

# Package ‘RLumCarlo’

October 8, 2019

**Type** Package

**Title** Monte-Carlo Methods for Simulating Luminescence Phenomena

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**Author** Johannes Friedrich [aut, trl] (<<https://orcid.org/0000-0002-0805-9547>>),  
Sebastian Kreutzer [aut, trl, cre] (<<https://orcid.org/0000-0002-0734-2199>>),  
Vasilis Pagonis [aut] (<<https://orcid.org/0000-0002-4852-9312>>),  
Christoph Schmidt [aut] (<<https://orcid.org/0000-0002-2309-3209>>),  
Ena Rajovic [ctb],  
Alex Roy Duncan [ctb],  
Christian Laag [ctb]

**Maintainer** Sebastian Kreutzer <[sebastian.kreutzer@u-bordeaux-montaigne.fr](mailto:sebastian.kreutzer@u-bordeaux-montaigne.fr)>

**Description** A Collection of Functions to Simulate Luminescence Production in Minerals using Monte-Carlo methods.

**Contact** Package Developer Team <[sebastian.kreutzer@u-bordeaux-montaigne.fr](mailto:sebastian.kreutzer@u-bordeaux-montaigne.fr)>

**License** GPL-3

**BugReports** <https://github.com/R-Lum/RLumCarlo/issues>

**Depends** R (>= 3.3.0),  
utils,  
magrittr

**URL** <https://CRAN.R-project.org/package=RLumCarlo>

**LinkingTo** Rcpp (>= 1.0.2),  
RcppArmadillo (>= 0.9.700.2.0)

**Imports** abind (>= 1.4-5),  
doParallel (>= 1.0.15),  
foreach (>= 1.4.7),  
parallel,  
methods,  
Rcpp (>= 1.0.2)

**Suggests** R.rsp

**Encoding** UTF-8

**VignetteBuilder** R.rsp

**RoxygenNote** 6.1.1

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plot_RLumCarlo	<i>Plot results from Monte-Carlo simulations with RLumCarlo</i>
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### Description

Plot results from Monte-Carlo simulations with RLumCarlo

### Usage

```
plot_RLumCarlo(object, times = NULL, plot_uncertainty = "range",
  norm = FALSE, add = FALSE, ...)
```

### Arguments

object	<b>data.frame</b> ( <b>required</b> )
times	<b>numeric</b> ( <i>optinal</i> ): Optional vector for the x-axis
plot_uncertainty	<b>logical</b> ( <i>with default</i> ): Enable/disable uncertainty polygon plot
norm	<b>logical</b> ( <i>with default</i> ): Normalise curve to the highest intensity
add	<b>logical</b> ( <i>with default</i> ): allow overplotting of results
...	further arguments that can be passed to control the plot output. Currently supported are: xlab, xlim, ylim, main, lwd, type, pch, lty,col, grid, legend

### Value

This function returns a graphical output

### Function version

0.1.0

**How to cite**

Friedrich, J., Kreutzer, S., 2019. plot\_RLumCarlo(): Plot results from Monte-Carlo simulations with RLumCarlo. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

**Author(s)**

Johannes Friedrich, University of Bayreuth (Germany), Sebastian Kreutzer, IRAMAT-CRP2A, Université Bordeaux Montaigne (France)

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run\_MC\_CW\_IRSL\_DELOC     *Run Monte-Carlo simulation for CW-IRSL for delocalized transition*

---

**Description**

Runs a Monte-Carlo (MC) simulation of constant wave infrared stimulated luminescence (CW-IRSL) using the one trap one recombination center (OTOR) model.

**Usage**

```
run_MC_CW_IRSL_DELOC(A, times, clusters = 10, N_e = 200,
  n_filled = N_e, R, method = "par", output = "signal", ...)
```

**Arguments**

A	<b>numeric (required)</b> : The transition probability (cm <sup>3</sup> /s).
times	<b>numeric (with default)</b> : The number of MC runs.
clusters	<b>numeric (with default)</b> : The number of clusters.
N_e	<b>integer (with default)</b> : The number of electrons.
n_filled	<b>integer (with default)</b> : The number of electron traps that are filled at the beginning of the simulation.
R	<b>numeric (with default)</b> : The retrapping ratio.
method	<b>character (with default)</b> :
output	<b>character (with default)</b> :
...	further arguments

**Details**

$$I_{DELOC}(t) = -dn/dt = p(t) * (n^2 / (NR + n(1 - R)))$$

**Value**

This function returns an **array** with dimension length(times) x length(r) x clusters

**Function version**

0.1.0

## How to cite

Kreutzer, S., 2019. run\_MC\_CW\_IRSL\_DELOC(): Run Monte-Carlo simulation for CW-IRSL for delocalized transition. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

## Author(s)

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C., 2017. Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars, Journal of Luminescence 181, 114–120. doi: [10.1016/j.jlumin.2016.09.014](https://doi.org/10.1016/j.jlumin.2016.09.014)

## Examples

```
##=====##
## Example 1: Simulate CW-IRSL
##=====##
## Not run:
run_MC_CW_IRSL_DELOC(
  A = 0.12,
  R = 1,
  times = 0:100) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)

#' @examples
##=====##
## Example 2: Simulate CW-IRSL DELOC with several parameter changes
##=====##
## Not run:

# define your parameters
A=c(0.1,0.3,0.5,1)
times=seq(0,60,1)
s=1e12
E=1
R<-c(1e-7,1e-6,0.01,0.1) # sequence of different R values
clusters=1000 # number of Monte Carlo simulations
N_e =c(200, 500, 700, 400) # number of free electrons
n_filled =c(200, 500, 100, 70) # number of filled traps
method="par"
output ="signal"
col=c(1,2,3,4) # different colours for the individual curves
plot_uncertainty <- c(T,F,T,F) # do you want to see the uncertainty?
add_TF <- c(F,rep(T, (length(R)-1)))
for (u in 1:length(R)){
  results <-run_MC_CW_IRSL_DELOC(A=A[u], times, clusters =clusters, N_e = N_e[u],
                                n_filled = n_filled[u], R=R[u], method = method, output = output)
  plot_RLumCarlo(results,add=add_TF[u],legend = F, col=col[u], main=" your plot")
}
```

```

legend("topright",ncol=4,cex=0.55,title = "parameters" ,legend=c(paste0("A = ", A),
                                                                    paste0("n_filled = ", n_filled),
                                                                    paste0("N_e = ", N_e),
                                                                    paste0("R = ", R)), text.col=col)

## End(Not run)

```

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run_MC_CW_IRSL_LOC	<i>Run Monte-Carlo simulation for CW-IRSL for localised transition</i>
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---

## Description

Runs a Monte-Carlo (MC) simulation of constant wave infrared stimulated luminescence (CW-IRSL) using the generalized one trap (GOT) model.

## Usage

```
run_MC_CW_IRSL_LOC(A, times, clusters = 10, n_filled = 100, r,
  method = "par", output = "signal", ...)
```

## Arguments

A	<b>numeric (required)</b> : The transition probability (cm <sup>3</sup> /s).
times	<b>numeric (with default)</b> : The number of MC runs.
clusters	<b>numeric (with default)</b> : The number of clusters.
n_filled	<b>integer (with default)</b> : The number of electron traps that are filled at the beginning of the simulation.
r	<b>numeric (with default)</b> : The retrapping ratio.
method	<b>character (with default)</b> :
output	<b>character (with default)</b> :
...	further arguments

## Details

$$I_{LOC}(t) = -dn/dt = A * (n^2/(r + n))$$

## Value

This function returns an [array](#) with dimension length(times) x length(r) x clusters

## Function version

0.1.0

## How to cite

Kreutzer, S., 2019. run\_MC\_CW\_IRSL\_LOC(): Run Monte-Carlo simulation for CW-IRSL for localised transition. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

## Author(s)

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C., 2017. Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars. Journal of Luminescence 181, 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
##=====##
## Example 1: Simulate CW-IRSL
##=====##
## Not run:
run_MC_CW_IRSL_LOC(
  A = 0.12,
  r = 1,
  times = 0:100) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

---

run_MC_CW_IRSL_TUN	<i>Run Monte-Carlo simulation for CW-IRSL</i>
--------------------	---

---

## Description

Runs a Monte-Carlo (MC) simulation of constant wave infrared stimulated luminescence (CW-IRSL) using the model.

## Usage

```
run_MC_CW_IRSL_TUN(A, rho, times, clusters = 10, r = NULL, N_e = 200,
  method = "seq", output = "signal", ...)
```

## Arguments

A	<b>numeric (required)</b> : The transition probability ( $\text{cm}^3/\text{s}$ ).
rho	<b>numeric (required)</b> : The calculated dimensionless Charge density (normally written Rho').
times	<b>numeric (with default)</b> : The number of MC runs.
clusters	<b>numeric (with default)</b> : The number of clusters.

**r**                    **numeric** (*with default*): The retrapping ratio.  
**N\_e**                **numeric** (*with default*): The number of electrons  
**method**           **character** (*with default*):  
**output**            **character** (*with default*):  
**...**               further arguments

## Details

####equation here please####

## Value

This function returns a list.

## Function version

0.2.0

## How to cite

Friedrich, J., Kreutzer, S., 2019. run\_MC\_CW\_IRSL\_TUN(): Run Monte-Carlo simulation for CW-IRSL. Function version 0.2.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence PhenomenaR package version 0.1.0.9000-61.

## Author(s)

Johannes Friedrich, University of Bayreuth (Germany), Sebastian Kreutzer, IRAMAT-CRP2A, Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
## Not run:

##=====##
## Example 1: Simulate CW-IRSL measurement
##=====##

run_MC_CW_IRSL_TUNL(A = 0.12, rho = 0.003, times = 0:1000) %>%
  plot_RLumCarlo(norm = T, legend = T)

## End(Not run)
```

run\_MC\_ISO\_DELOC

*Run Monte-Carlo simulation for ISO for delocalized transition***Description**

Runs a Monte-Carlo (MC) simulation of isothermally stimulated luminescence (ISO-TL or ITL) using the one trap one recombination center (OTOR) model.

**Usage**

```
run_MC_ISO_DELOC(s, E, T = 20, times, clusters = 10, N_e = 200,
  n_filled = N_e, R, method = "par", output = "signal", ...)
```

**Arguments**

s	<b>numeric (required)</b> : Escape frequency of the trap (s <sup>-1</sup> ).
E	<b>numeric (required)</b> : Thermal activation energy of the trap (eV).
T	<b>numeric (with default)</b> : Temperature (deg. C).
times	<b>numeric (with default)</b> : The number of MC runs.
clusters	<b>numeric (with default)</b> : The number of clusters.
N_e	<b>integer (with default)</b> : The number of electrons.
n_filled	<b>integer (with default)</b> : The number of electron traps that are filled at the beginning of the simulation.
R	<b>numeric (with default)</b> : The retrapping ratio.
method	<b>character (with default)</b> :
output	<b>character (with default)</b> :
...	further arguments

**Details**

$$I_{DELOC}(t) = -dn/dt = p(t) * (n^2 / (NR + n(1 - R)))$$

**Value**

This function returns an **array** with dimension length(times) x length(r) x clusters

**Function version**

0.0.1

**How to cite**

Kreutzer, S., 2019. run\_MC\_ISO\_DELOC(): Run Monte-Carlo simulation for ISO for delocalized transition. Function version 0.0.1. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence PhenomenaR package version 0.1.0.9000-61.



**Author(s)**

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

**References**

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

**Examples**

```
##=====##
## Example 1: Simulate ITL
##=====##
## Not run:
run_MC_ISO_DELOC(
  s = 3.5e12,
  E = 1.45,
  T = 200,
  R = 1,
  times = 0:10000) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

---

run\_MC\_ISO\_LOC

---

*Run Monte-Carlo simulation for ITL for localised transition*


---

**Description**

Runs a Monte-Carlo (MC) simulation of isothermally stimulated luminescence (ISO-TL or ITL) using the model.

**Usage**

```
run_MC_ISO_LOC(s, E, T = 20, times, clusters = 10, n_filled = 100, r,
  method = "par", output = "signal", ...)
```

**Arguments**

s	<b>numeric (required)</b> : Escape frequency of the trap ( $s^{-1}$ ).
E	<b>numeric (required)</b> : Thermal activation energy of the trap (eV).
T	<b>numeric (with default)</b> : Temperature (deg. C).
times	<b>numeric (with default)</b> : The number of MC runs.
clusters	<b>numeric (with default)</b> : The number of clusters.
n_filled	<b>integer (with default)</b> : The number of electron traps that are filled at the beginning of the simulation.
r	<b>numeric (with default)</b> : The retrapping ratio.

method            **character** (*with default*):  
 output           **character** (*with default*):  
 ...               further arguments

## Details

$$I_{LOC}(t) = -dn/dt = p(t) * (n^2/(r + n))$$

## Value

This function returns an **array** with dimension length(times) x length(r) x clusters

## Function version

0.0.1

## How to cite

Kreutzer, S., 2019. run\_MC\_ISO\_LOC(): Run Monte-Carlo simulation for ITL for localised transition. Function version 0.0.1. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence PhenomenaR package version 0.1.0.9000-61.

## Author(s)

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
##=====##
## Example 1: Simulate ITL
##=====##
## Not run:
run_MC_ISO_LOC(
  s = 3.5e12,
  E = 1.45,
  T = 200,
  r = 1,
  times = 0:10000) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

run\_MC\_ISO\_TUN

*Run Monte-Carlo simulation for isothermal measurements***Description**

Runs a Monte-Carlo (MC) simulation of isothermally stimulated luminescence (ISO-TL or ITL) using the .

**Usage**

```
run_MC_ISO_TUN(E, s, T = 200, rho, times, clusters = 10, r = NULL,
  N_e = 200, method = "par", output = "signal", ...)
```

**Arguments**

E	<b>numeric (required):</b> Thermal activation energy of the trap (eV).
s	<b>numeric (required):</b> Escape frequency of the trap (s <sup>-1</sup> ).
T	<b>numeric (required):</b> Temperature (deg. C).
rho	<b>numeric (required):</b> The calculated dimensionless Charge density (normally written Rho').
times	<b>numeric (with default):</b> The number of MC runs.
clusters	<b>numeric (with default):</b> The number of clusters.
r	<b>numeric (with default):</b> The retrapping ratio.
N_e	<b>numeric (with default):</b> The number of electrons.
method	<b>character (with default)</b>
output	<b>character (with default)</b>
...	further arguments

**Details**

$$I_{LOC}(t) = -dn/dt = A * (n^2/(r + n))$$

**Value**

This function returns a list.

**Function version**

0.1.0

**How to cite**

Friedrich, J., Kreutzer, S., 2019. run\_MC\_ISO\_TUN(): Run Monte-Carlo simulation for isothermal measurements. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

**Author(s)**

Johannes Friedrich, University of Bayreuth (Germany), Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

**References**

Pagonis, V. and Kulp, C., 2017. ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence 181, 114–120. doi: [10.1016/j.jlumin.2016.09.014](https://doi.org/10.1016/j.jlumin.2016.09.014)

**Examples**

```
## Not run:
##=====##
## Example 1: Simulate isothermal measurement
##=====##

times <- seq(0, 5000)
run_MC_ISO_TUN(
  E = 1.2,
  s = 1e10,
  T = 200,
  rho = 0.007,
  times = times) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

---

run\_MC\_LM\_OSL\_DELOC      *Run Monte-Carlo simulation for LM-OSL for delocalized transition*

---

**Description**

Runs a Monte-Carlo (MC) simulation of linearly modulated optically stimulated luminescence (LM-OSL) using the one trap one recombination center (OTOR) model.

**Usage**

```
run_MC_LM_OSL_DELOC(A, times, clusters = 10, N_e = 200,
  n_filled = N_e, R, method = "par", output = "signal", ...)
```

**Arguments**

A	<b>numeric (required):</b> The transition probability ( $\text{cm}^3/\text{s}$ ).
times	<b>numeric (with default):</b> The number of MC runs.
clusters	<b>numeric (with default):</b> The number of clusters.
N_e	<b>integer (with default):</b> The number of electrons.
n_filled	<b>integer (with default):</b> The number of electron traps that are filled at the beginning of the simulation.
R	<b>numeric (with default):</b> The retrapping ratio.

method	<a href="#">character</a> (with default):
output	<a href="#">character</a> (with default):
...	further arguments

## Details

$$I_{DELOC}(t) = -dn/dt = p(t) * (n^2 / (NR + n(1 - R)))$$

## Value

This function returns an [array](#) with dimension length(times) x length(r) x clusters

## Function version

0.1.0

## How to cite

Kreutzer, S., 2019. run\_MC\_LM\_OSL\_DELOC(): Run Monte-Carlo simulation for LM-OSL for delocalized transition. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence PhenomenaR package version 0.1.0.9000-61.

## Author(s)

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
##=====##
## Example 1: Simulate LM-OSL
##=====##
## Not run:
run_MC_LM_OSL_DELOC(
  A = 0.12,
  R = 1,
  times = 0:100) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

---

run_MC_LM_OSL_LOC	<i>Run Monte-Carlo simulation for LM-OSL for localized transition</i>
-------------------	---

---

## Description

Runs a Monte-Carlo (MC) simulation of linearly modulated optically stimulated luminescence (LM-OSL) using the generalized one trap (GOT) model.

## Usage

```
run_MC_LM_OSL_LOC(A, times, clusters = 10, n_filled = 100, r,
  method = "par", output = "signal", ...)
```

## Arguments

A	<b>numeric (required)</b> : The transition probability (cm <sup>3</sup> /s).
times	<b>numeric</b> (with default): The number of MC runs.
clusters	<b>numeric</b> (with default): The number of clusters.
n_filled	<b>integer</b> (with default): The number of electron traps that are filled at the beginning of the simulation.
r	<b>numeric</b> (with default):
method	<b>character</b> (with default):
output	<b>character</b> (with default):
...	further arguments

## Details

$$I_{DELOC}(t) = -dn/dt = p(t) * (n^2 / (NR + n(1 - R)))$$

## Value

This function returns an **array** with dimension length(times) x length(r) x clusters

## Function version

0.0.1

## How to cite

Kreutzer, S., 2019. run\_MC\_LM\_OSL\_LOC(): Run Monte-Carlo simulation for LM-OSL for localized transition. Function version 0.0.1. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

## Author(s)

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
#####
## Example 1: Simulate LM-OSL
#######
## Not run:
run_MC_LM_OSL_LOC(
  A = 0.12,
  r = 1,
  times = 0:100) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

---

run\_MC\_LM\_OSL\_TUN

Run Monte-Carlo simulation for LM-OSL

---

## Description

Run Monte-Carlo simulation for LM-OSL

## Usage

```
run_MC_LM_OSL_TUN(A, rho, times, clusters = 10, r = NULL,
  delta.r = 0.1, N_e = 200, method = "par", output = "signal", ...)
```

## Arguments

A	<b>numeric (required)</b> : The transition probability ( $\text{cm}^3/\text{s}$ ).
rho	<b>numeric (required)</b> : The calculated dimensionless Charge density (normally written Rho’).
times	<b>vector (with default)</b> : The number of MC runs.
clusters	<b>numeric (with default)</b> : The number of clusters.
r	<b>numeric (with default)</b> : The retrapping ratio.
delta.r	<b>numeric (with default)</b> :
N_e	<b>numeric (with default)</b> : The number of electrons.
method	<b>character (with default)</b> :
output	<b>character (with default)</b> :
...	further arguments

## Details

ADD EQUATION

**Value**

This function returns a list.

**Function version**

0.1.0

**How to cite**

Friedrich, J., 2019. run\_MC\_LM\_OSL\_TUN(): Run Monte-Carlo simulation for LM-OSL. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

**Author(s)**

Johannes Friedrich, University of Bayreuth (Germany)

**References**

Pagonis, V. and Kulp, C. (2017) 'Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars', Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

**Examples**

```
## Not run:

##TODO: Primary example, should be verified
run_MC_LM_OSL_TUN(A = 10000, rho = 0.0001, times = 1:100, clusters = 10, r = NULL,
  delta.r = 0.1,
  N_e = 200, method = "par", output = "signal") %>%
  plot_RLumCarlo(norm = T)

## End(Not run)
```

---

run\_MC\_TL\_DELOC

---

*Run Monte-Carlo simulation for TL for delocalized transition*


---

**Description**

Runs a Monte-Carlo (MC) simulation of Thermo-luminescence (LM-OSL) using the one trap one recombination center (OTOR) model.

**Usage**

```
run_MC_TL_DELOC(s, E, times, clusters = 10, N_e = 200,
  n_filled = N_e, R, method = "par", output = "signal", ...)
```



**Arguments**

s	<b>numeric (required)</b> : Escape frequency of the trap ( $s^{-1}$ ).
E	<b>numeric (required)</b> : Thermal activation energy of the trap (eV).
times	<b>numeric (with default)</b> : the number of MC runs.
clusters	<b>numeric (with default)</b> : the number of clusters.
N_e	<b>integer (with default)</b> : The number of electrons.
n_filled	<b>integer (with default)</b> : The number of electron traps that are filled at the beginning of the simulation.
R	<b>numeric (with default)</b> : The retrapping ratio.
method	<b>character (with default)</b> :
output	<b>character (with default)</b> :
...	further arguments

**Details**

$$I_{DELOC}(t) = -dn/dt = p(t) * (n^2 / (NR + n(1 - R)))$$

**Value**

This function returns an **array** with dimension `length(times) x length(r) x clusters`

**Function version**

0.0.1

**How to cite**

Kreutzer, S., 2019. `run_MC_TL_DELOC()`: Run Monte-Carlo simulation for TL for delocalized transition. Function version 0.0.1. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence Phenomena R package version 0.1.0.9000-61.

**Author(s)**

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

**References**

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, *Journal of Luminescence*. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

**Examples**

```
##=====##
## Example 1: Simulate TL
##=====##
## Not run:
run_MC_TL_DELOC(
  s = 3.5e12,
```

```

E = 1.45,
R = 1,
times = 100:450) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)

```

run\_MC\_TL\_LOC

*Run Monte-Carlo simulation for TL for localised transition*

## Description

Runs a Monte-Carlo (MC) simulation of thermo-luminescence (LM-OSL) using the generalized one trap (GOT) model.

## Usage

```
run_MC_TL_LOC(s, E, times, clusters = 10, n_filled = 100, r,
  method = "par", output = "signal", ...)
```

## Arguments

s	<b>numeric (required)</b> : Escape frequency of the trap ( $s^{-1}$ ).
E	<b>numeric (required)</b> : Thermal activation energy of the trap (eV).
times	<b>numeric (with default)</b> : The number of Mc runs.
clusters	<b>numeric (with default)</b> : The number of clusters.
n_filled	<b>integer (with default)</b> : The number of electron traps that are filled at the beginning of the simulation.
r	<b>numeric (with default)</b> : The retrapping ratio.
method	<b>character (with default)</b> :
output	<b>character (with default)</b> :
...	further arguments

## Details

$$I_{LOC}(t) = -dn/dt = p(t) * (n^2/(r + n))$$

## Value

This function returns an [array](#) with dimension length(times) x length(r) x clusters

## Function version

0.1.0

## How to cite

Kreutzer, S., 2019. run\_MC\_TL\_LOC(): Run Monte-Carlo simulation for TL for localised transition. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence PhenomenaR package version 0.1.0.9000-61.

## Author(s)

Sebastian Kreutzer, IRAMAT-CRP2A, UMR 5060, CNRS - Université Bordeaux Montaigne (France)

## References

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
##=====##
## Example 1: Simulate TL
##=====##
## Not run:
run_MC_TL_LOC(
  s = 3.5e12,
  E = 1.45,
  r = 1,
  times = 100:450) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

---

run\_MC\_TL\_TUN

*Run Monte-Carlo simulation for TL*


---

## Description

Run Monte-Carlo simulation for TL

## Usage

```
run_MC_TL_TUN(s, E, rho, r_c, times, clusters = 10, N_e = 200,
  delta.r = 0.1, method = "par", output = "signal", ...)
```

## Arguments

s **list (required)**: Escape frequency of the trap ( $s^{-1}$ ).

E **numeric (required)**: Thermal activation energy of the trap (eV).

rho **numeric (required)**: The calculated dimensionless Charge density (normally written  $\rho$ ).

r_c	<b>numeric</b> (with default):
times	<b>vector</b> (with default): The number of MC runs.
clusters	<b>numeric</b> (with default): The number of clusters.
N_e	<b>numeric</b> (with default): The number of electrons
delta.r	<b>numeric</b> (with default):
method	<b>character</b> (with default):
output	<b>character</b> (with default):
...	further arguments

## Details

ADD EQUATION

## Value

This function returns an **array** with dimension length(times) x length(r) x clusters

## Function version

0.1.0

## How to cite

Friedrich, J., 2019. run\_MC\_TL\_TUN(): Run Monte-Carlo simulation for TL. Function version 0.1.0. In: Friedrich, J., Kreutzer, S., Pagonis, V., Schmidt, C., 2019. RLumCarlo: Monte-Carlo Methods for Simulating Luminescence PhenomenaR package version 0.1.0.9000-61.

## Author(s)

Johannes Friedrich, University of Bayreuth (Germany)

## References

Pagonis, V. and Kulp, C. (2017) ‘Monte Carlo simulations of tunneling phenomena and nearest neighbor hopping mechanism in feldspars’, Journal of Luminescence. Elsevier, 181, pp. 114–120. doi: 10.1016/j.jlumin.2016.09.014.

## Examples

```
## Not run:
##=====##
## Example 1: Simulate TL measurement
##=====##

times <- seq(200, 500) # time = temperature

run_MC_TL_TUN(s = 3.5e12,
  E = 1.45,
  rho = 0.015,
  r_c = 0.85,
  times = times) %>%
  plot_RLumCarlo(legend = T)

## End(Not run)
```

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