Lorenzo X. Van Muñoz

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Research Interests

Nanophotonics; Numerical methods; Quantum materials

Education

$2022 \rightarrow Present$	Ph.D. in Physics, Massachusetts Institute of Technology (MIT)
	Advisor: Steven G. Johnson; Division: Condensed matter theory
$2018 \rightarrow 2022$	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

$2023 \rightarrow Present$	S. G. Johnson Group, MIT
Project: Free sp	ace optical beam cleaning using integrated photonics
Contribution: 1	Metasurface and vertical grating coupler inverse design with topology optimization
Result: High-p	erformance, ultra-compact, multi-modal free-space to chip receivers
Summer 2022	Summer Research Associate, CCQ, Flatiron Institute
Project: Autom	atic and adaptive Brillouin zone integration
Contribution: I	mplemented high-order accurate integrators to compute optical conductivity for SrVO ₃
Result: Created	l a Julia library and co-authored a paper on the method
Summer 2021	S. G. Johnson Group, MIT; Mellon Mays Undergraduate Fellow
Project: DeltaR	CWA, a solver for electromagnetic scattering through sheet-like metasurfaces
Contribution: I	Derived and implemented scattering matrices, and explored nested iterative methods
Result: Created	l open-source solver with Julia
Summer 2020	S. M. Troian Group, Caltech; Mellon Mays SURF Fellow
Project: Influer	ce of substrate curvature on dynamic cone formation in electrified liquids
Contribution: S	Simulated Larmor-Frenkel-Tonks instability in curved geometries and analyzed wavelets.
Result: Present	ed results of simulations at the Mellon Mays Undergraduate Fellowship Conference
Summer 2019	N. S. Lewis Group, Caltech; Richard H. Cox SURF Fellow
Project: Influer	ce of substrates on the nucleation of phototropic Se-Te nanostructures
Contribution: I	Fabricated nanostructures in experimental apparatus and analyzed SEM data
Result: Co-aut	nored 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. 15, 2023. DOI: 10.21468/SciPostPhys.15.2.062.
- 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. 22478–22486, Nov. 20, 2020. DOI: 10.1039/ D0NR07617A.

Preprints

1. L. Van Muñoz, J. Kaye, A. Barnett, and S. Beck. "High-order and adaptive optical conductivity calculations using Wannier interpolation." (Jun. 14, 2024), [Online]. Available: http://arxiv.org/abs/2406.15466.

Fellowships and Awards

$2022 \rightarrow Present$	MIT Dean of Science Fellowship
$2022 \rightarrow Present$	National Science Foundation Graduate Research Fellowship
$2020 \rightarrow 2022$	Mellon Mays Undergraduate Fellowship

Conference presentations

August 2023ICIAM 2023; Invited talk; Algorithmic advances in computational quantum mechanicsTitle: 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 stude	ents one-on-one in lab with circuit design, construction, and testing
Inspired stuc	lents 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

$2024 \rightarrow Present$	MIT Graduate Student Union: Physics Department Chief Steward
Organize issue o	ampaigns and assist graduate workers with problems in the workplace
2018 ightarrow 2022	Caltech Science Olympiad; Test Writer and Event Captain
Translated event	t descriptions and presentations into Spanish for National Science Olympiad outreach
Wrote exams and	d supervised Sounds of Music event at regional, state, and national competitions
2018 ightarrow 2022	Caltech Bike Lab; President
Rebuilt the Calte	ech Bikeshare to provide free, sustainable transport for campus community
Maintained the	campus bicycle workshop and gave free weekly bicycle repair lessons
2020 ightarrow 2022	Caltech Physics Undergraduate Club; Secretary
Developed and	maintained club website and mailing lists for event outreach

Technical Experience

Languages	Native fluency in Spanish
Programming	Proficient in Julia, Python
	Coursework in Fortran, R, MATLAB
Software	Competent with Git, Slurm, LATEX
	Author of AutoBZ.jl and contributor to QuadGK.jl, Integrals.jl, and SymmetryReduceBZ.jl

Clubs

$2022 \rightarrow Present$	Caltech Gnome Club; Member
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