Miguel Ángel Jaramillo Quenguán

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Profile

I am an undergraduate physics student working in quantum optics and nonlinear spectroscopy, with research focused on the use of quantum light for spectroscopy. My current work involves developing a theoretical framework for coherent Raman spectroscopy with entangled photons, building upon Quantum Femtosecond Raman Spectroscopy and the principle of induced coherence in SU(1,1) interferometers. This approach seeks to overcome classical trade-offs between temporal and spectral resolution while enhancing resilience against noise, and is being advanced through analytical modeling and numerical simulations.
I have got strong background in quantum mechanics, electromagnetism, statistical mechanics, and quantum field theory, complemented by training in quantum information and quantum simulators. My technical skills include programming in C++, Python, with applications to numerical methods, data analysis, and machine learning.
Beyond my core research, I am motivated by the broader field of quantum technologies. I am particularly interested in quantum computing and in exploring its techniques, alongside quantum information and simulation approaches, can be used to design new strategies for encoding, processing, and extracting information.
I am motivated to expand my knowledge through collaborative research and to contribute to the development of quantum-enhanced technologies that connect fundamental science with practical applications.

Education

Institución Educativa "Sucre" 2019
Academic baccalaureate *Ipiales, Colombia*

- For having completed and passed the studies corresponding to the Academic Secondary Education Level, according to the Institutional Educational Project.

Cambridge Academy of English 2019
Proficiency in English *Ipiales, Colombia*

- **CERTIFIES GRADE** A In the examination for the Proficiency English Test-Intensity 1000 hours. CEFR (80% and above) / B2-C1 MCER

Universidad del Valle Expected June 2026
Bachelor of Science in Physics *Santiago de Cali, Colombia*

- **Relevant Coursework:** Machine Learning Methods, Quantum Mechanics, Quantum Simulators, low dimensional systems, Statistical Mechanics, Classical Mechanics, General relativity, Electromagnetic Theory, Quantum Field Theory.

Experience

Universidad Del Valle - QuanTIC Jul 2024 - current
Quantum technology, information and complexity research group member at Universidad del valle *Cali, Colombia*

- Developing theoretical frameworks and numerical simulations for coherent Raman spectroscopy with entangled photons, integrating quantum correlations and induced coherence to overcome classical limits of resolution and noise.

Academic Projects

Device for counting fringes in a Michelson–Morley interferometer | *Arduino IDE, MIT App Inventor.*

- Designed and implemented, using photoresistors, arduino and a bluetooth module, with suitable software implemented in a mobile app to control the counting device, allowing faster data acquisition at modern physics laboratory at the faculty of natural and exact sciences in Universidad del Valle.

Neural networks for solving differential equations | *PyTorch*

- Navier Stokes equation solved for the particular case of a driven cavity in two dimensions, with given boundary conditions.

Solution of electric fields by numerical resolution of Laplace's equation | *Numpy, matplotlib*

- Using relaxations methods the Laplace equation was solved in two dimensions for any discrete distribution of charge, founding the scalar potential and the vector field associated to two finite parallel wires .

Support Vector Classification with quantum kernels from variational circuits | *Qiskit*

- Exploration and implementation of quantum support vector machines (QSVM) using quantum feature maps and fidelity-based kernels, with Qiskit simulations that reproduce theoretical results and apply classification to benchmark datasets.

Solution of horizontal displacement of a slinky going downstairs | *Tracker Video Analysis and Modeling Tool, Mathematica*

- Taking experimental data through video of the movement of a slinky going down stairs considering a logistic like numerical simulation was performed.

Technical Skills

Programming: Experience in: Python, C++, Wolfram Mathematica, Matlab.
Research: Strong research and problem-solving skills.
Communication: Effective written and verbal communication skills.

Languages Proficiency

Spanish
Native language

English
Listening: Advanced.
Reading: Advanced.
Writing: Advanced.
Speaking: Intermediate.

French
Listening: Basic.
Reading: Intermediate.
Writing: basic.
Speaking: basic.

Certifications

Certificate of Attendance and participation | *School of Quantum Computing in Spanish* 23-27 Oct 2023

- In the framework of the Qiskit Fall Fest 2023, During this programme, topics from fundamental mathematical tools to quantum algorithms were covered, providing a comprehensive understanding of the principles and applications of quantum computing.

Advanced Lectures on Theoretical Physics and Mathematics: Quantum Information Theory Course 2024 | *The Abdus Salam International Centre for Theoretical Physics (ICTP) - PWF Physics Latam* March 11 - July 31 2024

- Covered topics including quantum channels, measurements, source coding, entanglement, quantum algorithms, and key protocols such as quantum teleportation. Lecturer: José Polo-Gómez

Colombian Physicists' Tournament 2025 - National Champion Universidad del Valle – Team Member | *Colombian section of the International Physicists' Tournament* 13-15 dec 2024

- Supported the university team in the national competition.
- Contributed to problem-solving and strategy development, leading to a championship win.

Extracurricular Activities

Universidad Del Valle 2023-Current

IPT Univalle team member

- collaboration in solving open physics problems to be presented in International Physicists' Tournament

Universidad Del Valle Jun-Dec 2024

Academic supporter at the Physics Documentation Center

- Provide academic support in Newtonian physics, thermodynamics, electromagnetism, as well as calculus and linear algebra to students of science and engineering.