Package 'photobiologyLamps'

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Type Package

Title Spectral Irradiance Data for Lamps

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Description Spectral emission data for some frequently used lamps including bulbs and flashlights based on led emitting diodes (LEDs) but excluding 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. Part of the 'r4photobiology' suite, Aphalo P. J. (2015) <doi:10.19232/uv4pb.2015.1.14>.

License GPL (>= 2)

VignetteBuilder knitr

Depends R (>= 4.1.0), photobiology (>= 0.13.2)

Suggests knitr (>= 1.50), rmarkdown (>= 2.29), ggspectra (>= 0.3.16), photobiologyWavebands (>= 0.5.4), ggplot2 (>= 3.5.0), photobiologyLEDs

LazyLoad yes

LazyData yes

ByteCompile true

Encoding UTF-8

URL https://docs.r4photobiology.info/photobiologyLamps/, https://github.com/aphalo/photobiologylamps

BugReports https://github.com/aphalo/photobiologylamps/issues

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NeedsCompilation no

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photobiologyLamps: Spectral Irradiance Data for Lamps

Description

Spectral emission data for some frequently used lamps including bulbs and flashlights based on led emitting diodes (LEDs) but excluding 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. Part of the 'r4photobiology' suite, Aphalo P. J. (2015) doi:10.19232/uv4pb.2015.1.14.

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 included in the main data set.

The main data set `lamps.mspct` contains spectra for different lamps all of them measured at air temperatures between 20 C and 25 C complemented by vectors of names to be used as indexes to extract different subsets of spectra. These spectral data are normalized to spectral energy irradiance equal to one at their maximum (strongest emission peak).

In addition a set of spectral emission for UVB lamps exposed to different ambient temperatures and a data set from a four channels LED bulb are included as two additional collections of spectra. Temperature response data are included both as a `source_mspct` object and as a `source_spct` object (to ensure backwards compatibility).

The 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 provided 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 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 the radiation emission 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]

References

Aphalo, Pedro J. (2015) The r4photobiology suite. UV4Plants Bulletin, 2015:1, 21-29. doi:10.19232/uv4pb.2015.1.14.

See Also

Packages photobiology-package and ggspectra-package.

Examples

```
library(photobiologyLamps)
library(photobiologyWavebands)
# extract one spectrum
```

```
lamps.mspct$Generic.Inc.bulb.60W
lamps.mspct[["Generic.Inc.bulb.60W"]]
# using one spectrum in a calculation
q_ratio(lamps.mspct$Generic.Inc.bulb.60W, Blue(), Green())
# extracting all the spectra measured with a given instrument
lamps.mspct[bentham_lamps]
```

`amaran_m9.mspct` *Spectra for an Amaran AL-M9 LED video light*

Description

A collection of lamp emission spectra for an Aputure Amaran pocket-sized daylight-balanced LED light type AL-M9.

Usage

```
amaran_m9.mspct
```

Format

`amaran_m9.mspct` is a `"source_mspct"` object containing a collection of 6 `"source_spct"` objects as members. Members are named.

Details

`amaran_m9.mspct` contains a collection of `"source_spct"` objects with spectral emission data for six different dimming settings. The lamp was maintained at the same distance of 160 mm from the input optics of the spectrometer. In all cases the diffuser was kept in place. Thus, the different spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

This light source has 9 LEDs in a 3×3 grid. The LEDs are in SMD packages. A built-in Lithium battery powers it. It comes with a detachable plastic diffuser

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

References

Lamp manufacturer: https://aputure.com/.

Aphalo, Pedro J. (2022) Small fill/video LED lights revisited: A new comparison. https://www.photo-spectrum.info/pages/illumination/led-fill-lights-2.html.

Examples

```
summary(amaran_m9.mspct)
```

`andoer_ir49.mspct` *Spectra for an Andoer IR49 LED video lamp*

Description

A collection of two light emission spectra for a small infra-red emitting LED-based light source for video and photography. The lamp is advertised as "Andoer IR49S Mini IR Night Vision Light"

Usage

```
andoer_ir49.mspct
```

Format

`andoer_ir49.mspct` is a `"source_mspct"` object containing a collection of two `"source_spct"` objects as members. Members are named.

Details

`andoer_ir49.mspct` contains a collection of two `"source_spct"` objects with spectral emission data for the lamp at full and minimum power. Dimming setting is stepless. The lamp was maintained at the same distance from the input optics so the two spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

This light source has 49 LEDs in a 7 $\times$ 7 grid. The LEDs are in through-hole packages. A built-in Lithium battery powers it.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

Examples

```
summary(andoer_ir49.mspct)
```

`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
```

`elgato_klm_cct.mspct` *Spectra for an Elgato Key Light Mini LED video lamp*

Description

A collection of lamp emission spectra for an Elgato Key Light Mini bi-colour LED lamp for video and photography.

Usage

```
elgato_klm_cct.mspct

elgato_klm_dim.mspct
```

Format

`elgato_klm_cct.mspct` is a `"source_mspct"` object containing a collection of 6 `"source_spct"` objects as members. Members are named.

An object of class `source_mspct` (inherits from `generic_mspct`, `list`) with 6 rows and 1 columns.

Details

`elgato_klm_cct.mspct` contains a collection of `"source_spct"` objects with spectral emission data for different colour temperature (CCT) settings at full power. The lamp was maintained at the same distance of 170 mm from the input optics of the spectrometer. Thus, the different spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

`elgato_klm_dim.mspct` contains a collection of `"source_spct"` objects with spectral emission data for different dimming settings at a CCT setting of 4000 K. The lamp was maintained at the same distance of 165 mm from the input optics of the spectrometer. Thus, the different spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

This light source uses LEDs on the edges of a diffusion panel giving very evenly distributed diffuse light. It is based on Osram warm white light and cool white LEDs. A built-in Lithium battery powers it. The mix of warm and cool light can be adjusted as well as the dimming. Remote control through Wifi is possible.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

References

Lamp manufacturer: https://www.elgato.com/.

Aphalo, Pedro J. (2022) Small fill/video LED lights revisited: A new comparison. https://www.photo-spectrum.info/pages/illumination/led-fill-lights-2.html.

Examples

```
summary(elgato_klm_cct.mspct)
summary(elgato_klm_dim.mspct)
```

---

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.FT.UVB313.40W
```

---

lamp_brands *Spectral data for Lamps from different suppliers*

Description

Names of members of the `lamps.mspct` collection of spectra grouped by brand name.

Usage

```
lamp_brands

Osram_lamps

Philips_lamps

Sylvania_lamps

QPanel_lamps

Airam_lamps

Toshiba_lamps

Aputure_lamps

Sunwayfoto_lamps

Godox_lamps

Valoya_lamps

Fluence_lamps

Convoy_lamps

Jaxman_lamps

Generic_lamps
```

Format

A vector of character strings.

An object of class `character` of length 8.

An object of class `character` of length 16.

An object of class `character` of length 1.

An object of class `character` of length 2.

An object of class `character` of length 5.

An object of class `character` of length 2.

An object of class `character` of length 1.

An object of class `character` of length 3.

An object of class `character` of length 4.

An object of class `character` of length 2.

An object of class `character` of length 7.

An object of class `character` of length 2.

An object of class `character` of length 2.

An object of class `character` of length 12.

Details

The character vectors described here contain the names of the spectra for lamps from each brand to facilitate their extraction from the collection. One additional vector, `lamp_brands` contains the names of the brands as used in the names of the spectra in the collection.

Osram

Lamps branded Osram are currently sold by Ledvance, of Chinese ownership. Osram currently makes and sells other products. When Osram (Germany) and Sylvania (USA) merged years back both brands remained in use in different markets and many types of lamps remained differentiated. .

Philips

Lamps branded Philips are sold by Signify Netherlands B.V.

Sylvania

Lamps branded Sylvania are currently sold by Ledvance in the USA, of Chinese ownership. Osram currently makes and sells other products. When Osram (Germany) and Sylvania (USA) merged years back both brands remained in use in different markets and many types of lamps remained differentiated.

Q-LAB

Q-Lab Corporation is a global provider of material durability testing products including UV-B and UV-A lamps used in test cabinets.

Airam

Airam Electric Oy Ab is Finnish supplier and manufacturer of lamps and luminaires.

Toshiba

Lamps branded Toshiba are sold by Toshiba Lighting.

Aputure

Aputure is a Chinese supplier of LED lighting and related equipment for filmmaking.

Sunwayfoto

Sunwayfoto is a Chinese supplier of ancillary equipment for photography, including battery-powered fill-in LED lights with high CRI ratings..

Godox

Godox is a Chinese supplier of photography and video lighting equipment. They sell both LED lights and Xenon flashes of a wide range to output power.

Valoya

Valoya Oy (Finland) sells LED lamps and luminaires for commercial plant cultivation. Both for indoor cultivation and to supplement sunlight in greenhouses.

Fluence

Fluence, a division of Osram, sells LED luminaires for commercial plant cultivation. Both for indoor cultivation and to supplement sunlight in greenhouses.

Convoy

Is a Chinese supplier of LED flashlights/torches and their parts. Sold through AliExpress, eBay and Banggood.

Jaxman

Is a Chinese supplier of LED flashlights/torches. Formerly sold through AliExpress.

Generic, shop branded or distributor branded

We group under this category shop-branded or generic (no-brand) lamps that usually have specifications with limited details. These lamps are unlikely to remain consistent from batch to batch or have limited availability.

Note

Some of the lamps are from resellers' brands, usually obscure ones, and others are from well-known brands. Some of the brands have changed ownership through take-overs and merges. When known the vintage is indicated in the comment field of each spectrum. Multiple brands may also belong to the same company.

References

https://www.ledvance.com/

https://www.lighting.philips.com

https://www.ledvanceus.com/Pages/default.aspx

https://www.q-lab.com/

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

https://www.tlt.co.jp/tlt/index_e.htm

https://aputure.com/

https://sunwayfoto.com/

https://www.godox.com/

https://www.valoya.com/

https://fluence-led.com/

See Also

lamps.mspct

Other indexing vectors of names: lamp_colors, lamp_types, lamp_uses

Other indexing vectors of names: lamp_colors, lamp_types, lamp_uses

Examples

```
lamp_brands
Osram_lamps
```

---

lamp_colors *Spectral data for Lamps of different colours*

Description

Names of members of the lamps.mspct collection of spectra grouped by colour or wavelength band.

Usage

```
lamp_colors

uv_lamps

purple_lamps

blue_lamps

green_lamps

yellow_lamps

orange_lamps

red_lamps

ir_lamps

amber_lamps

white_lamps
```

Format

A vector of character strings.

An object of class `character` of length 11.

An object of class `character` of length 0.

An object of class `character` of length 0.

An object of class `character` of length 0.

An object of class `character` of length 0.

An object of class `character` of length 0.

An object of class `character` of length 4.

An object of class `character` of length 2.

An object of class `character` of length 0.

An object of class `character` of length 50.

Details

contain the names of the members of `lamps.mspct` with peaks of emission within the wavelength range corresponding to the light colours as defined by ISO standards. Vector `amber_lamps` is the union of `"yellow_lamps"` and `"orange_lamps"`. Vector `white_lamps` contains the names of spectra for lamps with broad or multiple peaks of emission in the visible range. Vectors `"uv_lamps"` and `"ir_lamps"` contain the names for lamps with peak emission at wavelengths < 400 nm and

wavelengths > 700 nm, respectively. One additional vector, `lamp_colors` contains the names of the colors as used in the vectors.

These vectors can be used to extract subsets of spectra from `lamps.mspct`.

See Also

`lamps.mspct`

Other indexing vectors of names: `lamp_brands`, `lamp_types`, `lamp_uses`

Examples

```
lamp_colors

uv_lamps
blue_lamps
red_lamps
white_lamps

# select data for lamps  emitting in the ultraviolet region
lamps.mspct[uv_lamps]
```

---

lamp_types *Spectral data for Lamps of different types*

Description

Names of members of the `lamps.mspct` collection of spectra grouped by the technology their are based on, i.e., type.

Usage

```
lamp_types

incandescent_lamps

fluorescent_lamps

led_lamps

mercury_lamps

multimetal_lamps

sodium_lamps

xenon_lamps
```

Format

A vector of character strings.

An object of class `character` of length 3.

An object of class `character` of length 24.

An object of class `character` of length 33.

An object of class `character` of length 25.

An object of class `character` of length 1.

An object of class `character` of length 1.

An object of class `character` of length 4.

Details

These vectors can be used to extract subsets of spectra from `lamps.mspct`. One additional vector, `lamp_types` contains the names used for types of lamps in the names and vectors.

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`

Other indexing vectors of names: `lamp_brands`, `lamp_colors`, `lamp_uses`

Examples

```
lamp_types

sodium_lamps
multimetal_lamps
mercury_lamps
led_lamps

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

lamp_uses *Spectral data for Lamps designed for specific uses*

Description

Names of members of the lamps.mspct collection of spectra grouped by intended use.

Usage

```
lamp_uses

photography_lamps

plant_grow_lamps

germicidal_lamps

flashlights
```

Format

A vector of character strings.

An object of class character of length 8.

An object of class character of length 9.

An object of class character of length 1.

An object of class character of length 6.

Details

These vectors can be used to extract subsets of spectra from lamps.mspct. The set of names is not exhaustive. One additional vector, lamp_uses contains the naming given to intended specific lamp uses. Photography and video lamps are listed together in the vector photography_lamps.

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

Other indexing vectors of names: lamp_brands, lamp_colors, lamp_types

Examples

```
plant_grow_lamps
photography_lamps

# select lamps for photography
lamps.mspct[photography_lamps]
```

`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. This type of lamps is no longer available under the Ledsavers brand.

Usage

```
ledsavers.mspct

ledsavers_channels

ledsavers_mixes

ledsavers_RG_mixes

ledsavers_RB_mixes

ledsavers_GB_mixes
```

Format

`ledsavers.mspct` is a `"source_mspct"` object containing a collection of 16 `"source_spct"` 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.mspct)`.

An object of class `character` of length 4.

An object of class `character` of length 12.

An object of class `character` of length 4.

An object of class `character` of length 4.

An object of class `character` of length 4.

Details

ledsavers.mspct contains a collection of 16 "source_spct" 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 spectral energy irradiance units.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

Acknowledgements

We thank Prof. Lars Olof Bjoern 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_spct objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired using R package 'ooacquire'.

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. https://hdl.handle.net/2324/8257.

Examples

```
macam_lamps
```

`Nichia_LED_RECOM_dim.mspct` *Spectra for a custom LED source in growth chamber*

Description

A collection of LED emission spectra for the white LEDs in an Aralab plant-cultivation chamber at different nominal dimming settings.

Usage

```
Nichia_LED_RECOM_dim.mspct
```

Format

`Nichia_LED_RECOM_dim.mspct` is a `"source_mspct"` object containing a collection of 11 `"source_spct"` objects as members. Members are named.

Details

`Nichia_LED_RECOM_dim.mspct` contains a collection of `"source_spct"` objects with spectral emission data for different dimming settings. The entrance optics, a cosine diffuser, was kept at a distance of 24 cm from light source. Thus, the different spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

This growth chamber uses as light source a custom-built panel of Nichia Optisolis LEDs with CRI 97 rating based on LinearZ modules suplied by Lumitronix. Each LED module is driven by an RCD-48-.350 driver dimmed in constant current mode using a voltage supplied by the chamber controller.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

References

Growth chamber manufacturer: https://aralab.pt/.

LED modules manufacturer: https://www.lumitronix.com/en.

SMD LEDs manufacturer: https://www.nichia.co.jp/en/.

LED drivers manufacturer: https://recom-power.com/en/. #'

Examples

```
summary(Nichia_LED_RECOM_dim.mspct)
```

---

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_L_18W_840_temp.mspct` *Spectral irradiance of white fluorescent tubes at different temperatures.*

Description

Dataset of spectral irradiance from a set of four Osram L 18W/840 Lumilux fluorescent tubes in an Aralab FitoClima 1200 growth chamber. The tubes are located in the temperature controlled space.

Usage

```
Osram_L_18W_840_temp.mspct
```

Format

`Osram_L_18W_840_temp.mspct` is a `"source_mspct"` object containing a collection of `"source_spct"` objects, each with 1775 rows (250 nm to 1050 nm, 0.42 to 0.48 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 as the location of the entrance optics remained unchanged and dimming at 100 The lamps and the cosine diffuser were located inside the growth chamber. The Ocean Optics Maya 2000Pro array spectroradiometer as kept outside the chamber at a room temperature of approximately 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.

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

Examples

```
Osram_L_18W_840_temp.mspct[["20C"]]
```

`Percival_LED_dim.mspct` *Spectra for a Percival growth chamber*

Description

A collection of lamp emission spectra for the white LEDs in a Percival plant-cultivation chamber at different nominal dimming settings.

Usage

```
Percival_LED_dim.mspct
```

Format

`Percival_LED_dim.mspct` is a `"source_mspct"` object containing a collection of 11 `"source_spct"` objects as members. Members are named.

Details

`Percival_LED_dim.mspct` contains a collection of `"source_spct"` objects with spectral emission data for different dimming settings. The diffuser was maintained at the same distance from the LEDs. Thus, the different spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

This growth chamber uses as light source a panel of LEDs above each shelf at a close distance from plants.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

References

Growth chamber manufacturer: https://percival-scientific.com/.

Examples

```
summary(Percival_LED_dim.mspct)
```

qp_uvb313_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_uvb313_temp.spct

qp_uvb313_temp.mspct
```

Format

`qp_uvb313_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_uvb313_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)

An object of class `source_mspct` (inherits from `generic_mspct`, `list`) with 7 rows and 1 columns.

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_uvb313_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_uvb313_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.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. https://hdl.handle.net/2324/8257.

Examples

```
qp_uvb313_temp.mspct[["plus20C"]]
```

`sunwayfoto_fl96.mspct` *Spectra for a Sunwayfoto FL96 LED video light*

Description

A collection of lamp emission spectra for a Sunwayfoto LED fill light type FL96.

Usage

```
sunwayfoto_fl96.mspct
```

Format

`sunwayfoto_fl96.mspct` is a `"source_mspct"` object containing a collection of 6 `"source_spct"` objects as members. Members are named.

Details

`sunwayfoto_fl96.mspct` contains a collection of `"source_spct"` objects with spectral emission data for different dimming and colour temperature settings. The lamp was maintained at the same distance from the input optics of the spectrometer. Thus, the different spectra are comparable and provided expressed in calibrated spectral energy irradiance units.

This light source has 96 white LEDs half emitting warm white light and half emitting cool white light. The LEDs are in SMD packages and are interspersed. A built-in Lithium battery powers it. The mix of warm and cool light can be adjusted as well as the overall power output.

The variables in each member spectrum are as follows:

- w.length (nm)
- s.e.irrad ($\mathrm{W\,m^{-2}\,nm^{-1}}$)

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. The `source_spct` objects have attributes with additional information on the measurement and data processing. Measurements done by Pedro J. Aphalo. Data acquired and processed using R packages 'ooacquire' and 'photobiology'.

References

Lamp manufacturer: https://sunwayfoto.com/.

Aphalo, Pedro J. (2022) Small fill/video LED lights revisited: A new comparison. https://www.photo-spectrum.info/pages/illumination/led-fill-lights-2.html.

Examples

```
summary(sunwayfoto_fl96.mspct)
```

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