SEBASTIÁN ALEJANDRO BERRÍOS CARVAJAL

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SUMMARY

Ph.D. student in Applied Physics at Rice University with a strong background in theoretical and computational physics. Experienced in mesoscale modeling and numerical simulations of lithium-ion batteries, with expertise in PDE-based modeling and phase-field methods. Passionate about bridging fundamental science with applied materials research, aiming to develop innovative solutions for energy storage technologies. Fulbright Scholar with ability to tackle complex scientific problems, collaborate across disciplines, and contribute to cutting-edge research in battery materials and energy systems.

HIGHER EDUCATION

Rice University *August 2024 - Today*
Applied Physics Ph. D. degree.

Pontificia Universidad Católica de Chile *March 2020 - November 2023*
Theoretical Physics Master degree.
Thesis title: From Momentum to Real Space: Investigating the Hofstadter Butterfly and Landau Levels in Hexagonal Lattices. Conferred with Maximum Distinction.

Pontificia Universidad Católica de Chile *January 2016 - December 2020*
Bachelor's degree in Physics. Conferred with Maximum Distinction.

RESEARCH EXPERIENCE

Graduate Research Assistant
December 2024 - Today

- Conducting mesoscale modeling of lithium-ion batteries, focusing on phase-field and P2D simulations to understand electrochemical and mechanical degradation mechanisms.
- Developing numerical simulations for electrode microstructure evolution and lithium transport using Python-based computational frameworks.
- Investigating the asymmetry between lithiation and delithiation processes in battery materials, analyzing its impact on battery performance and degradation.

The Anillo for Light-Matter Interactions in Topological Nanomaterials: Thesis student
July 2020 - December 2022

- Obtained numerical results for topological features in 2D lattices using KWANT package for PYTHON.
- Studied persistence of Hofstadter Butterfly pattern on a hexagonal lattice under random disorder in the Tight Binding approximation.
- Characterized the Landau Levels in hexagonal lattices in configuration space with open boundary conditions, and the persistence of this levels under disorder.

Undergraduate Practice: Research assistant
June - December 2020

- Reproduced results for Weyl Semimetals edge states programming a FORTRAN code for numerical estimations of the eigenvalues and eigenvectors for a given hamiltonian in Tight Binding approximation.
- Studied the formation and persistence of edge states in Weyl Semimetals and Kitaev Chain model under random disorder in the system.

Research Center for Nanotechnology and Advanced Materials: Research assistant
July - September 2020

· Characterized Fe/Ni core/shell nanorods and nanotubes mechanical properties like Young Modulus and Bulk Modulus using LAMMPS code for molecular dynamics.
· Published results of this work on Journal of Alloys and Compounds.

Plasma Laboratory UC: Laboratory assistant
January - June 2019

· Built a gas injector controller for the pulsed power generator of the Plasma UC group, designing and assembling the printed circuit board.

TEACHING EXPERIENCE

- **MSNE 401/503 Thermodynamics for Material Science:** Teaching Assistant, Rice 2025-1.
- **FIZ0411 Statistical mechanics:** Teaching Assistant, PUC 2023-1.
- **Algebra Fundamentals:** Teaching Assistant, Military School 2022-Summer.
- **FIZ1431 Computational Physics:** Teaching Assistant, PUC 2021-1.
- **EM-ALG101 Algebra:** Teaching Assistant, Military School 2021-1, 2022-1.
- **MAT1620 Calculus II:** Teaching Assistant, PUC 2019-2.
- **FIS0152 Thermodynamics:** Laboratory Assistant, PUC 2018-1, 2019-1.
- **MAT1100 Calculus I:** Teaching Assistant, PUC 2017-2, 2018-2, 2020-1, 2021-1.
- **FIS109C Physics for Sciences:** Teaching Assistant, PUC 2017-1, 2023-2.

COURSES AND DIPLOMAS

Density Functional Theory, Institut Polythecnique de Paris, Coursera, 2021.

PUBLICATIONS

Structural stability, shape memory and mechanical properties of Fe/Ni core/shell nanorods.
`https://doi.org/10.1016/j.jallcom.2021.160206`

LANGUAGES

Spanish: Native proficiency.
English: Professional working proficiency.

SCOLARSHIPS

Fulbright-ANID BIO Doctoral Scolarship: Granted by ANID & the Fulbright-Chile Commission.

***Matrícula Facultades* Scolarship 2021 - 2022:** Partial tuition fee waiver, granted by the *Pontificia Universidad Católica de Chile* Physics Institute.

***Gratuidad* Scholarship 2016-2020:** Full tuition fee waiver, granted by Government of Chile.

EXTRA CURRICULAR

Fulbright Ring Member *August 2024 - Today*

· As a member of the Fulbright Ring at Rice University, I have actively organized events that foster cultural exchange and strengthen the Fulbright community. These initiatives provide a platform for scholars to share their academic experiences and cultural backgrounds, reinforcing the program's mission of mutual understanding. By coordinating networking events and social gatherings, I have contributed to building a supportive environment where international students can connect with each other and the local community, enhancing their exchange experience.

Graduate Physics Seminar Coordinator *August 2021 - December 2022*

· I was responsible for organizing Pizza Seminar, an instance where graduate students from different universities presents their research in front of colleagues who would discuss their results. The event concludes with free pizza for all attendants, and a present for the expositors.

Physics and Astronomy Student Body President *January 2018 - December 2018*

· I was responsible for keeping clear communication between students and university authorities. Also, we organized various events for the faculty students. For example, we organized weekly conferences, where physics and astronomy professors would come to the conferences and present their research topics to motivate students to join their groups.