

Rubén Seoane Souto

CONTACT INFORMATION	Trollebergsvägen 30b Lund, Sweden 22731	+34-600-546567 ruben.seoane_souto@ftf.lth.se
ACADEMIC POSITIONS	<p>Researcher 11/2020 to present Solid state division and Nanolund, Lund university, Visiting researcher at Center for Quantum Devices University of Copenhagen</p> <p>Postdoctoral researcher 11/2018 to 10/2020 Solid state division and Nanolund, Lund university, Visiting researcher at Center for Quantum Devices University of Copenhagen</p> <p>Teaching assistant (during the Ph.D. studies) 10/2016-10/2018 Department of theoretical condensed matter physics, Universidad Autónoma de Madrid</p> <p>Doctoral student 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	Laboratoire Ondes et Matière d'Aquitaine, CNRS 4/2016-7/2016 Université de Bordeaux Supervisor: Dr. Rémi Avriller	
EDUCATION	<p>Universidad Autónoma de Madrid, 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>Universidad Complutense de Madrid, Madrid, Spain</p> <p>Extended Bachelor in Physics (5 years degree), 7/2012</p> <ul style="list-style-type: none">• Undergraduate thesis: <i>Strong coupling correlation functions and semiclassical strings</i>• Supervisor: Rafael Hernández Redondo, Ph.D.• Topic: String theory	
RESEARCH INTERESTS	<ul style="list-style-type: none">• Quantum transport• Topological states of matter• Mesoscopic superconductivity• Full counting statistics• Quantum computation	

REFEREED
JOURNAL
PUBLICATIONS

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. S. Krøjer, **R. Seoane Souto**, and K. Flensberg, “Demonstrating Majorana nonabelian exchange using fast adiabatic charge-transfer” [arXiv:2107.11833](#)
2. D. Kuzmanovski, **R. Seoane Souto**, and A. V. Balatsky, “Persistent current noise in narrow Josephson junctions” [arXiv:2101.07063](#)
3. S. Vaitiekenas, **R. Seoane Souto**, Y. Liu, P. Krogstrup, K. Flensberg, M. Leijnse, C. M. Marcus, “Spin-polarized bound states in semiconductor-superconductor-ferromagnetic insulator islands” [arXiv:2104.01463](#)

REFeree
ACTIVITIES

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

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	<i>2D hybrid materials as a platform for topological quantum computing.</i>	11/2018 to present
	Coordinator: Prof. Klaus Ensslin. P.I. at Lund university: Dr. Martin Leijnse	
	Quanterra project. Budget: 1,047,258 €	
	<i>Dynamics, superconductivity and topology in hybrid nanostructures.</i>	1/2017 - 10/2018
	Principal investigator: Prof. Alfredo Levy Yeyati.	
	Granted by MINECO, FIS2017-84860-R. Budget: 157,300 €	
	<i>Interactions, topology and non-stationary effects in quantum transport.</i>	1/2014 - 1/2018
	Principal investigator: Prof. Alfredo Levy Yeyati.	
	Granted by MINECO, FIS2014-55486-P. Budget: 48,400 €	
	<i>Correlated electrons in hybrid nanostructures: from transport properties to quantum information processing.</i>	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).	
	• <i>Coherent control of Andreev bound states in superconducting quantum dots</i>	11/2016 - 4/2017
	Estimated cost: 2571.75 €	
	Responsible of the project proposal, intermediate reports and justification.	
	• <i>Transient transport properties of superconducting quantum dots</i>	11/2015 - 11/2016
	Estimated cost: 4572.00 €	
	Responsible of the project proposal, intermediate reports and justification.	
	• <i>Theoretical study of Majorana single-charge transistor using numerical renormalization group</i>	7/2015 - 11/2015
	Estimated cost: 3817.62 €	
	Responsible of the project proposal, intermediate reports and justification.	

AWARDS	<ul style="list-style-type: none"> Seal of Excellence Certificate delivered by the European Commission 3/2021 For the project proposal: <i>Simulating transport and dynamics of non-local and non-abelian quasiparticles</i> (STONNES) Horizon 2020's Marie Skłodowska-Curie actions call H2020-MSCA-IF-2020.
	<ul style="list-style-type: none"> Best question award 12/2020 SPICE-Workshop Coherent order and transport in spin-active systems. Cash prize 50 €.
	<ul style="list-style-type: none"> Junior Scientist Ideas Award 4/2020 Awarded by Nanolund
	<ul style="list-style-type: none"> Seal of Excellence Certificate delivered by the European Commission 3/2020 For the project proposal: <i>Dynamical aspects of Majorana fermions out-of-equilibrium: non-local properties and quantum operations</i> (DYNAMO) Horizon 2020's Marie Skłodowska-Curie actions call H2020-MSCA-IF-2019.
	<ul style="list-style-type: none"> Springer Thesis award for outstanding Ph.D. research 8/2019 Invitation to publish doctoral thesis in Springer Theses series. Cash prize 500 €.
	Student awards
	<ul style="list-style-type: none"> Young researcher 1st prize in material science 12/2017 Awarded by Instituto Nicolás Cabrera. Cash prize 400 €.
	<ul style="list-style-type: none"> 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 ¥.
	<ul style="list-style-type: none"> Young researcher 2nd prize in material science 12/2015 Awarded by Instituto Nicolás Cabrera. Cash prize 100 €.
SUPERVISION	Master theses direction
EXPERIENCE	<ul style="list-style-type: none"> Jakob Westerberg, <i>Theory of Time-Dependent Transport and Levitons in Nanowires</i> 23/4/2021 Solid State Division, Lund University Co-directed with M. Leijnse
	<ul style="list-style-type: none"> Svend K. Møller, <i>Detecting Majorana Bound States</i>. 27/8/2020 Center for Quantum Devices, Copenhagen University Co-directed with K. Flensberg
	Bachelor theses direction
	<ul style="list-style-type: none"> Adrien Delpoux, <i>Tight-Binding models of Nanowires</i>. 4/6/2020 Université Toulouse III, Paul Sabatier Co-directed with A. Tsintzis and M. Leijnse
TEACHING	Lund university.
EXPERIENCE	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> 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.
	<ul style="list-style-type: none"> 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.
	<ul style="list-style-type: none"> Laboratory of general physics. Courses: 2014-2017 Introductory Physics course, chemical degree. Responsible of the weekly practices, holding office hours and grading reports.

PRESENTATIONS Oral presentations

- *Charge-transfer based operations revealing non-abelian statistics of Majorana bound states.* 15/3/2021
APS March meeting (online).
- *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
10th 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
33rd 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

- *Quantum transport in topological superconductors: role of non-abelian quasiparticles.* 16/6/2021
Aachen University (Germany).
- *Dynamics of magnetic impurities coupled to superconductors.* 12/5/2021
Niels Bohr institute, University of Copenhagen (Denmark).

- *Spin-polarized bound states in semiconductor-superconductor-ferromagnetic insulator islands.* 16/2/2021
Autonomous University of Madrid (Spain).
- *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
Autonomous University of Madrid (Spain).
- *Electronic time dependent counting statistics in interacting nanojunctions* 27/4/2016
Autonomous University of Madrid (Spain).
- *Inelastic effects in transport through molecular junctions* 11/3/2015
Autonomous University of Madrid (Spain).

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