

## Rubén Seoane Souto

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CONTACT INFORMATION	Trollebergsvägen 30b Lund, Sweden 22731	+34-600-546567 <a href="mailto:ruben.seoane_souto@ftf.lth.se">ruben.seoane_souto@ftf.lth.se</a>
ACADEMIC POSITIONS	<p><b>Researcher</b> 11/2020 to present Solid state division and Nanolund, Lund university, Visiting researcher at Center for Quantum Devices University of Copenhagen</p> <p><b>Postdoctoral researcher</b> 11/2018 to 10/2020 Solid state division and Nanolund, Lund university, Visiting researcher at Center for Quantum Devices University of Copenhagen</p> <p><b>Teaching assistant</b> (during the Ph.D. studies) 10/2016-10/2018 Department of theoretical condensed matter physics, Universidad Autónoma de Madrid</p> <p><b>Doctoral student</b> 1/2013-10/2016 Department of theoretical condensed matter physics, Condensed matter Physics center (IFIMAC) Universidad Autónoma de Madrid Supervisors: Prof. Alfredo Levy Yeyati and Prof. Álvaro Martín-Rodero</p>	
RESEARCH VISITS	<b>Laboratoire Ondes et Matière d'Aquitaine, CNRS</b> 4/2016-7/2016 Université de Bordeaux Supervisor: Dr. Rémi Avriller	
EDUCATION	<p><b>Universidad Autónoma de Madrid</b>, Madrid, Spain</p> <p>Ph.D., Condensed matter physics, nanophysics and biophysics, 15/6/2018 Thesis title: <i>Quench dynamics in interacting and superconducting nanojunctions</i>. Supervisors: Prof. Alfredo Levy Yeyati and Prof. Álvaro Martín Rodero</p> <p>Master's degree, Master in condensed matter physics and nanotechnology, 7/2013 Master thesis: <i>Electronic transport through molecular transistors in the polaronic regime</i> Supervisors: Prof. Alfredo Levy Yeyati, Prof. Álvaro Martín Rodero and Prof. Rosa C. Monreal</p> <p><b>Universidad Complutense de Madrid</b>, Madrid, Spain</p> <p>Extended Bachelor in Physics (5 years degree), 7/2012</p> <ul style="list-style-type: none"><li>• Undergraduate thesis: <i>Strong coupling correlation functions and semiclassical strings</i></li><li>• Supervisor: Rafael Hernández Redondo, Ph.D.</li><li>• Topic: String theory</li></ul>	
RESEARCH INTERESTS	<ul style="list-style-type: none"><li>• Quantum transport</li><li>• Topological states of matter</li><li>• Mesoscopic superconductivity</li><li>• Full counting statistics</li><li>• Quantum computation</li></ul>	

1. A. Maiani, **R. Seoane Souto**, M. Leijnse, and K. Flensberg “Topological superconductivity in semiconductor-superconductor-magnetic insulator heterostructures” *Phys. Rev. B* **103** 104508 (2021)
2. **R. Seoane Souto**, D. Kuzmanovski, and A. V. Balatsky, “Signatures of odd-frequency pairing in the Josephson junction current noise” *Phys. Rev. Research* **2** 043193 (2020)
3. D. Kuzmanovski; **R. Seoane Souto**, and A. V. Balatsky, “Odd-frequency superconductivity near a magnetic impurity in a conventional superconductor” *Phys. Rev. B* **101** 094505 (2020)
4. **R. Seoane Souto**, K. Flensberg, and M. Leijnse, “Timescales for charge transfer based operations on Majorana systems” *Phys. Rev. B* **101** 081407 (Rapid communication) (2020)
5. R. Avriller, **R. Seoane Souto**, A. Martín-Rodero, and A. Levy Yeyati, “Build-up of Vibron-Mediated Electron Correlations in Molecular Junctions”. *Phys. Rev. B* **99** 121403 (Rapid communication) (2019)
6. **R. Seoane Souto**, R. Avriller, A. Levy Yeyati, and A. Martín-Rodero, “Transient dynamics in interacting nanojunctions within self-consistent perturbation theory”. *New J. Phys.* **20** 083039 (2018)
7. **R. Seoane Souto**, A. Martín-Rodero, and A. Levy Yeyati, “Quench dynamics in superconducting nanojunctions: Metastability and dynamical Yang-Lee zeros”. *Phys. Rev. B* **96** 165444 (2017)
8. **R. Seoane Souto**, A. Martín-Rodero, and A. Levy Yeyati, “Analysis of universality in transient dynamics of coherent electronic transport”. *Fortschr. Phys.* **65**, 1600062 (2017)
9. **R. Seoane Souto**, A. Martín-Rodero, and A. Levy Yeyati, “Andreev Bound States Formation and Quasiparticle Trapping in Quench Dynamics Revealed by Time-Dependent Counting Statistics”. *Phys. Rev. Lett.* **117** 267701 (2016)
10. **R. Seoane Souto**, R. Avriller, R. C. Monreal, A. Martín-Rodero, and A. Levy Yeyati, “Transient dynamics and waiting time distribution of molecular junctions in the polaronic regime”. *Phys. Rev. B* **92** 125435 (2015)
11. **R. Seoane Souto**, A. Levy Yeyati, A. Martín-Rodero, R. C. Monreal, “Dressed tunneling approximation for electronic transport through molecular transistors”. *Phys. Rev. B* **89** 085412 (2014)

PREPRINTS

1. D. Kuzmanovski, **R. Seoane Souto**, and A. V. Balatsky, “Persistent current noise in narrow Josephson junctions” arXiv:2101.07063

REFeree  
ACTIVITIES

Regular referee of journals of the American Physical Society, including Physical Review Letters, Physical Review B and Physical Review Research.

MONOGRAPHS

*Quench dynamics in interacting and superconducting nanojunctions.* 2020  
Springer Thesis series recognizing outstanding Ph.D. research. ISBN: 978-3-030-36594-3

PATENTS

Improved plano-convex lens projector, [ES2570808B1](#) 5/2016  
Participation on the invention and design: 50%

PARTICIPATION IN  
FUNDED  
PROJECTS

*2D hybrid materials as a platform for topological quantum computing.* 11/2018 to present  
Coordinator: Prof. Klaus Ensslin. P.I. at Lund university: Dr. Martin Leijnse  
Quantera project. Budget: 1,047,258 €

*Dynamics, superconductivity and topology in hybrid nanostructures.* 1/2017 - 10/2018  
Principal investigator: Prof. Alfredo Levy Yeyati.  
Granted by MINECO, FIS2017-84860-R. Budget: 157,300 €

*Interactions, topology and non-stationary effects in quantum transport.* 1/2014 - 1/2018

Principal investigator: Prof. Alfredo Levy Yeyati.  
 Granted by MINECO, FIS2014-55486-P. Budget: 48,400 €  
*Correlated electrons in hybrid nanostructures: from transport properties to quantum information processing.* 12/2013 - 12/2014  
 Principal investigator: Prof. Alfredo Levy Yeyati.  
 Granted by MINECO, FIS2011-26516. Budget: 47,000 €

AWARDED  
GRANTS AND  
FELLOWSHIPS

Research grants as principal investigator:  
 • Nanolund seedling project 1/2020 - 12/2020  
 Budget 100,000 SEK  
 Student grants:  
 • Predoctoral grant from the national research agency 1/2013 - 10/2016  
 21,500€ per year, including tuition fee  
 Department of theoretical condensed matter physics  
 Universidad Autónoma de Madrid  
 Supervisors: Prof. Alfredo Levy Yeyati and Prof. Álvaro Martín-Rodero  
 • MsC studentship (4,000 €) 1/2013 - 10/2016  
 Master's degree in condensed matter physics and nanotechnology  
 Universidad Autónoma de Madrid  
 • Summer research fellowship from the Ignacio Cirac program chair (2700€) 7/2012 - 9/2012  
 Quantum photonics with solids and atoms group  
 Institute of photonic sciences (ICFO)  
 Supervisor: Prof. Hugues de Riedmatten  
 • Spanish undergraduate research fellowship (2,700 €) 1/2012 - 7/2012  
 Theoretical physics department II, Universidad Complutense de Madrid  
 Supervisor: Dr. Rafael Hernández Redondo  
 Travel grants  
 • Lindau Nobel Laureate meeting, Lindau (Germany).  
 Granted by Ragnar Söderberg and Lindau Nobel Laureate Meeting foundations, 5500 €  
 • Workshop in bound states in superconductors and interfaces, Dresden (Germany)  
 Granted by Lunds Tekniska Högskola, 8664 SEK  
 • International school and symposium on nanoscale transport and photonics.  
 Granted by Nippon Telegraph and Telephone Corporation, 2600 €  
 Access to high-performance computational facilities granted by RES (Spanish supercomputing network).  
 • *Coherent control of Andreev bound states in superconducting quantum dots* 11/2016 - 4/2017  
 Estimated cost: 2571.75 €  
 Responsible of the project proposal, intermediate reports and justification.  
 • *Transient transport properties of superconducting quantum dots* 11/2015 - 11/2016  
 Estimated cost: 4572.00 €  
 Responsible of the project proposal, intermediate reports and justification.  
 • *Theoretical study of Majorana single-charge transistor using numerical renormalization group* 7/2015 - 11/2015  
 Estimated cost: 3817.62 €  
 Responsible of the project proposal, intermediate reports and justification.

AWARDS

• Seal of Excellence Certificate delivered by the European Commission 3/2021  
 For the project proposal: *Simulating transport and dynamics of non-local and non-abelian quasiparticles* (STONNES)  
 Horizon 2020's Marie Skłodowska-Curie actions call H2020-MSCA-IF-2019.  
 • Best question award 12/2020  
 SPICE-Workshop Coherent order and transport in spin-active systems. Cash prize 50 €.  
 • Junior Scientist Ideas Award 4/2020  
 Awarded by Nanolund

- Seal of Excellence Certificate delivered by the European Commission 3/2020  
For the project proposal: *Dynamical aspects of Majorana fermions out-of-equilibrium: non-local properties and quantum operations* (DYNAMO) Horizon 2020's Marie Skłodowska-Curie actions call H2020-MSCA-IF-2019.
- Springer Thesis award for outstanding Ph.D. research 8/2019  
Invitation to publish doctoral thesis in Springer Theses series. Cash prize 500 €.

#### Student awards

- Young researcher 1<sup>st</sup> prize in material science 12/2017  
Awarded by Instituto Nicolás Cabrera. Cash prize 400 €.
- Best student poster award 8/2016  
Awarded by the International Union of pure and applied Physics.  
33rd international conference on the physics of semiconductors, Beijing.  
Cash prize 2,500 ¥.
- Young researcher 2<sup>nd</sup> prize in material science 12/2015  
Awarded by Instituto Nicolás Cabrera. Cash prize 100 €.

#### PRESENTATIONS Oral presentations

- *Odd frequency superconductivity in quantum dot systems.* 28/9/2020  
Nanolund annual meeting, Lund (Sweden).
- *Revealing non-abelian statistics of Majorana states using charge-transfer operations.* 2/9/2020  
Meeting of the European Physical society, condensed matter division, GEFES (online presentation).
- *Time scales for charge-transfer based operations on Majorana systems.* 22/11/2019  
Entangled states of matter, CRC183, Berlin (Germany).
- *Time scales for charge-transfer based operations on Majorana systems.* 9/9/2019  
Q Rob workshop at Microsoft, Redmond (USA).
- *Quench Dynamics in superconducting nanojunctions: metastability and dynamical phase transitions.* 10/4/2019  
Workshop on Bound states in superconductors and interfaces
- *Quench Dynamics in superconducting nanojunctions.* 15/12/2017  
Nicolás Cabrera Young Research Meeting.
- *Quench dynamics in superconducting nanojunctions.* 15/11/2017  
International school and symposium on nanoscale transport and photonics.
- *Quench dynamics in superconducting nanojunctions: metastability and dynamical Yang-Lee zeros.* 2/8/2017  
Nanophysics, from fundamental to applications: reloaded.
- *Quench dynamics and counting statistics in interacting nanojunctions: quasi-particles trapping.* 20/9/2016  
10<sup>th</sup> RES (national supercomputing network) users conference.
- *Electronic Time Dependent Counting Statistics in interacting Nanojunctions.* 11/4/2016  
Nonequilibrium condensed matter and biological system.
- *Non-stationary and noise properties of molecular junctions in the polaronic regime.* 19/12/2015  
At Nicolás Cabrera Young Research Meeting.

#### Poster presentations

- *Optimal manipulation of Majorana bound states using quantum dots.* 12/1/2021  
Advances in Scalable Hardware Platforms for Quantum Computing (online).
- *Time scales for charge-transfer based operations on Majorana systems.* 6/11/2019  
Quantum life workshop, Copenhagen (Denmark).
- *Time scales of charge transfer based operations of a topological qubit.* 22/7/2019  
Summer School Nanotechnology meets Quantum Information, Donostia (Spain).
- *Quench dynamics in superconducting nanojunctions: Andreev bound states formation and dynamical phase transitions.* 30/6/2019 - 5/7/2019  
Poster displayed during the Lindau Nobel Laureate meeting, Lindau (Germany).
- *Quench dynamics in superconducting nanojunctions.* 25/7/2018  
International Conference on Superlattices, Nanostructures and Nanodevices.

- *Self-consistent dynamics in interacting nanojunctions: the fate of bistability.* 25/7/2018  
International Conference on Superlattices, Nanostructures and Nanodevices.
- *Transient dynamics and Full Counting statistics in superconducting nanojunctions.* 2/8/2015  
33<sup>rd</sup> International Conference on the Physics of Semiconductors.  
Poster awarded with the best poster award.
- *Non-stationary transport properties of molecular junctions in the polaronic regime.* 30/7/2015  
Frontiers of Quantum and Mesoscopic Thermodynamics.
- *Non-stationary transport properties of molecular junctions in the polaronic regime.* 3/6/2015  
Nano Electromechanical Systems and beyond.

#### Seminar presentations

- *Time scales for charge-transfer based operations on Majorana systems.* 23/6/2020  
Nordita, Stockholm (Sweden).
- *Odd-frequency superconductivity close to magnetic impurities.* 27/5/2020  
Lund university (Sweden).
- *Odd-frequency superconductivity close to magnetic impurities.* 17/4/2020  
Lund university (Sweden).
- *Time scales for charge-transfer based operations on Majorana systems.* 30/10/2019  
Niels Bohr institute, University of Copenhagen (Denmark).
- *Quench dynamics in interacting and superconducting nanojunctions.* 10/4/2019  
Nordita, Stockholm (Sweden).
- *Counting statistics revealing quasiparticle trapping in superconducting nanojunctions.* 30/1/2019  
Niels Bohr institute, University of Copenhagen (Denmark).
- *Counting statistics revealing dynamical phase transitions.* 16/11/2018  
Lund university (Sweden).
- *Quench dynamics in interacting and superconducting nanojunctions.* 25/7/2018  
Lund university (Sweden).
- *Quench dynamics in interacting and superconducting nanojunctions.* 9/7/2018  
Würzburg university (Germany).
- *Counting statistics in superconducting nanojunctions.* 13/12/2017  
Department of theoretical condensed matter physics, UAM.
- *Electronic time dependent counting statistics in interacting nanojunctions* 27/4/2016  
Department of theoretical condensed matter physics, UAM.
- *Inelastic effects in transport through molecular junctions* 11/3/2015  
Department of theoretical condensed matter physics, UAM.

#### Public engagement in science

- Farad student job fair, Lund (Sweden). 28/1/2020
- Forskar Grand Prix, Helsingborg (Sweden). 26/9/2019  
Short presentation to a young audience of about 200 high school students

#### INTERNATIONAL SCHOOLS

- Nanotechnology meets Quantum Information, San Sebastián. 22-26/7/2019
- Quantum transport in topological materials, Madrid. 4-8/9/2017
- Capri spring school on transport in nanostructures, Capri. 8-12/4/2013

#### SUPERVISION EXPERIENCE

##### Master theses direction

- Jakob Westerberg, To be defended early 2021  
Solid State Division, Lund University  
Co-directed with M. Leijnse
- Svend K. Møller, *Detecting Majorana Bound States.* 2020  
Center for Quantum Devices, Copenhagen University  
Co-directed with K. Flensberg

##### Bachelor theses direction

- Adrien Delpoux, *Tight-Binding models of Nanowires*. 2020  
 Université Toulouse III, Paul Sabatier  
 Co-directed with A. Tsintzis and M. Leijnse

TEACHING  
EXPERIENCE

Lund university.

- Theory of superconductivity, course for Ph.D. students. 6/12/2019  
 Guest lecture about topological superconductivity and Majorana fermions.

Universidad Autónoma de Madrid. Average evaluation 4.5/5 in internal performance assessments

- Experimental Techniques: Optics and Thermodynamics. Courses: 2016-2018  
 Third year course of the physics degree.  
 Responsible of the weekly practices, holding office hours and grading reports.

- Physics I. Courses: 2015-2018  
 Introductory Physics course for chemical engineers: Mechanics and thermodynamics  
 Responsible of the weekly homework sessions, holding office hours and grading problem sets.

- Laboratory of general physics. Courses: 2014-2017  
 Introductory Physics course, chemical degree.  
 Responsible of the weekly practices, holding office hours and grading reports.