

ESTEBAN MARULANDA A.

Physicist

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EDUCATION

M.Sc. in Physics

University of São Paulo (USP) • GPA: 4.00/4.00

Aug 2024 – Present São Paulo, Brazil

- **Research focus:** terahertz time-domain spectroscopy (THz-TDS) to measure low-energy physical properties of quantum materials.
- **Selected courses:** Solid-State Physics I; Quantum Mechanics I–II; Topics in Computational Statistical Physics; Group Theory for Molecules and Solids; Statistical Mechanics – Phase Transitions and Critical Phenomena.

B.Sc. in Physics

University of Antioquia • GPA: 4.48/5.00

Feb 2017 – Jun 2023 Medellín, Colombia

- **Program workload (credit clarification):** 5-year program, 162 institutional credits. One credit equals 48 hours of student-workload (total $\approx 7,776$ hours), which corresponds to ≈ 260 – 310 ECTS by workload (25–30 h/ECTS).
- **Selected courses – Optics & Photonics:** Nonlinear Optics; Photonics; Fourier Optics & Optical Information Processing; Experimental Optics.
- **Quantum:** Quantum Theory of Radiation; Atomic & Molecular Physics.
- **Condensed Matter:** Physics of Heterostructures; Solid-State Physics.

Undergraduate thesis: *Experimental parameters' uncertainty limits for z-scan and f-scan techniques.*

SPECIALIZED COURSES & SCHOOLS

- **ICTP Courses:** Quantum Field Theory; Condensed-Matter Field Theory; General Relativity. (2024 - 2025) [Certificate]
- **10th International Symposium "Optics & its Applications"** (2022): Talks and tutorials across photonics, laser physics, and applications [Certificate].
- **Siegman International School on Lasers** (2021): One-week intensive on lasers and applications with academic/industry instructors [Certificate].
- **IBM x The Coding School – Intro to Quantum Computing** (2020) [Certificate].

ORAL PRESENTATIONS AT CONFERENCES

- *On the use of windowing of THz time-domain spectroscopy signals.* Autumn Meeting of the Brazilian Physical Society, Belém – Brazil, 2025. [Certificate]
- *Physical Interpretation of a Generated Class-Label Vector by GK-Means in Spectral Width and Mean Power Analysis of Supercontinuum.* XVIII National Meeting on Optics and the IX Andean and Caribbean Conference on Optics and its Applications, Cartagena – Colombia, 2024. [Certificate]
- *Simulation of Dual-Band Generation in a Mode-Locked Erbium-Doped Fiber Laser Based on Monolayer Graphene.* XVIII National Meeting on Optics and the IX Andean and Caribbean Conference on Optics and its Applications, Cartagena – Colombia, 2024. [Certificate]
- *Comparison among f-scan, z-scan, and p-scan techniques for measurement of two-photon absorption in semiconductors.* XVII ENO & VIII CANCOA, Remote, 2021. [Certificate]

PUBLISHED PAPERS

Windowing in terahertz time-domain spectroscopy: resolving resonances in thin-film samples.

Switchable dual-band generation of femtosecond pulses in a mode-locked Erbium-doped fiber laser based on monolayer graphene.

Measuring semiconductors two-photon absorption with a technique based on laser power variations.

Generalized Finite Differences Method Applied to Finite Photonic Crystal.

Correspondence Between the Energy Equipartition Theorem in Classical Mechanics and its Phase-Space Formulation in Quantum Mechanics.

JOURNAL PROJECTS

Influence of Initial Entangled States on the Temperature-Dependent CHSH Inequality.

Experimental parameters' uncertainty limits for z-scan and f-scan techniques.

RESEARCH EXPERIENCE

Theoretical and Computational Research

[See simulations on GitHub](#)

📅 2021 – Present

📍 Remote

- Simulations in Python of ultrafast laser dynamics, supercontinuum generation, laser cavities with saturable absorbers, and quantum confinement in condensed-matter systems.
- Algorithms & numerical methods: experimental data processing, model fitting, and parameter extraction from physical models.
- Experience computing TE/TM eigenmodes of the electromagnetic field in diverse geometries using **COMSOL Multiphysics**.
- Quantum thermodynamics and open systems: Theoretical experience with quantum-mechanical methods applied to open systems, including the use of the Lindblad master equation and non-Markovian approaches to study decoherence and thermodynamic processes.

Experimental Research

[Multiple labs](#)

📅 Mar 2021 – Present

- THz-TDS for quantum materials: operated transmission setup with cryostat; Python-based automation for acquisition/analysis.
- Implemented z-scan and f-scan to measure two-photon absorption in 2D materials; optical alignment/calibration (IR/visible); Python-based automation.

Research Internships

📅 2021 – 2024

📍 Medellín, Colombia

- **SIU, Medellín** — *Nonlinear Optics*. Project: Effects of the nonlinear properties of 2D materials in the construction and performance of ultrafast sources in the mid-infrared region. Supervisor: Edgar Alberto Rueda.
- **UdeA, Medellín** — *Nonlinear Optics*. Project: Design of an automated multispectral supercontinuum laser source in the infrared region based on monolayer graphene for engineering applications. Supervisor: Juan Diego Zapata.

Data Scientist (Python Developer)

📅 2023 – Present

📍 Remote

- Advanced Python developer with extensive project experience building reliable data/ML and scientific-computing pipelines, with strong emphasis on performance, automation, and testing.

Science Outreach & Community Service

[OPTICA & SPIE Student Chapters, Universidad de Antioquia](#)

📅 2020 – Dec 2024

📍 Colombia

- Former active member and **President** of the OPTICA Student Chapter (term ended Dec 2024).
- Organized seminars, hands-on workshops, and outreach events; coordinated speakers/volunteers and small budgets.

AWARDS

Award for distinction in research.

[Click to see information](#)

📅 11.2023

📍 Medellín, Colombia

The Medellín Investiga Awards honor the city's researchers' dedication, commitment, and passion

Bachelor's thesis: honorable mention

[Experimental parameters' Uncertainty limits for z-scan and f-scan techniques](#)

📅 03.07.2023

📍 Medellín

Contest: National mathematics olympiad

[Universidad Nacional - Click to see certification](#)

📅 08.2019

📍 Medellín, Colombia

Bronze medal

LANGUAGES

Spanish — Native

English — Advanced

Portuguese — Intermediate

German — Elementary

REFERENCES



Felix G. G. Hernandez (Associate professor at University of Sao Paulo)

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Carlos A. Rios Ocampo (Assistant Professor at University of Maryland, College Park.)

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Silvio R. A. Salinas (Associate professor at University of Sao Paulo)

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For all legal purposes, I certify that all the answers and information written down by me in this resume are true.