



MAX-PLANCK-GESELLSCHAFT

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Personal data

Name: Edgar Roldan Estebanez
Date of birth: 16/07/1985 (age 31)
Place of birth: San Sebastian (Spain)
Nationality: Spanish

Scientific career

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

Qualifications

- 2013 PhD in Physics. Universidad Complutense de Madrid. Madrid, Spain.
Title: *Irreversibility and dissipation in microscopic systems*.
Date: 29th July 2013.
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 in scientific journals

- 1. 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).
- 2. 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.
- 3. 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).
- 4. 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).
- 5. 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).
- 6. 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
- 7. Decision Making in the Arrow of Time**
É. Roldán, I. Neri, M. Dörpinghaus, H. Meyr and F. Jülicher
Phys. Rev. Lett. **115**, 2506023 (2015).
- 8. 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).

9. **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).
10. **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).
11. **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).
12. **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).
13. **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).
14. **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).
15. **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).
16. **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).

Preprints

1. Quantum mechanical approach to stochastic resetting

É. Roldán and S. Gupta

arXiv:1703.10615 (2017)

Submitted to New J Phys Fast Track Communications

2. An information-theoretic analysis of sequential decision making

M. Dörpinghaus, É. Roldán, I. Neri, H. Meyr and F. Jülicher

arXiv:1510.08952 (2016)

Accepted as a conference proceeding in IEEE International Symposium on Information Theory 2017.

Awards and honours

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|------|---|
| 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. |

Contributions in conferences

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".

Universität 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.

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

Seminars in external institutions

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 Fisica 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 Matemàtica, 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

- 2016 **Practicals for PhD students, Dresden International PhD Program**
Max Planck Institute for the Physics of Complex Systems.
Dresden, Germany.
Total time: 40h.
- 2012-2013 **Lectures on “Physics applied to biology”**
Faculty of Biology and Geology.
Universidad Complutense de Madrid, Madrid, Spain.
Total time: 20h.
- 2011-2012 **Lectures on “Physics applied to biology”**
Faculty of Biology and Geology.
Universidad Complutense de Madrid, Madrid, Spain.
Total time, 20h.
- 2007-2008 **Tutorships on “Differential Equations I”**
Universidad Complutense de Madrid, Madrid, Spain.
- 2006-2007 **Tutorships on “Calculus I”**
Universidad Complutense de Madrid, Madrid, Spain.

Grants

- 2009-2013 **PhD grant "Beca de Formación de Profesorado Universitario (FPU)"**
Ministerio de Educación y Ciencia, Spanish Government.
- 2008-2009 **Master grant “Beca para estudios de master”**
Obra Social La Caixa, Barcelona, Spain.
- 2007-2008 **Bachelor grant “Beca de Colaboración en la investigación”**
Ministerio de Educación y Ciencia, Spanish Government.
- 2005-2006 **Bachelor grant “Beca de Excelencia”**
Comunidad de Madrid, Madrid, Spain.
- 2004-2005 **Bachelor grant “Beca de Excelencia”**
Comunidad de Madrid, Madrid, Spain.

Divuligation

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

Attendance to scientific courses

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

APS referee (since 2015)

Scientific referee in:

Physical Review Letters
Physical Review E
New Journal of 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.