

Lorenzo X. Van Muñoz

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MIT Physics Ph.D. student

Research Interests

Nanophotonics; Numerical methods; Optical conductivity

Education

2022 → Present Ph.D. in Physics, Massachusetts Institute of Technology (MIT)
Advisor: Steven G. Johnson; Division: Condensed matter theory
2018 → 2022 B.S. in Physics, California Institute of Technology (Caltech)
Academic Advisor: Gil Refael; Cumulative GPA: 3.88 (4.02) on 4.00 (4.33) scale

Research Experience

Summer 2022 *Summer Research Associate, CCQ, Flatiron Institute*
Project: Automatic and adaptive Brillouin zone integration
Contribution: Implemented high-order accurate integrators to compute optical conductivity for SrVO₃
Result: Created a Julia library and co-authored a paper on the method
Summer 2021 *S. G. Johnson Group, MIT; Mellon Mays Undergraduate Fellow*
Project: DeltaRCWA, a solver for electromagnetic scattering through sheet-like metasurfaces
Contribution: Derived and implemented scattering matrices, and explored nested iterative methods
Result: Created open-source solver with Julia
Summer 2020 *S. M. Troian Group, Caltech; Mellon Mays SURF Fellow*
Project: Influence of substrate curvature on dynamic cone formation in electrified liquids
Contribution: Simulated Larmor-Frenkel-Tonks instability in curved geometries and analyzed wavelets.
Result: Presented results of simulations at the Mellon Mays Undergraduate Fellowship Conference
Summer 2019 *N. S. Lewis Group, Caltech; Richard H. Cox SURF Fellow*
Project: Influence of substrates on the nucleation of phototropic Se-Te nanostructures
Contribution: Fabricated nanostructures in experimental apparatus and analyzed SEM data
Result: Co-authored paper on results and presented at Caltech SURF Seminar Day

Publications

2. J. Kaye, S. Beck, A. Barnett, L. Van Muñoz, and O. Parcollet, "Automatic, high-order, and adaptive algorithms for Brillouin zone integration," *SciPost Physics*, vol. 15, no. 2, p. 062, Aug. 2023. DOI: 10.21468/SciPostPhys.15.2.062.
1. E. Simonoff, L. X. Van Muñoz, and N. S. Lewis, "Increased spatial randomness and disorder of nucleates in dark-phase electrodeposition lead to increased spatial order and pattern fidelity in phototropically grown Se-Te electrodeposits," *Nanoscale*, vol. 12, no. 44, pp. 22 478–22 486, Nov. 2020. DOI: 10.1039/D0NR07617A.

Fellowships and Awards

2022 → Present MIT Dean of Science Fellowship
2022 → Present National Science Foundation Graduate Research Fellowship
2020 → 2022 Mellon Mays Undergraduate Fellowship

Conference presentations

- August 2023 ICIAM 2023; Invited talk; Algorithmic advances in computational quantum mechanics
Title: Efficient algorithms for Brillouin zone and frequency integration
Keywords: efficient quadratures, rational approximation, AAA
- March 2023 APS March Meeting; Contributed talk; DCOMP; Quantum embedding
Title: AutoBZ.jl: An Open-Source Library for Automatic and Adaptive Brillouin Zone Integration
Keywords: adaptive, high-order integration; DFT+DMFT; Wannier interpolation; optical conductivity

Teaching

- Fall 2021 *Ph 5, Analog Electronics for Physicists; Teaching Assistant*
Guided students one-on-one in lab with circuit design, construction, and testing
Inspired students to imagine and implement a circuit application for a final project
- Spring 2021 *PS/Ec 172, Game Theory; Teaching Assistant*
Taught students one-on-one in office hours about course concepts and graded assignments

Outreach and Volunteering

- 2023 → Present *MIT Graduate Student Union: Physics Contract Action Team*
Rallied the vote and informed workers during the contract fight
- 2018 → 2022 *Caltech Science Olympiad; Test Writer and Event Captain*
Translated event descriptions and presentations into Spanish for National Science Olympiad outreach
Wrote exams and supervised Sounds of Music event at regional, state, and national competitions
- 2018 → 2022 *Caltech Bike Lab; President*
Rebuilt the Caltech Bikeshare to provide free, sustainable transport for campus community
Maintained the campus bicycle workshop and gave free weekly bicycle repair lessons
- 2020 → 2022 *Caltech Physics Undergraduate Club; Secretary*
Developed and maintained club website and mailing lists for event outreach
- 2019 → 2020 *Lloyd House; Peer Advocate*
Trained and served as a resource for peer counseling and tea-time chats in undergraduate house

Technical Experience

- Languages Native fluency in Spanish
- Programming Proficient in Julia, Python
Coursework in Fortran, R, MATLAB
Other projects in Bash, JavaScript
- Software Competent with Git, Slurm, \LaTeX
Contributor to open source packages including Integrals.jl and QuadGK.jl
Previous experience with COMSOL, Mathematica, Stan

Clubs

- 2022 → Present *Caltech Gnome Club; Member*