generic_lamps](#), [osram_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples

```
aputure_lamps
```

bentham_lamps

Spectra acquired with Bentham spectrometer

Description

Spectra measured with a Bentham spectroradiometer. Datasets contain wavelengths at a 0.5 nm interval and corresponding values for spectral emittance from different lamps. As absolute values are not meaningful because measuring distances are in most cases unknown data have been normalized to one at the wavelength of maximum energy irradiance.

Usage

```
bentham_lamps
```

Format

An object of class character of length 2.

Details

bentham_lamps is a character vector with indexes to members of [lamps.mspct](#)

Note

Instrument used: Bentham scanning double monochromator spectroradiometer with a cosine corrected input optics. Recently calibrated at STUK (Radiation Safety Authority Finland). Measurements done by Lasse Ylianttila (STUK, Helsinki, Finland).

Examples

bentham_lamps

generic_lamps *Spectral data for shop-branded lamps*

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps from Toshiba. Data are normalized to one at the wavelength of maximum emission.

Usage

generic_lamps

Format

A vector of character strings.

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [osram_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples

generic_lamps

incandescent_lamps *Spectral data for Lamps of different types*

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for the lamps of different types.

Usage

```
incandescent_lamps  
  
led_lamps  
  
mercury_lamps  
  
multimetal_lamps  
  
sodium_lamps
```

Format

A vector of character strings.

Note

In the case of LED-based lamps we include here only ready built commercially available lamps. In some cases assembled from multiple discrete LEDs, possible of mixed types and spectral output. For emission spectra for LEDs available as electronic components please see [photobiologyLEDs-package](#).

See Also

[lamps.mspct](#)

Examples

```
sodium_lamps  
multimetal_lamps  
mercury_lamps  
led_lamps  
  
# select lamps emitting in the amber, yellow, orange region  
lamps.mspct[sodium_lamps]
```

lamps.mspct

Spectral irradiance for diverse lamps

Description

A collection of lamp emission spectra measured with different spectroradiometers.

Usage

```
lamps.mspct
```

Format

A "source_mspct" object containing several "source_spct".

Details

The "source_mspct" object contains "source_spct" objects with spectral emission data. These classes are defined in package [photobiology-package](#) together with corresponding methods and functions.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad (relative energy based units)

Note

Please see the help corresponding to each instrument for details.

See Also

[bentham_lamps](#), [licor_lamps](#), [macam_lamps](#), [oo_maya_lamps](#) for information on the spectroradiometers, and [photobiologyLEDs-package](#) for spectra for LEDs available as electronic components.

Examples

```
uv_lamps
union(qpanel_lamps, uv_lamps)
lamps.mspct[union(philips_lamps, red_lamps)]

lamps.mspct$qpanel.uvb313
```

ledsavers.mspct

Spectra for a multichannel LED bulb

Description

A collection of lamp emission spectra for a household LED bulb with four channels and a remote control allowing color mixing. In addition character vectors useful as indexes for extracting subsets of the data are defined. Pairs of RGB channels are used in mixes. This is by design of the lamp and/or its remote control. The lamp here used is a 7.6 W, 230 V, E-27 LED lamp bulb accompanied by a small wireless remote control from a Swedish supplier. Similar (identical?) lamps are at the moment (early 2018) widely available through eBay and Aliexpress sellers.

Usage`ledsavers.mspect``ledsavers_channels``ledsavers_mixes``ledsavers_RG_mixes``ledsavers_RB_mixes``ledsavers_GB_mixes`**Format**

`ledsavers.mspect` is a "source_mspect" object containing a collection of 16 "source_spect" objects as members. Members are named.

`ledsavers_channels`, `ledsavers_mixes`, `ledsavers_RG_mixes`, `ledsavers_RB_mixes`, `ledsavers_GB_mixes` are character vectors containing subsets of names(`ledsavers.mspect`).

Details

`ledsavers.mspect` contains a collection of 16 "source_spect" objects with spectral emission data for each of the colors obtainable from the lamp. All colors were measured at maximum power output although the lamp supports dimming. The lamp was maintained at the same distance from the input optics so the different spectra are comparable and provided expressed in calibrated units.

The variables in each member spectrum are as follows:

- `w.length` (nm)
- `s.e.irrad` (relative energy based units)

Acknowledgements

We thank Prof. Lars Olof Björn for the gift of the lamp.

Note

Instrument used: Ocean Optics Maya2000 Pro single-monochromator array spectroradiometer with a Bentham cosine corrected input optics. A complex set of corrections and calibration procedure used. Raw spectral data processed with R package `MayaCalc`. The `source_spect` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired using R package `'ooacquire'`.

References

<http://www.ledsavers.com/>

Examples

```
ledsavers_channels  
ledsavers.mspct$W  
ledsavers.mspct[["W"]]  
ledsavers.mspct[ledsavers_channels]
```

licor_lamps

Spectra acquired with LI-COR LI-1800

Description

Lamp emission spectra measured with a LI-COR LI-1800 spectroradiometer. Member spectra containing the wavelengths at a 0.5 nm, 1.0 nm, or 2.0 nm interval and tabulated values of spectral irradiance for different lamps. As absolute values are not meaningful because measuring distances are in most cases unknown data have been normalized to one at the wavelength of maximum energy irradiance.

Usage

```
licor_lamps
```

Format

A vector of character strings.

Details

`licor` is a character vector with indexes to members of `lamps.mspct`

Note

Instrument used: LI-COR LI1800 scanning single monochromator spectroradiometer with a cosine corrected input optics. Recently calibrated with a LI-COR calibration lamp. Measurements done by Pedro J. Aphalo between 1992 and 2001.

Examples

```
licor_lamps
```

`macam_lamps`*Spectra acquired with Macam SR-9010-PC*

Description

Lamp emission spectra measured with a Macam SR-9010-PC spectroradiometer.

Usage`macam_lamps`**Format**

A vector of character strings.

Details

`macam_lamps` is a character vector with indexes to members of [lamps.mspct](#).

Note

Instrument used: Macam SR-9010-PC scanning double monochromator spectroradiometer with a cosine corrected input optics. Recently calibrated. The lamps were probably driven by a high frequency electronic ballast. Measured between 1996 to 1998.

References

Aphalo, P J, R Tegelberg, and R Julkunen-Tiitto. 1999. The Modulated UV-B Irradiation System at the University of Joensuu." *Biotronics* 28: 109–120. <http://ci.nii.ac.jp/naid/110006175827/en>.

Examples`macam_lamps`

`oo_maya_lamps`*Spectra acquired with Ocean Optics Maya2000 Pro*

Description

Spectra measured with a Ocean Optics Maya2000 Pro spectroradiometer. Datasets contain wavelengths at variable intervals and corresponding values for spectral emittance from different lamps. Absolute values are not meaningful because data have been normalized to one at the wavelength of maximum energy irradiance.

Usage

```
oo_maya_lamps
```

Format

A vector of character strings.

Details

oo_maya_lamps is a character vector with indexes to members of [lamps.mspct](#)

Note

Instrument used: Ocean Optics Maya2000 Pro single-monochromator array spectroradiometer with a Bentham cosine corrected input optics. A complex set of corrections and calibration procedure used. Raw spectral data processed with R package MayaCalc. The source_spct object contains a comment with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo.

Examples

```
oo_maya_lamps
```

```
osram_lamps
```

Spectral data for lamps supplied by Osram

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps from Osram. Data are normalized to one at the wavelength of maximum emission.

Usage

```
osram_lamps
```

Format

A vector of character strings.

References

<https://www.osram.com/>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [generic_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples

osram_lamps

philips_lamps	<i>Spectral data for lamps supplied by Philips</i>
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Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps from Osram. Data are normalized to one at the wavelength of maximum emission.

Usage

philips_lamps

Format

A vector of character strings.

References

<http://www.lighting.philips.com/>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [generic_lamps](#), [osram_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples

philips_lamps

qpanel_lamps

Spectral data for lamps supplied by Q-LAB

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps branded Q-Panel and supplied by Q-LAB. Data are normalized to one at the wavelength of maximum emission.

Usage

qpanel_lamps

Format

A vector of character strings.

References

<http://www.q-lab.com/>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [generic_lamps](#), [osram_lamps](#), [philips_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples

qpanel_lamps

qp_uv313_temp.spct

Spectral irradiance of UVB lamps at different temperatures.

Description

Dataset of spectral irradiance from a set of two Q-Panel UVB-313 40W fluorescent tubes, measured at different temperatures.

Usage

qp_uv313_temp.spct

qp_uv313_temp.mspct

Format

qp_uv313_temp.spct is a "source_spct" object with 777 rows (290 nm to 400 nm, 1.0 nm step) and 3 variables.

The variables are as follows:

- temperature (C)
- w.length (nm)
- s.e.irrad (W m⁻² nm⁻¹)

qp_uv313_temp.mspct is a "source_mspct" object containing a collection of "source_spct" objects, each with 111 rows (290 nm to 400 nm, 1.0 nm step) and 2 variables.

The variables in the member spectra are as follows:

- w.length (nm)
- s.e.irrad (W m⁻² nm⁻¹)

Details

Absolute values are comparable among the different temperatures. The lamps and the cosine diffuser were located inside a Conviron growth chamber. The measurements were done with a recently calibrated Macam double-monochromator spectroradiometer located outside the chamber and maintained at constant room temperature of 22 C. After each change in the temperature controller set-point enough time was allowed after the temperature had stabilized inside the chamber, for the output of the lamps to also become stable.

qp_uv313_temp.spct contains data for different temperatures in a "tidy" long form with a factor indicating the temperature at which the lamp was during measurement.

qp_uv313_temp.mspct contains the same data as a collection of spectra stored in a "source_mspct" object, with member "source_spct" objects named minus5C, plus00C, plus05C, plus10C, plus20C, plus30C, and plus35C.

Note

Instrument used: Macam SR-9010-PC scanning double monochromator spectroradiometer with a cosine corrected input optics. Recently calibrated. The lamps were driven by a high frequency electronic ballast.

References

Aphalo, P J, R Tegelberg, and R Julkunen-Tiitto. 1999. The Modulated UV-B Irradiation System at the University of Joensuu." Biotronics 28: 109–120. <http://ci.nii.ac.jp/naid/110006175827/en>.

Examples

```
qp_uv313_temp.mspct[["plus20C"]]
```

sylvania_lamps *Spectral data for lamps supplied by Sylvania*

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps from Osram. Data are normalized to one at the wavelength of maximum emission.

Usage

sylvania_lamps

Format

A vector of character strings.

References

<https://www.sylvania.com/>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [generic_lamps](#), [osram_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [toshiba_lamps](#), [valoya_lamps](#)

Examples

sylvania_lamps

toshiba_lamps *Spectral data for lamps supplied by Toshiba*

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for lamps from Toshiba. Data are normalized to one at the wavelength of maximum emission.

Usage

toshiba_lamps

Format

A vector of character strings.

References

<https://www.toshiba.eu/lighting/en>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [generic_lamps](#), [osram_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [valoya_lamps](#)

Examples

toshiba_lamps

uv_lamps

Spectral data for Lamps of different colors

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for the lamps of different types from various suppliers.

Usage

uv_lamps

white_lamps

blue_lamps

amber_lamps

red_lamps

Format

A vector of character strings.

See Also

[lamps.mspct](#)

Examples

```
uv_lamps
blue_lamps
red_lamps
amber_lamps
white_lamps

# select lamps emitting in the amber, yellow, orange region
lamps.mspct[red_lamps]
```

valoya_lamps

Spectral data for lamps supplied by Valoya

Description

Names of datasets containing the wavelengths and tabulated values spectral emittance for photography and video lamps from Valoya Data are normalized to one at the wavelength of maximum emission.

Usage

```
valoya_lamps
```

Format

A vector of character strings.

References

<https://www.valoya.com/>

See Also

[lamps.mspct](#)

Other manufacturers: [airam_lamps](#), [aputure_lamps](#), [generic_lamps](#), [osram_lamps](#), [philips_lamps](#), [qpanel_lamps](#), [sylvania_lamps](#), [toshiba_lamps](#)

Examples

```
valoya_lamps
```

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