

# Package ‘zeitgebr’

June 23, 2018

**Title** Analysis of Circadian Behaviours

**Date** 2018-05-17

**Version** 0.3.2

**Description** Use behavioural variables to compute period, rhythmicity and other circadian parameters. Methods include computation of chi square periodograms (Sokolove and Bushell (1978) <DOI:10.1016/0022-5193(78)90022-X>), Lomb-Scargle periodograms (Lomb (1976) <DOI:10.1007/BF00648343>, Scargle (1982) <DOI:10.1086/160554>, Ruf (1999) <DOI:10.1076/brhm.30.2.178.1422>), and autocorrelation-based periodograms.

**Depends** R (>= 3.00),  
behavr

**Imports** data.table,  
lomb,  
pracma

**Suggests** testthat,  
covr,  
knitr,  
ggetho

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**URL** <https://github.com/rethomics/zeitgebr>

**BugReports** <https://github.com/rethomics/zeitgebr/issues>

**RoxygenNote** 6.0.1

**Roxygen** list(markdown = TRUE)

## R topics documented:

dams_sample . . . . .	2
find_peaks . . . . .	2
periodogram . . . . .	3
periodogram_methods . . . . .	4

**Index****6**


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dams_sample	<i>A behavr table with approximately ten days of DAM2 recording for 32 fruit flies. The first 10, the following 11 and the last 11 animals have long, short and wild type period, respectively (see meta(dams_sample)).</i>
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**Description**

A behavr table with approximately ten days of DAM2 recording for 32 fruit flies. The first 10, the following 11 and the last 11 animals have long, short and wild type period, respectively (see meta(dams\_sample)).

**Usage**

```
dams_sample
```

**Format**

An object of class behavr (inherits from data.table, data.frame) with 415040 rows and 3 columns.

**Author(s)**

Luis Garcia

**References**

Raw data stored at [https://github.com/rethomics/zeitgebr/tree/master/raw\\_data](https://github.com/rethomics/zeitgebr/tree/master/raw_data)

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find_peaks	<i>Find peaks in a periodogram</i>
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**Description**

This function locates the peaks in a pregenerated periodogram. Detection is based on [pracma::findpeaks](#). Only the significant (i.e. power > signif\_threshold) peaks are extracted.

**Usage**

```
find_peaks(data, n_peaks = 3)
```

**Arguments**

data	<a href="#">behavr::behavr</a> table representing a periodogram, as returned by <a href="#">periodogram</a>
n_peaks	maximal numbers of peak to be detected

**Value**

`behavr::behavr` table that is data with an extra column `peak`. `peak` is filled with zeros except for rows match a peak. In which case, rows have an integer value corresponding to the rank of the peak (e.g. 1 for the first peak).

**References**

- [zeitgebr tutorial](#) – the relevant rehtomics tutorial

**See Also**

- [periodogram](#) – to generate a periodogram in a first place
- [ggetho::geom\\_peak](#) – a layer to show peaks on a periodogram

**Examples**

```
data(dams_sample)
# only a half of the individuals for the sake of the example
dt <- dams_sample[xmv(region_id) %in% (1:16 * 2)]
per_dt_xs <- periodogram(activity, dt, FUN = chi_sq_periodogram)
per_dt_xs_with_peaks <- find_peaks(per_dt_xs)
per_dt_xs_with_peaks[peak == 1]
```

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periodogram

*Computes periodograms*


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**Description**

This function builds periodograms, with one of several methods, for each individual of a `behavr` table

**Usage**

```
periodogram(var, data, period_range = c(hours(16), hours(32)),
  resample_rate = 1/mins(15), alpha = 0.01, FUN = chi_sq_periodogram, ...)
```

**Arguments**

<code>var</code>	variable to analyse
<code>data</code>	<code>behavr</code> table
<code>period_range</code>	vector of size 2 defining minimal and maximal range of period to study (in seconds)
<code>resample_rate</code>	frequency to resample (up or down) the data at (in hertz)
<code>alpha</code>	significance level
<code>FUN</code>	function used to compute periodogram (see <a href="#">periodogram_methods</a> )
<code>...</code>	additional arguments to be passed to <code>FUN</code>

**Value**

A `behavr::behavr` table. In addition to the metadata, it contains data that encodes a periodogram (i.e. power vs period). The data contains the columns:

- `power` – the power the or equivalent (according to FUN)
- `period` – the period at which power is computed (in seconds)
- `p_value` – the p value associated to the power estimation
- `signif_threshold` – the threshold above which power is considered significant

**References**

- [zeitgebr tutorial](#) – the relevant rehtomics tutorial

**See Also**

- [periodogram\\_methods](#) – the list of built-in methods
- [find\\_peaks](#) – to find peaks in the periodogram
- [ggetho::ggperio](#) – to plot periodograms

**Examples**

```
data(dams_sample)
# only a half of the individuals for the sake of the example
dt <- dams_sample[xmv(region_id) %in% (1:16 * 2)]
pdt <- periodogram(activity, dt, FUN = ls_periodogram, oversampling = 4)
pdt <- periodogram(activity, dt, FUN = chi_sq_periodogram)

require(ggetho)
ggperio(pdt, aes(colour=period_group)) + stat_pop_etho()
```

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periodogram\_methods      *Methods For Computing Periodograms*

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**Description**

These functions provides a series of methods to assess periodicity of circadian processes.

**Usage**

```
ac_periodogram(x, period_range = c(hours(16), hours(32)),
  sampling_rate = 1/mins(1), alpha = 0.05)

chi_sq_periodogram(x, period_range = c(hours(16), hours(32)),
  sampling_rate = 1/mins(1), alpha = 0.05, time_resolution = hours(0.1))
```

```
fourier_periodogram(x, period_range = c(hours(16), hours(32)),  
  sampling_rate = 1/mins(1), alpha = 0.05)
```

```
ls_periodogram(x, period_range = c(hours(16), hours(32)),  
  sampling_rate = 1/mins(1), alpha = 0.05, oversampling = 8)
```

### Arguments

x	numeric vector
period_range	vector of size 2 defining minimal and maximal range of period to study (in seconds)
sampling_rate	the – implicitly regular – sampling rate of x (in hertz)
alpha	significance level
time_resolution	the resolution of periods to scan
oversampling	the oversampling factor (see <a href="#">lomb::lsp</a> )

### Value

a [data.table](#) with the columns:

- period – the period (in s)
- power – the power (or equivalent) for a given period
- p\_value – the significance of the power
- signif\_threshold – the significance threshold of the power (at alpha)

### References

- [zeitgebr tutorial](#) – the relevant rehtomics tutorial

### See Also

- [lomb::lsp](#) – the original function for ls\_periodogram
- [xsp::chiSqPeriodogram](#) – code modified from
- [stats::acf](#) – the original function for ac\_periodogram

# Index

## \*Topic **datasets**

- dams\_sample, [2](#)
- ac\_periodogram (periodogram\_methods), [4](#)
- beavr, [3](#)
- beavr::beavr, [2–4](#)
- chi\_sq\_periodogram  
(periodogram\_methods), [4](#)
- dams\_sample, [2](#)
- data.table, [5](#)
- find\_peaks, [2, 4](#)
- fourier\_periodogram  
(periodogram\_methods), [4](#)
- ggetho::geom\_peak, [3](#)
- ggetho::ggperio, [4](#)
- lomb::lsp, [5](#)
- ls\_periodogram (periodogram\_methods), [4](#)
- periodogram, [2, 3, 3](#)
- periodogram\_methods, [3, 4, 4](#)
- pracma::findpeaks, [2](#)
- stats::acf, [5](#)
- xsp::chiSqPeriodogram, [5](#)