

Esteban A. Rodríguez Mena

Theoretical Physicist

🎓 Google Scholar - Esteban A. Rodríguez-Mena github.com/estebanrodriguezmena
in [linkedin.com/in/esteban-rodriguez-mena](https://www.linkedin.com/in/esteban-rodriguez-mena) <https://estebanrodriguezmena.github.io>
☎ +33 0650978691 / +56 972611946 @ estebanarodriguezm@gmail.com
📍 38000 Grenoble, France

I am a condensed matter physics researcher, currently working as a postdoc at the French Alternative Energies and Atomic Energy Commission (CEA) in Grenoble. I received my PhD in Physics from the Universidad de Chile, in the Faculty of Physical and Mathematical Sciences (FCFM) in Santiago, Chile, under the supervision of Prof. Dr. Luis E. F. Foa Torres in 2021.

My doctoral research focused on the interplay between driven systems and topological phenomena in two-dimensional quantum systems. My current research interests lie in the theoretical and numerical modeling of solid-state devices for electronic applications and, more recently, in the design of quantum computing-capable architectures—particularly semiconductor spin qubits.

Personal Data

Full name	Esteban Alonso Rodríguez Mena
Date of birth	November 6th, 1993
Citizenship	Chilean
Office address	Commissariat à l'énergie atomique et aux énergies alternatives (CEA) - Grenoble. 17, avenue des Martyrs, Grenoble - France

Present Position

February 2022 to date	Ingénieur Chercheur (Postdoctoral Researcher), CEA, Grenoble, France > Topic: "Modeling of silicon/germanium spin qubits" > Principal Investigator: Yann-Michel Niquet > Theory and numerical modeling of silicon/germanium spin quantum bits: study of structural and electronic properties of Si/SiGe and Ge/SiGe dots. Manipulation and benchmarking for both electron and hole spin qubits. > Expected end of contract: September 2026.
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Education

2012 - 2016	Bachelor of Science in Physics. Facultad de Ciencias Físicas y Matemáticas (FCFM - DFI), Universidad de Chile, Santiago, Chile
2017 - 2021	PhD in Physics. Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile (FCFM - DFI), Santiago, Chile

Former research experience

December 2015 to January 2016	Research work, DFI-FCFM, Universidad de Chile, Santiago, Chile Title: <i>Renormalization of density fluctuations on disordered media</i> Introductory research work for undergraduate students. Determination of the behavior of density waves on granular media. Numerical solution to stochastic partial differential equations which define the dynamics. Principal Investigators: Rodrigo Soto and Néstor Sepúlveda.
December 2016 to August 2016	Research work, DFI-FCFM, Universidad de Chile, Santiago, Chile Title: <i>Topological insulators and new phases induced by light</i> Introductory research work for undergraduate students. Introduction to the main features of Floquet topological insulators in the case of irradiated graphene. Numerical study of spectral properties of Floquet topological insulators. Principal Investigator: Luis Foa Torres.
August 2020 to November 2020	Doctoral Internship, Budapest University of Technology and Economics, Budapest, Hungary International internship for national PhD candidates sponsored by <i>Agencia Nacional de Investigación y Desarrollo</i> (ANID, Chile). Research work studying quantum walks and its topological features and properties of quantum transport related to Floquet topological phases. Numerical studies of spectral properties of higher Chern number quantum walks and exclusive topological phenomena of driven systems. Principal Investigator: János Asbóth.

March 2017	PhD Student, DFI-FCFM, Universidad de Chile, Santiago, Chile
December 2021	Program of doctoral studies sponsored by <i>Agencia Nacional de Investigación y Desarrollo</i> (ANID, Chile). Topological states in quantum matter (mainly 2D materials) induced by periodically driven potentials. Study of topological signatures measuring by numerical means their quantum transport properties: Hall conductance and current fluctuations in Floquet systems. Principal Investigator: Luis E. F. Foa Torres.

Supervision of Junior Researchers

February 2024	Ahmad Fouad Kalo, IRIG/MEM-LSim, CEA Grenoble, Grenoble, France
July 2024	(Master 2 thesis) Title: <i>Modeling the spin-photon coupling in double quantum dot germanium hole spin qubits</i> Realistic numerical modeling of double quantum dots in germanium and their potential applications for spin-photon coupling.

Reviewing Activities

Since 2024	Referee, Physical Review B, Condensed Matter Physics and Materials
Since 2025	Referee, Physical Review Applied, Applied Science
Since 2025	Referee, Physical Review Letters,

Publications

2019	Topological Signatures in Quantum Transport in Anomalous Floquet-Anderson Insulators , Phys. Rev. B 100 , 195429, Esteban A. Rodríguez Mena and Luis E. F. Foa Torres
2021	Spin-Polarized Tunable Photocurrents , Nano Lett. 21 , 3177, Matías Berdakin*, Esteban A. Rodríguez Mena* and Luis E. F. Foa Torres *These two authors contributed equally.
2022	Hole spin manipulation in inhomogeneous and nonseparable electric fields , Physical Review B 106 , 235426, Biel Martinez*, José Carlos Abadillo-Uriel*, Esteban A. Rodríguez-Mena*, and Yann-Michel Niquet *These three authors contributed equally.
2023	Hole spin driving by strain-induced spin-orbit interactions , Physical Review Letters, 131 , 097002, José Carlos Abadillo-Uriel, Esteban A. Rodríguez-Mena, Biel Martinez and Yann-Michel Niquet
2023	Linear-in-momentum spin orbit interactions in planar Ge/GeSi heterostructures and spin qubits , Physical Review B 108 , 205416, Esteban A. Rodríguez-Mena, José Carlos Abadillo-Uriel, Gaëtan Veste, Biel Martinez, Jing Li, Benoît Sklénard and Yann-Michel Niquet
2024	Geometry of the dephasing sweet spots of spin-orbit qubits , Physical Review B 109 , 155406, Lorenzo Mauro*, Esteban A. Rodríguez-Mena*, Marion Bassi, Vivien Schmitt and Yann-Michel Niquet *These two authors contributed equally.
2024	Optimal operation of hole spin qubits , arXiv: 2412.13069, Marion Bassi, Esteban A. Rodríguez-Mena, Boris Brun, Simon Zihlmann, Thahn Nguyen, Victor Champain, José Carlos Abadillo-Uriel, Benoît Bertrand, Heimanu Niebojewski, Romain Maurand, Yann-Michel Niquet, Xavier Jehl, Silvano De Franceschi and Vivien Schmitt

2024	A two-dimensional 10-qubit array in germanium with robust and localised qubit control, arXiv: 2412.13069, Valentin John, Cécile X. Yu, Barnaby van Straaten, Esteban A. Rodríguez-Mena , Mauricio Rodríguez, Stefan Oosterhout, Lucas E. A. Stehouwer, Giordano Scapucci, Stefano Bosco, Maximilian Rimbach-Russ, Yann-Michel Niquet, Francesco Borsoi and Menno Veldhorst
2025	Unifying Floquet theory of longitudinal and dispersive readout, Physical Review Letters, 134, 037003, Alessandro Chessari, Esteban A. Rodríguez-Mena , José Carlos Abadillo-Uriel, Victor Champain, Simon Zihlmann, Romain Maurand, Yann-Michel Niquet and Michele Filippone
2025	Strain engineering in Ge/GeSi spin qubits heterostructures, Physical Review B, 23, 024057, Lorenzo Mauro, Esteban A. Rodríguez-Mena , Biel Martinez and Yann-Michel Niquet
2025	Dressed basis sets for the modeling of exchange interactions in double quantum dots, arXiv: 2504.18281, Mauricio J. Rodríguez, Esteban A. Rodríguez-Mena , Ahmad Fouad Kalo and Yann-Michel Niquet
2025	Hole spin in unstrained Germanium layers, arXiv: 2506.04977, Lorenzo Mauro, Mauricio J. Rodríguez, Esteban A. Rodríguez-Mena , and Yann-Michel Niquet
2025	Spin precession and laser-induced spin-polarized photocurrents, arXiv: 2507.06315, Esteban A. Rodríguez-Mena , Matías Berdakin, and Luis E. F. Foa Torres

Works Presented

January 2016	Renormalization of Density Fluctuations on Disordered Media Esteban A. Rodríguez Mena, Rodrigo Soto and Néstor Sepúlveda > Presented at Summer Research Tutoring 2016, DFI-FCFM, Universidad de Chile, Santiago, Chile. > Poster contribution.
December 2016	Topological Insulators and New Phases Induced by Light Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at final session on introduction to scientific research course, DFI-FCFM, Universidad de Chile, Santiago, Chile. > Oral contribution.
November 2018	Floquet-Anderson Topological Insulators Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at V National Congress on Nanotechnology, Núcleo Milenio MultiMat, Pucón, Chile. > Poster contribution.
January 2019	Multiterminal Transport in Floquet-Anderson Topological Insulators Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented X School for Nanostructures, Departamento de Física, Universidad Técnica Federico Santa María, Valparaíso, Chile. > Oral contribution.
June 2019	Topological Signatures in Quantum Transport in Anomalous Floquet-Anderson Insulators Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at Theoretical Condensed Matter Seminars, DFI-FCFM, Universidad de Chile, Santiago, Chile. > Oral contribution.
July 2019	Topological Signatures in Quantum Transport in Anomalous Floquet-Anderson Insulators Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at Majorana Meetings, Institute of Physics, Budapest University of Technology and Economics (BME), Budapest, Hungary. > Oral contribution.

October 2019	Topological Signatures in Quantum Transport in Anomalous Floquet-Anderson Insulators Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at 2D Materials: From Fundamentals to Spintronics, International Institute of Physics (IIP), Natal, Brazil. > Poster contribution.
October 2019	Topological States in Photonic Systems Rocío González, Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at 2D Materials: From Fundamentals to Spintronics, International Institute of Physics (IIP), Natal, Brazil. > Poster contribution.
December 2019	Topological Signatures in Quantum Transport in Anomalous Floquet-Anderson Insulators Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at 9th International Conference on Low Dimensional Structures and Devices, Núcleo Milenio MultiMat, Puerto Varas, Chile. > Poster contribution.
December 2019	Topological States in Photonic Systems Rocío González, Esteban A. Rodríguez Mena and L.E.F Foa Torres > Presented at 9th International Conference on Low Dimensional Structures and Devices, Núcleo Milenio MultiMat, Puerto Varas, Chile. > Poster contribution.
August 2020	Harnessing light to control spin, charge and valley currents in two-dimensional honeycomb materials Esteban A. Rodríguez Mena, Matias Berdakin and L.E.F Foa Torres > Presented at Theoretical Condensed Matter Seminars, DFI-FCFM, Universidad de Chile, Santiago, Chile. > Oral contribution.
September 2020	Harnessing light to control spin, charge and valley currents in two-dimensional honeycomb materials Esteban A. Rodríguez Mena, Matías Berdakin and L.E.F Foa Torres > Presented at Modern Trends in Topological Quantum Matter, Joint Conference of the Condensed Matter Divisions, Royal Spanish Physical Society and European Physics Society. > Oral contribution.
November 2021	Spin-Polarized Tunable Photocurrents Esteban A. Rodríguez Mena, Matías Berdakin and L.E.F Foa Torres > Virtual Graphene2021. > Oral contribution.
December 2021	Spin-Polarized Tunable Photocurrents Esteban A. Rodríguez Mena, Matías Berdakin and L.E.F Foa Torres > Quantum2021 Conference, Phantom Foundation, Bilbao, Spain. > Oral contribution.
January 2022	Spin-Polarized Tunable Photocurrents Esteban A. Rodríguez Mena, Matías Berdakin and L.E.F Foa Torres > Topological quantum matter: foundations and applications, held virtually by Universidad Nacional Autónoma de México, Mexico. > Oral contribution.
November 2022	Hole spin manipulation in inhomogeneous and non-separable electric fields Esteban A. Rodríguez Mena, Biel Martinez, José Carlos Abadillo-Uriel and Yann-Michel Niquet > Quantum Engineering, Fundamental Aspects to Applications (IQFA), Centre for Nanoscience and Nanotechnology (CNRS, Université Paris Saclay), Palaiseau, France. > Poster contribution.
March 2023	Hole spin manipulation in inhomogeneous and non-separable electric fields Esteban A. Rodríguez Mena, Biel Martinez, José Carlos Abadillo-Uriel and Yann-Michel Niquet > American Physical Society - March Meeting, Las Vegas, United States of America. > Oral contribution.

April 2023	Hole spin manipulation in inhomogeneous and non-separable electric fields Esteban A. Rodríguez Mena, Biel Martinez, José Carlos Abadillo-Uriel and Yann-Michel Niquet > Hybrid Quantum Technologies Workshop and Germanium Day, Institute of Science and Technology Austria (ISTA), Vienna, Austria. > Poster contribution.
July 2023	Manipulation of hole spin qubits in germanium heterostructures quantum dots Esteban A. Rodríguez Mena, Biel Martinez, José Carlos Abadillo-Uriel and Yann-Michel Niquet > Invited talk for the Theoretical and Computational Nanoscience Group, Institut Català i Nanotecnologia (ICN2), Universitat Autònoma de Barcelona (UBA), Barcelona, Spain. > Oral contribution.
May 2024	Geometry of the dephasing sweet spots of spin-orbit qubits Esteban A. Rodríguez Mena, Lorenzo Mauro, Marion Bassi, Vivien Schmitt and Yann-Michel Niquet > 2nd Canada-France Quantum Alliance International Research Network, University of Ottawa, Ottawa, Canada. > Oral contribution.
September 2024	Geometry of the dephasing sweet spots of spin-orbit qubits Esteban A. Rodríguez Mena, Marion Bassi, Boris Brun, Simon Zilhmman, Lorenzo Mauro, Jose Carlos Abadillo-Uriel, Benoit Bertrand, Heimanu Niebojewski, Romain Maurand, Yann-Michel Niquet, Xavier Xehl, Vivien Schmitt, Silvano de Franceschi > Present at Silicon Quantum Electronics Workshop (SiQEW 2024), Davos, Switzerland. > Oral contribution.
December 2024	Modeling of spin-orbit qubits Esteban A. Rodríguez Mena > Presented at Journée du MEM (Laboratoire de Modélisation et Exploration des Matériaux), Grenoble, France. > Oral contribution.
March 2025	Unifying Floquet theory of longitudinal and dispersive readout Esteban A. Rodríguez Mena, Alessandro Chessari, José Carlos Abadillo-Uriel, Victor Champain, Simon Zilhmman, Romain Maurand, Yann-Michel Niquet and Michele Filippone > Presented at Rencontres de Moriond 2025, La Thuile, Italy. > Oral contribution.
May 2025	Unifying Floquet theory of longitudinal and dispersive readout Esteban A. Rodríguez Mena, Alessandro Chessari, José Carlos Abadillo-Uriel, Victor Champain, Simon Zilhmman, Romain Maurand, Yann-Michel Niquet and Michele Filippone > Presented at QuantumMatter 2025, Grenoble, France. > Oral contribution.
May 2025	Unifying Floquet theory of longitudinal and dispersive readout Esteban A. Rodríguez Mena, Alessandro Chessari, José Carlos Abadillo-Uriel, Victor Champain, Simon Zilhmman, Romain Maurand, Yann-Michel Niquet and Michele Filippone > Present at 3rd Canada-France Quantum Alliance International Research Network, CNRS Institut Néel, Grenoble, France. > Poster contribution.
June 2025	Modeling of spin-orbit qubits Esteban A. Rodríguez Mena > Presented at NanoSeires Conference, Valencia, Spain. > Oral contribution.
September 2025	Unifying Floquet theory of longitudinal and dispersive readout Esteban A. Rodríguez Mena, Alessandro Chessari, José Carlos Abadillo-Uriel, Victor Champain, Simon Zilhmman, Romain Maurand, Yann-Michel Niquet and Michele Filippone > Presented at NEQ Seminar, Institut Néel, CNRS, Grenoble, France. > Oral contribution.
September 2025	Hole spin qubits in unstrained Germanium layers Esteban A. Rodríguez Mena, Lorenzo Mauro, Mauricio J. Rodríguez, Yann-Michel Niquet > Presented at Qtech'25, Hungarian Academy of Sciences, Budapest, Hungary. > Oral contribution.

October 2025	Hole spin qubits in unstrained Germanium layers Esteban A. Rodríguez Mena, Lorenzo Mauro, Mauricio J. Rodríguez, Yann-Michel Niquet > Presented at Silicon Quantum Electronics Workshop (SiQEW 2025), Los Angeles, United States of America. > Poster contribution.
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Other Events

October 2017	Quantum Fields, Condensed Matter and Information Theory, Balseiro Institute, CNEA, San Carlos de Bariloche, Argentina. > One month intensive course on theoretical physics > Taught by argentinian scientists of Balseiro Institute to graduate students of Argentina and Latin America.
February 2019	Advanced School on Ubiquitous Quantum Physics: the New Quantum Revolution, International Centre for Theoretical Physics, Trieste, Italy. > Topics on quantum coherence and entanglement, quantum information and simulation and quantum devices and machines.
March 2019	Workshop on Ubiquitous Quantum Physics: the New Quantum Revolution, International Centre for Theoretical Physics, Trieste, Italy. > Presentations on the last developments on quantum coherence and entanglement, quantum information and simulation and quantum devices and machines.
October 2019	2D Materials: From Fundamentals to Spintronics, International Institute of Physics, Natal, Brazil. > Presentations on the latest advances in methodology and techniques applied to the study of 2D materials and their relation to spintronics.

Teaching Experience

March 2014	Teaching assistant (as undergraduate student), DFI-FCFM, Universidad de Chile.
December 2016	> Taught in courses of: Classical mechanics (undergraduate level), thermodynamics and electromagnetism.
March 2017	Teaching assistant (as graduate student), DFI-FCFM, Universidad de Chile.
July 2020	> Taught in courses of: Quantum mechanics, Statistical mechanics, Classical mechanics (graduate level), Solid state physics, thermodynamics, quantum mechanics and colloquium from graphene to topological insulators.

Scholarships and Awards

2020	International internship doctoral grant, National Agency of Research and Development (ANID), Chile
2017 - 2021	Doctoral grant, National Committee of Scientific and Technological Research (CONICYT), Chile
2016	Outstanding undergraduate student, FCFM, Universidad de Chile

Languages and Skills

Languages	Spanish (native), English (fluent), French (upper-intermediate – fluent in informal contexts), Hungarian (elementary)
Computer skills	Python (Numpy, Matplotlib, scipy, sympy, dash/plotly, pandas, QTip, Kwant among others), Fortran90, C, bash, Linux/Windows, Latex.