



MAX-PLANCK-GESellschaft

Dr. Edgar Roldan
Max-Planck Institut für Physik Komplexer Systeme
Nöthnizer Str. 38
01187 Dresden, Germany
Tel: +49 351 871 1211
Email: edgar@pks.mpg.de
Website: www.edgarroldan.com
13.07.2017

Last Name: Roldán Estébanez
First Name: Édgar
Degree: Ph. D.
Date of birth: 16.07.1985
Place of birth: San Sebastian (Spain)
Nationality: Spanish

PROFESSIONAL EXPERIENCE

- 2016 - current **Project Leader**
Max-Planck Institute for the Physics of Complex Systems
Biological Physics Division
Dresden, Germany.
- 2014 - 2016 **Guest Scientist**
Max-Planck Institute for the Physics of Complex Systems
Biological Physics Division
Dresden, Germany.
- 2014 **Postdoctoral researcher**
ICFO - The Institute of Photonic Sciences
Optical Tweezers Group
Castelldefels (Barcelona), Spain.
- 2013 - 2014 **Postdoctoral researcher**
Instituto de Ciencia de Materiales de Madrid
Madrid, Spain.
- 2009 - 2013 **PhD student**
Universidad Complutense de Madrid
Departamento de Física Atomica, Molecular y Nuclear
Madrid, Spain.

QUALIFICATIONS

- 2016 **Assistant Professor**
Spanish National Agency for Assessment and Accreditation (ANECA).
- 2013 **PhD in Physics**
Title: *Irreversibility and dissipation in microscopic systems*
Date: 29th July 2013
Universidad Complutense de Madrid, Madrid, Spain
Qualification: *Summa cum laude*.
- 2009 **Master in Fundamental Physics**
Universidad Complutense de Madrid, Madrid, Spain.
- 2008 **Bachelor in Physics**
Universidad Complutense de Madrid, Madrid, Spain.

PUBLICATIONS

1. ***Path-integral formalism for stochastic resetting: Exactly solved examples and shortcuts to confinement***
É. Roldán and S. Gupta
Phys. Rev. E **96** (2) 022130 (2017)
2. ***Statistics of infima and stopping times of entropy production and applications to active molecular processes***
I. Neri, É. Roldán, and F. Jülicher
Phys. Rev. X. **7**, 011019 (2017)
3. ***Colloidal heat engines: a review***
I. A. Martínez, É. Roldán, L. Dinis, and R. A. Rica
Soft Matter **13** (1), 22-36 (2017).
Special Issue Emerging Investigators 2017.
4. ***Mechanisms of backtrack recovery by RNA polymerases I and II***
A. Lisica, C. Engel, M. Jahnel, É. Roldán, E. A. Galburt, P. Cramer and S. W. Grill
PNAS **113** (11), 2946-2951 (2016).
5. ***Stochastic resetting in backtrack recovery by RNA polymerases***
É. Roldán, A. Lisica, D. Sanchez-Taltavull and S. W. Grill
Phys. Rev. E **93** (6), 062411 (2016).

6. ***Brownian Carnot engine***
I. A. Martínez*, **É. Roldán***, L. Dinis, J. M. R. Parrondo, D. Petrov and R. A. Rica
Nature Phys. **12**, 67-70 (2016)
* equal contribution.
7. ***Thermodynamics at the microscale: from effective heating to the Brownian Carnot engine***
L. Dinis , I. A. Martínez, **É. Roldán**, J. M. R. Parrondo, and R. A. Rica
J. Stat. Phys.: Theory and Experiment **5**, 054003 (2016).
Special issue Focus on Stochastic Thermodynamics
8. ***Decision Making in the Arrow of Time***
É. Roldán, I. Neri, M. Dörpinghaus, H. Meyr and F. Jülicher
Phys. Rev. Lett. **115**, 2506023 (2015).
9. ***Adiabatic processes realized with a trapped Brownian particle***
I. A. Martínez, **É. Roldán**, L. Dinis, D. Petrov and R. A. Rica
Phys. Rev. Lett. **114** (12), 120601 (2015).
10. ***Fluctuation theorems between non-equilibrium states in an RC circuit***
L. Granger, J. Mehlis, **É. Roldán**, S. Ciliberto and H. Kantz
New J. Phys. **17**, 065005 (2015).
11. ***Universal features in the energetics of symmetry breaking***
É. Roldán*, I. A. Martínez*, J. M. R. Parrondo and D. Petrov
Nature Phys. **10**, 457-461 (2014).
Highlighted article in *News and Views* (Nature Physics)
* equal contribution.
12. ***Realization of nonequilibrium thermodynamic processes using external colored noise***
P. Mestres, I. A. Martínez, A. Ortiz-Ambriz, R. A. Rica and **É. Roldán**
Phys. Rev. E **90** (3), 032116 (2014).
13. ***Measuring kinetic energy changes in the mesoscale with low acquisition rates***
É. Roldán, I. A. Martínez, L. Dinis and R. A. Rica
Appl. Phys. Lett. **104** (23), 234103 (2014).
14. ***Effective heating to several thousand kelvin of an optically trapped sphere in a liquid***
I. A. Martínez, **É. Roldán**, J. M. R. Parrondo and D. Petrov
Phys. Rev. E **85** 031129 (2012).
15. ***Time series irreversibility: a visibility graph approach***
L. Lacasa, À. Núñez, **É. Roldán**, J. M. R. Parrondo and B. Luque
Eur. Phys. J. B **85** (6), 1-11 (2012).

16. ***Entropy production and Kullback-Leibler divergence between stationary trajectories of discrete systems***

É. Roldán and J. M. R. Parrondo
Phys. Rev. E **85** 031129 (2012).

17. ***Estimating dissipation from single stationary trajectories***

É. Roldán and J. M. R. Parrondo
Phys. Rev. Lett. **105** 150607 (2010).

BOOKS

1. ***Irreversibility and dissipation in microscopic systems***

É. Roldán
Springer, ISBN 978-3-319-07079-7 (2014).

CONFERENCE PROCEEDINGS

1. ***An information-theoretic analysis of sequential decision making***

M. Dörpinghaus, É. Roldán, I. Neri, H. Meyr and F. Jülicher
IEEE International Symposium on Information Theory (ISIT), 3051 (2017).

PREPRINTS

1. ***Generic properties of stochastic entropy production***

S. Pigolotti, I. Neri, É. Roldán and F. Jülicher
arXiv:1704.0406 (2017)
Submitted to Phys. Rev. Lett.

AWARDS AND HONOURS

- 2017 **EPS-SNPD Early Career Prize**
European Physical Society
- 2017 **PKS Distinguished Fellow**
Max Planck Institute for the Physics of Complex Systems
- 2017 **Liquid Art Prize**
10th Liquid Matter Conference - LIQUIDS 2017
Ljubljana (Slovenia), 17th July.
- 2017 **Prize “for excellent poster presentation”**
Gordon Research Conference “Stochastic Physics in Biology”.
Ventura, California (United States), 12th January.
- 2014 **International Springer Theses Prize**
- 2014 **PhD extraordinary prize**
Universidad Complutense de Madrid, Madrid, Spain.
- 2007 **Accesit of Award “Premio Promoción 60”.**
Facultad de Ciencias Físicas.
Universidad Complutense de Madrid, Madrid, Spain.

PRESENTATIONS AT INTERNATIONAL CONFERENCES

2017 - LIQUIDS´17 Liquid Matter Conference

Talk: “Brownian Carnot engine”

Cankarjev dom Cultural and Congress Centre, Ljubljana July 17-21th.

2017 - FQMT´17 Frontiers of Quantum and Mesoscopic Thermodynamics

Talk: “Negative records of entropy production: the infimum law”

Orea Hotel Pyramida, Prague, July 10-15th.

2017 - FQMT´17 Frontiers of Quantum and Mesoscopic Thermodynamics

Poster: “Decision Making in the Arrow of Time”

Orea Hotel Pyramida, Prague, July 10-15th.

2017 - Climate Fluctuations and Non-equilibrium Statistical Mechanics: an interdisciplinary dialogue

Talk: “Martingale theory for nonequilibrium thermodynamics”

Max Planck Institute for the Physics of Complex Systems, Dresden, July 10th.

2017 - Dynamics, Thermodynamics and Information Processing in Chemical Networks

Talk: "Negative records of entropy production: the infimum law"

University of Luxembourg, Luxembourg, June 13rd-16th.

2017 - DPG Spring Meeting

Talk: "Extreme values of mesoscopic currents in Physics and Biology"

TU Dresden, Dresden, Germany, March 21st-25th.

2017 - DPG Spring Meeting

Talk: "Brownian Carnot engine"

TU Dresden, Dresden, Germany, March 21st-25th.

2017 - Gordon Research Conference "Stochastic physics in biology"

Poster: "Decision Making in the arrow of time"

Ventura, California, United States. January 8th-13th.

2016 - Principles of biological and robotic navigation

Poster: "Experimental construction of a Brownian Carnot engine"

MPIPKS, Dresden, Germany. August 29th-31th.

2016 - Information, Probability and Inference in Systems Biology Conference (IPISB2016)

Poster: "Decision Making in the Arrow of Time"

IST Austria, Klosteneuburg, Austria. May 18th-20th.

2016 - DPG Spring Meeting

Talk: "Decision Making in the Arrow of Time"

Universitat Regensburg, Regensburg, Germany. March 6th-12th.

2015 - European Biophysics Congress

Poster: "Quantifying irreversibility in ear hair bundle spontaneous oscillations"

International Congress Center Dresden, Germany. July 18th-22th.

2015 - DPG Spring Meeting

Poster: "Mechanisms of backtrack recovery in RNA polymerases I and II"

Technische Universität Berlin, Germany. March 20th-25th.

2015 - Workshop on recent Developments In Non-Equilibrium Physics "Luxembourg out of Equilibrium"

Contribution (oral and poster): "Thermodynamics of symmetry breaking"

Université de Luxembourg, Luxembourg. January 12th-15th.

2014 - XI GISC Workshop

Talk: "Thermodynamics of symmetry breaking"

Universidad Complutense de Madrid, Madrid, Spain. February 7th.

2013 - X GISC Workshop

Talk: "Detecting active processes from spontaneous oscillations of Ear Hair Bundles"

Universidad Carlos III, Leganés (Madrid), Spain. February 8th.

2012 - FisEs 2012

Talk: "Mimicking high-temperature reservoirs for colloidal particles using noisy electric fields"

IFISC, Palma de Mallorca, Spain. October 18th-20th.

2011 - FisEs 2011

Poster: "Irreversibility and dissipation in stochastic processes"

Universitat de Barcelona, Barcelona, Spain. July 2nd-4th.

2010 - II Workshop MODELICO

Talk: "Relative entropy as a quantitative measure of irreversibility in non-equilibrium stationary states"

Centro de Astrobiología INTA-CSIC, Madrid, Spain. November 12th.

2010 - International Symposium on Quantum Thermodynamics

Talk: "Entropy production and time asymmetry in nonequilibrium stationary states"

Universität Stuttgart, Stuttgart, Germany. September 13th-17th.

2010 - Mechanics of Large Molecular Assemblies

Talk: "Construction of a microscopic Szilard engine"

IFISC, Mallorca, Spain. April 8th-11th.

2010 - VI GISC Workshop

Contribution (talk): "Dissipation and information in stochastic processes"

Universidad Carlos III, Madrid, Spain. February 19th.

2009 - kTlog2: Computing Matters.

Talk: "Estimating dissipation with single stationary trajectories"

Toledo, Spain. October 22th-24th.

2008 - I Congreso Complutense de Divulgación de Física Nuclear y de Partículas

Poster: "Neutrino mass research: Double Beta Decay and the Nemo Project"

Madrid, Spain. July 8th.

RESEARCH STAYS

2017 - Institut Curie - Laboratoire de Physico Chimie

Paris, France

February 23th - March 3rd.

2012 - ICFO - The institute of photonic sciences

Castelldefels (Barcelona), Spain

November 9th-24th.

2012 - Max Planck Institute for the Physics of Complex Systems

Dresden, Germany

July 1st - September 1st.

- 2012 - **ICFO - The institute of photonic sciences**
Castelldefels (Barcelona), Spain
March 28th - April 14th.
- 2012 - **ICFO - The institute of photonic sciences**
Castelldefels (Barcelona), Spain
February 6th-21th.
- 2011 - **ICFO - The institute of photonic sciences**
Castelldefels (Barcelona), Spain
August 20th - September 6th.
- 2010 - **Max Planck Institute for Molecular Cell Biology and Genetics**
Dresden, Germany
February 22th - April 8th.
- 2009 - **Max Planck Institute for the Physics of Complex Systems**
Dresden, Germany
July 1st - August 10th.
- 2008 - **Max Planck Institute for the Physics of Complex Systems**
Dresden, Germany
July 18th - August 18th.

INVITED SEMINARS

- 2017 - **"Martingale Theory for Nonequilibrium Thermodynamics"**
Theoretical Physics Colloquium. Institute for Theoretical Physics Cologne. Cologne, Germany. May 26th.
- 2017 - **"Decision Making and Infima in Physics and Biology"**
Seminar in Laboratoire de Physico Chimie. Institut Curie. Paris, France. February 28th.
- 2015 - **"Decision Making in the Arrow of Time"**
Seminario de Fisica Estadística GISC-UCM. Departamento de Física Atomica, Molecular y Nuclear. Universidad Complutense de Madrid. Madrid, Spain. December 18th.
- 2015 - **"Brownian Carnot engine"**
Origin of Life seminar. Max-Planck Institute for Molecular Cell Biology and Genetics. Dresden, Germany. October 1st.
- 2015 - **"To cleave or not to cleave: the choice of recovery pathway in RNA polymerase backtracking"**
Polymerase day. Deutsches Hygiene-Museum, Dresden, Germany. August 25th.
- 2014 - **"Mechanisms of backtrack recovery in RNA polymerases I and II"**
Universidad Politecnica de Madrid, Madrid, Spain. December 18th.

2014 - **"Thermodynamics of symmetry breaking"**
Universidad de Granada, Granada, Spain. April 22th.

2014 - **"Thermodynamics of symmetry breaking"**
Centre de Recerca Matematica, Bellaterra (Barcelona), Spain. March 12th.

2012 - **"Irreversibility and dissipation in the nonequilibrium stationary state (NESS)"**
Grill Lab group meeting.
Max-Planck Institute for Molecular Cell Biology and Genetics (MPI- CBG), Dresden, Germany. July 14th.

2012 - **"Increase of Effective temperature in a colloidal particle up to 3000K" (Joint seminar with Ignacio A. Martínez)**
Petrov Lab, ICFO- The Institute Of Photonic Sciences, Castelldefels (Barcelona), Spain. November 15th.

TEACHING

- | | |
|-----------|---|
| 2017 | Lectures "<i>Theoretical Biophysics</i>"
TU Dresden
Joint course with Frank Jülicher and Stephan Grill
Dresden, Germany. |
| 2016 | Practicals for PhD students, Dresden International PhD Program
Max Planck Institute for the Physics of Complex Systems
Dresden, Germany. |
| 2012-2013 | Lectures "<i>Physics applied to biology</i>"
Faculty of Biology and Geology
Universidad Complutense de Madrid, Madrid, Spain. |
| 2011-2012 | Lectures "<i>Physics applied to biology</i>"
Faculty of Biology and Geology
Universidad Complutense de Madrid, Madrid, Spain. |
| 2007-2008 | Tutorships "<i>Differential Equations I</i>"
Universidad Complutense de Madrid, Madrid, Spain. |
| 2006-2007 | Tutorships "<i>Calculus I</i>"
Universidad Complutense de Madrid, Madrid, Spain. |

PARTICIPATION IN THESIS COMMITTEES

2014 - **Ángel M. Núñez** “*Mapping dynamics into graphs. The visibility algorithm*”
Vice-chair of the committee.
Universidad Politecnica de Madrid
Madrid, Spain
December 19th.

FUNDING

2009-2013 **PhD grant “*Beca de Formación de Profesorado Universitario (FPU)*”**
Ministerio de Educación y Ciencia, Spanish Government (national).

2008-2009 **Master grant “*Beca para estudios de master*”**
Obra Social La Caixa, Barcelona, Spain (private).

2007-2008 **Bachelor grant “*Beca de Colaboración en la investigación*”**
Ministerio de Educación y Ciencia, Spanish Government (national).

2005-2006 **Bachelor grant “*Beca de Excelencia*”**
Comunidad de Madrid, Madrid, Spain (regional).

2004-2005 **Bachelor grant “*Beca de Excelencia*”**
Comunidad de Madrid, Madrid, Spain (regional).

SCIENTIFIC DIVULGATION

2017 **Article “*Termodinàmica Estocàstica: un camp científic emergent*”**
Notices per a Químics”
Col·legi de Químics de Catalunya

SUMMER SCHOOLS

2012 - “***II Gefenol Summer School on Statistical Physics of Complex and Small Systems***”
Centro de Ciencias de Benasque Pedro Pascual.
Benasque (Huesca), Spain.
September 3rd-14th.

2011 - “***Summer School on Statistical Physics of Complex and Small Systems***”
IFISC, Palma de Mallorca, Spain.
September 12th-23rd

OTHERS

Referee for the American Physical Society (APS) since 2015.

Scientific referee for:

- Physical Review Letters
- Physical Review E
- New Journal of Physics
- Journal of Chemical Physics
- Europhysics Letters - EPL
- European Physical Journal B
- Physica A
- Entropy

Spoken languages:

- English (fluent oral and written)
- Spanish (native)
- French (intermediate level)
- German (basic level)
- Basque (intermediate level)

Programming: C, C++, Python, MATLAB, Mathematica, MotionTracking.