

Lídia del Rio

CONTACT

INFORMATION

Institute for Theoretical Physics
ETH Zurich
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PERSONAL DATA

Born in February 1986, in Portugal.

RESEARCH

INTERESTS

Quantum foundations, quantum thermodynamics, foundations of quantum intelligence and machine learning, information security, quantum software, quantum resource theories and game design.

EMPLOYMENT

ETH Zurich, Switzerland

Senior scientist, Department of Physics, August 2017–present.

Postdoctoral research assistant, Department of Physics, October 2016–July 2017.

- Principal investigator: Renato Renner (quantum information theory group).

University of Bristol, United Kingdom

Postdoctoral research assistant, School of Physics, 2014–2016.

- Principal Investigator: Sandu Popescu (quantum information theory group).

ETH Zurich, Switzerland

PhD student and teaching assistant, Department of Physics, 2009–2014.

- Principal investigator: Renato Renner (quantum information theory group).

EDUCATION

ETH Zurich, Switzerland

PhD (Dr. sc. ETH Zurich), Department of Physics, 2015.

- Thesis: *Resource theories of knowledge*.
- Supervisor: Renato Renner.
- Co-examiners: Fernando Brandão and Patrick Hayden.

Universidade de Aveiro, Portugal

Master degree, Physics, 2009.

- Overall grade: 17 (out of 20). Thesis grade: 18.
- Thesis: *Thermalisation and entropy in Heisenberg spin chains*.
- Thesis supervisors: Renato Renner (ETH Zurich) and Ricardo Dias (U. Aveiro).

Licenciatura (4-year degree), Physics, 2008.

- Overall grade: 17. Thesis grade: 19.
- Thesis: *The Kondo effect in graphene*.
- Thesis supervisor: Ricardo Dias (U. Aveiro).

PAPERS

Raban Iten, Tony Metger, Henrik Wilming, Lídia del Rio and Renato Renner,
Discovering physical concepts with neural networks,
arXiv:1807.10300 (2018).

Carlo Sparaciari, Lidia del Rio, Carlo Maria Scandolo, Philippe Faist, Jonathan Oppenheim,
The first law of general quantum resource theories,
arXiv:1806.04937 (2018).

Nuriya Nurgalieva and Lídia del Rio,
Inadequacy of modal logic in quantum settings,
to appear in proceedings of QPL 2018, arXiv:1804.01106 (2018).

Lea Krämer and Lídia del Rio,
Operational locality in global theories,
Phil. Trans. R. Soc. A 2018 376 20170321 (May 2018).

V. Vilasini, Christopher Portmann and Lídia del Rio,
Composable security in relativistic quantum cryptography,
arXiv:1708.00433 (2017).

Lea Krämer and Lídia del Rio,
Currencies in resource theories,
arXiv:1605.01064 (2016).

Lídia del Rio, Adrian Hutter, Renato Renner and Stephanie Wehner,
Relative thermalization,
Phys. Rev. E 94, 022104 (2016).

John Goold, Marcus Huber, Arnau Riera, Lídia del Rio and Paul Skrzypczyk,
The role of quantum information in thermodynamics — a topical review
Journal of Physics A 49, 19 (2016).

Lídia del Rio, Lea Krämer and Renato Renner,
Resource theories of knowledge,
arXiv:1511.08818 (2015).

Lídia del Rio, Johan Åberg, Renato Renner, Oscar Dahlsten and Vlatko Vedral,
The thermodynamic meaning of negative entropy,
Nature 474, 61–63 (2011).

EVENT ORGANIZATION

Main organizer

- Together with Nuriya Nurgalieva: [QuID — Quantum Information for developers](#), summer school and hackathon, Zurich, Switzerland (September 2018).
- Together with Ana Belén Sainz and Matthew Fairbairn Pusey: [Observers in quantum and foil theories](#), Perimeter Institute, Canada (April 2018).
- [Solstice of foundations: summer school in quantum foundations and workshop on contextuality](#), Zurich, Switzerland (June 2017).
- [Workshop on quantum information and foundations of thermodynamics](#), Zurich, Switzerland (August 2011).

Programme committees

- [Quantum Information Processing 2019](#), University of Colorado Boulder, USA (January 2019).

RECENT AND
UPCOMING
CONFERENCES

- Fifth Quantum Thermodynamics Conference, Oxford, UK (March 2017).
- TQC — 12th Conference on the Theory of Quantum Computation, Communication and Cryptography, Paris, France (June 2017).
- Quantum physics and logic, Nijmegen, The Netherlands (July 2017).
- AQIS — 17th Asian Quantum Information Science Conference, Singapore (September 2017).

Invited talks

- Machine learning for quantum foundations, 1st International Workshop on Quantum Software and Quantum Machine Learning, University of Technology Sydney, Australia (July 2018).
- Composable security in relativistic quantum cryptography, Workshop for Quantum Innovators, University of Waterloo, Canada (September 2017).
- Subjectivity in thermodynamics, Conference on Quantum Information and Quantum Control VII, Toronto, Canada (September 2017).
- Panel discussion on Reconstructions and no-go theorems, workshop on Participatory Realism, Stellenbosch, South Africa (June 2017).
- Subjective thermodynamics, New Directions in the Foundations of Physics, Tarquinia, Italy (May 2017).
- Subjective thermodynamics, Workshop: thermodynamics and resource theories, Paris, France (May 2017).
- Tutorial on quantum information and thermodynamics, Quantum Information Processing 2017, Seattle, US (January 2017).
- Quantum — the open journal for quantum science, International Conference for Young Quantum Information Scientists, Barcelona (October 2016).
- Quantum information and thermodynamics, Theory of Quantum Computation, Communication and Cryptography, Berlin, Germany (September 2016).
- Discussion session on information and thermodynamics, 4th COST conference on quantum thermodynamics, Erice, Italy (May 2016).
- Discussion session on information and thermodynamics, 6th Working group meeting of COST Action Thermodynamics in the quantum regime, Malta (February 2016).
- The thermodynamic meaning of negative entropy, Gordon research seminar on quantum science, Easton, MA, USA (July 2014).
- The thermodynamic meaning of negative entropy, NanoEnergy 2013, Perugia, Italy (July 2013).

Contributed talks

- Experimentally robust no-go theorems, Quantum Networks, Oxford, UK (August 2017).
- Operational locality in global theories, Quantum Physics and Logic, Nijmegen, The Netherlands (July 2017).
- Finding non-signalling agents in global theories, Quantum networks, Barcelona, Spain (April 2016).
- Resource theories of knowledge, Workshop in quantum information and thermodynamics, São Carlos, Brazil (February 2015).
- Relative thermalization, Thermodynamics in the quantum regime, Berlin, Germany (January 2014).
- Subjectivity in quantum thermodynamics, Mathematical horizons for quantum physics 2, session on information-theoretic approaches to thermodynamics, Singapore (August 2013).

Posters

- Composable security in relativistic quantum cryptography , QIP, Delft, The Netherlands (January 2018).
- Currencies in resource theories, 4th COST conference on quantum thermodynamics, Erice, Italy (May 2016).
- Resource theories of knowledge, Quantum Information Processing 2016, Banff, Canada (January 2016).
- Resource theories of knowledge, Quantum physics and logic, Oxford, UK (July 2015).

Talks and group seminars in the context of scientific visits

- 2017: University College London (UK), University of Bristol (UK).
- 2016: Perimeter Institute (Canada), IQC (Canada), University of York (UK), University of Oxford (UK).
- 2015: University of Cambridge (UK), Perimeter Institute (Canada), IBM Watson Laboratories (US), University of Turko (Finland), University College London (UK), ETH Zurich (Switzerland).
- 2014: Institute of Photonic Sciences (Spain), University of Oxford (UK).

SUPERVISION OF STUDENTS

ETH Zurich

- Giulia Mazzola, *The equivalence principle in fully quantum settings*, semester project (ongoing).
- Laura Burri, *Quantum space-time and reference frames*, semester project (2018).
- Dmitry Grinko, *Collapse theories*, semester project (2018).
- Shishir Khandelwal, *Thermodynamics with accelerated observers*, semester project (2018).
- Nuriya Nurgalieva, *Logic of agents in quantum settings*, master's thesis (2018).
- Nuriya Nurgalieva, *Quantum reference frames for experiments where observers can be measured*, semester project (2017).
- V. Visalini, *quantum causal structures*, master thesis (2017).
- Martin Lieckteig, *Modeling explicit knowledge for noisy and thermal operations*, master's thesis (2017).

University of Bristol

- Tom Farshi, *Operational notions of temperature in quantum thermodynamics*, master's thesis (2016).

ETH Zurich (co-supervisor with Renato Renner)

- Philipp Kammerlander, *Self-contained work extraction — model of a semi-quantum Szilard engine*, master's thesis (2013).
- Bettina Meyer, *Work extraction from pure qubits in ion traps*, master's thesis (2013).
- Philipp Kammerlander, *Work extraction from pure qubits*, semester project (2012).
- Raphaël Christophe, *Purity compression*, master's thesis (2012).
- Adrian Hutter, *The foundations of statistical physics from first principles of quantum mechanics: deriving equipartition from the decoupling approach*, semester project (2011).

TEACHING EXPERIENCE

ETH Zurich

- Lecturer of the graduate course Quantum Information Processing I - Concepts (2018, 2019).

University of Bristol

- Seminar on Introduction to resource theories for the Quantum Engineering Centre for Doctoral Training (2016).

ETH Zurich

- Teaching assistant for the courses of Quantum Mechanics I and II, Quantum Information Theory, Quantum Science for Information Technology, and Statistical Physics, (2009 – 2013).
- Replacement lectures for Quantum Mechanics II and Quantum Information Theory (2013).

EXTRA-CURRICULAR ASPECTS

As a postdoc

- Co-founder and executive board member of *Quantum*, the open journal for quantum sciences (2016–present).
- Active member of groups that support women in science, such as *Alice: women in quantum information*, organizing meetings at conferences, debates, etc.

As a PhD student

- Dance and teaching assistant at *Cuartito Azul Tango* (2014–present).
- Webmaster for the COST Action on thermodynamics in the quantum regime (2013–2015). Helped writing the original proposal for the action. Member of the management committee (2013–2017).
- Webdesigner of *qutube*, a repo for videos of talks in quantum information theory and the permanent website for the QIP conferences. In both projects, the webmaster was Philippe Faist.
- Made a short video review of a paper on thermodynamics, together with Philipp Kammerlander (2013).

As an undergrad

- Participant in the 2006 edition of ESA’s Student Parabolic Flying Campaign. Our experiment aimed at measuring the vibration of mercury drops via laser Doppler vibrometry, in order to find their resonance frequencies. We did not anticipate that the whole plane would be shaking too much for us to obtain decent data.
- Politics: spokesperson of the physics’ students at University of Aveiro, from 2006 to 2008. I was the spokesperson of all university students for pedagogical matters, from 2007 to 2008.
- Active member of the Amnesty International local group in Aveiro (2006–2008).

GRANTS AND AWARDS

ETH Zurich

- Qstarter technology transfer award 2018, by QSIT, the Swiss National Centre of Competence in Research for Quantum Science and Technology, its industry partners, and a representative of the Swiss National Science Foundation, for Quantum Journal (2018).
- FQXi minigrant Physics of the Observer, for support for conference Q-TURN, to take place in late 2018 (2017/2018).
- FQXi minigrant Physics of the Observer, for support for the summer school on quantum foundations (2016/2017).
- FQXi large grant Physics of the Observer, for the project *Many worlds, many times: Emergent observers in non-probabilistic theories* (2016/2017).
- PhD scholarship from the Portuguese Foundation for Science and Technology (2009–2013).

Universidade de Aveiro

- Physics department award (best Physics undergraduate student), 2006/07.
- Merit award (awarded to the best students in science degrees) 2006/07 and 2005/06.
- Winner of the 2006 edition of Nightmat (mathematics contest for undergraduate students), at University de Aveiro.
- Best first-year student in a science degree 2005/06.
- Best first-year award (for the best applying mark to Physics), 2004/05 (kept the award in 2005/06 and 2006/07).

Pre-history

- National winner of the Environment Olympics, in 1999, runner-up in 2000 and 2003.