Alberto Ruiz-Biestro

Physics Graduate Student

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Education

Present — **Ph.D. Physics & Astronomy**, *Rice University*

2020 – 2024 — **B.Sc. Engineering Physics**, *Monterrey Institute of Technology*.
GPA: 96.68/100
TOEFL iBT Score: 108.

Publications

1. **Alberto Ruiz-Biestro** and Julio C. Gutierrez-Vega.
"Solutions of the Lippmann-Schwinger equation for confocal parabolic billiards".
Phys. Rev. E., Mar 2024. doi:10.1103/PhysRevE.109.034203.

Conference Presentations

2. **Mexican Optics and Photonics Meeting**. Poster presentation.
"Lippmann-Schwinger equation in parabolic geometries". Nov 2023.
1. **National Space Activity Congress** (CONACES). "Raman spectrometer design for biosignature detection" (virtual). Nov 2021.

Awards

Apr 2023 — **Best Team Project**. *International Centre for Theoretical Physics* & *Quantinuum*
Trieste, Italy. 2nd place in the quantum hackathon.

Aug 2020 — **Academic Merit Scholarship**, *Monterrey Institute of Technology*.

Skills

Numerical — Proficient in **Julia**, **MATLAB**, **Python**, and **Linux**. Proven skills in Mathematica, Bash and **Git**.

Experimental — Experimental optics. Bruker X-ray diffractometer D2 Phaser and related software, FTIR, UV-VIS.

Soft skills — Analytical thinking, problem solving, collaboration, scientific communication.

Teaching Experience

Aug 2023 – Dec 2023 — **Course assistant for Mathematical Methods for Physics**.
Graded homework and exams; held weekly advisory sessions.

Aug 2022 – Jun 2023 — **Course assistant for Modern Electrodynamics**.
Graded homework and exams; held weekly advisory sessions.

Leadership

2022 – 2023 — **Quantum Computing Club** co-founder and VP.

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- Organization of seminars, including one with Dr. Benjamín Perez-García on the implementation of Deutsch's algorithm with linear optics.
- Organization and construction of a variety of courses that gave undergraduate students tools to program and analyze quantum algorithms.
- Active participation in the organization of my institution's first **quantum hackathon**. Helped with dissemination and spreading the invitation to external faculty and students.
- Coordinated and teaching of workshops in colaboration with the *Physics Student Society* (AEF in Spanish) from Nuevo-Leon's Autonomous University (UANL).
- Organization, planning, and direction of quantum computing bootcamps, offering intensive courses to students from ITESM as well as from other universities.
- Our outreach has grown beyond the state of Nuevo León.

2023 SPIE Student Chapter President

2022 – 2023 Given talks and short courses on Julia, Python, and LaTeX.

Research Experience

Sep 2023 – Present **Photonics and Mathematical Optics Group**, *Monterrey, Mexico*
Advisors: Julio C. Gutierrez-Vega
Implemented a Boundary Integral Method for solving the Lippmann-Schwinger (scattering) Equation.
Development of meshes for discretization and parallel computation.
Advanced theoretical methods and mathematical formulations for analytic results.

Apr 2023 **International Centre for Theoretical Physics & Quantinuum**. *Trieste, Italy*
Advisor: Nathan Fitzpatrick (*Quantinuum*)

- Generated ground and excited state curves using a Quantum Krylov-subspace method along a reaction coordinate for an H_2 molecular Hamiltonian.
- Development of hybrid quantum-classical algorithms with TKET and the InQuanto quantum chemistry platform; aided team in setting up and using **Git** for version control.
- Collaborated with graduate students from diverse backgrounds. Our team received the *Best Team Project* award, along with second place.

Aug 2021 – Jun 2022 **Photonics and Mathematical Optics Group**, *Monterrey, Mexico*
Advisors: Dr. Antonio Ortiz-Ambriz Dr. Gerardo Fox Dr. Servando López

- Numerical simulation of the *Nonlinear Schrodinger Equation* through *pseudo-spectral method* (split-step Fourier) and numerical solutions of Boundary Value Problems (shooting method, finite differences, etc.).
- Developed audio-identification algorithm in order to identify an audio recording from a microphone (FFT and signal-processing methods).
- Analyzed the travelling-salesman-problem through simulated annealing; simulated the dynamics and critical points of the Lenz-Ising model.
- Developed **Genetic algorithms** and **Neural Networks**; Experience with **Agent Based Modeling**.

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