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SUMMARY

I am a sixth year Physics Ph.D. student focusing on developing analytical methods and using tensor-network based numerics to study non-equilibrium and open quantum systems. These systems include both condensed matter systems such as electronic and magnetic materials which can realize non-equilibrium steady states with desirable properties through dissipative engineering, quantum information systems such as qubits which naturally undergo dissipation and decoherence induced by their environment, and cavity quantum materials with ultrastrong light-matter coupling.

EDUCATION

University of Pennsylvania (UPenn) *August 2021 - August 2027*
 Ph.D. in Physics, *as an NSF Graduate Research Fellow*
 M.S. in Physics, *conferred December 2022*
 Research Advisors: *Martin Claassen, Eugene Mele*

University of California: Los Angeles (UCLA) *June 2017 - June 2021*
 Bachelor of Science in Physics, *with Highest Honors*
 Bachelor of Science in Mathematics, *with the Specialization in Computation*
 Research Advisors: *Rahul Roy, HongWen Jiang*

PROFESSIONAL
EXPERIENCE

HRL Laboratories: Quantum Theory and Simulation Group *June 2024 - August 2024*
 Doctorate Intern, Quantum Computing *Malibu, CA*

- Conducted tensor-network based simulations of decoherence processes in quantum devices
- Integrated a [C++ library](#) backend into an existing Python-based workflow and software stack

PEER REVIEWED
PUBLICATIONS

- [9] **Spenser Talkington**, Debarghya Mallick, An-Hsi Chen, Benjamin F. Mead, Seong-Jun Yang, Cheol-Joo Kim, Shaffique Adam, Liang Wu, Matthew Brahlek, and Eugene J. Mele, *Weak localization and universal conductance fluctuations in large-area twisted bilayer graphene* [Physical Review B](#) **113**, 165430 (2026).
- [8] Benjamin Mead, **Spenser Talkington**, An-Hsi Chen, Debarghya Mallick, Zhaodong Chu, Xingyue Han, Seong-Jun Yang, Cheol-Joo Kim, Matthew Brahlek, Eugene Mele, and Liang Wu, *Terahertz Landau level spectroscopy of Dirac fermions in millimeter-scale twisted bilayer graphene*, [Physical Review B](#) **112**, 205116 (2025).
- [7] **Spenser Talkington** and Martin Claassen, *Linear and Non-Linear Response of Quadratic Lindbladians*, [npj Quantum Materials](#) **9**, 104 (2024).
- [6] Christophe De Beule, Steven Gassner, **Spenser Talkington**, and Eugene Mele, *Floquet-Bloch Theory for Nonperturbative Response to a Static Drive*, [Physical Review B](#) **109**, 235421 (2024).
- [5] **Spenser Talkington** and Eugene Mele, *Terahertz circular dichroism in commensurate twisted bilayer graphene*, [Physical Review B](#) **108**, 085421 (2023).
- [4] **Spenser Talkington** and Eugene Mele, *Electric field tunable band gap in commensurate twisted bilayer graphene*, [Physical Review B](#) **107**, L041408 (2023).
- [3] **Spenser Talkington** and Martin Claassen, *Dissipation-induced flat bands*, [Physical Review B](#) **106**, L161109 (2022).
- [2] David Bauer, **Spenser Talkington**, Fenner Harper, Bartholomew Andrews, and Rahul Roy, *Fractional Chern insulators with a non-Landau level continuum limit*, [Physical Review B](#) **105**, 045144 (2022).
- [1] **Spenser Talkington** and HongWen Jiang, *Efficient unitary method for simulation of driven quantum dot systems*, [Journal of Physics Communications](#) **4**, 055004 (2020).

- [4] **Spenser Talkington** and Eugene Mele, *Gyrotropy from Extrinsic Geometry in Twisted Materials* [arXiv:2607.15189 \(2026\)](#).
- [3] Benjamin Kass, **Spenser Talkington**, and Martin Claassen, *Polarization-Resolved Photon Statistics of Cavity Quantum Materials*, [arXiv:2606.11550 \(2026\)](#).
- [2] **Spenser Talkington**, Benjamin Kass, and Martin Claassen, *Ultrastrong Coupling Signatures in Photon Statistics from Terahertz Higgs-Polaritons*, [arXiv:2604.15417 \(2026\)](#).
- [1] Benjamin Kass, **Spenser Talkington**, Ajit Srivastava, and Martin Claassen, *Many-Body Photon Blockade and Quantum Light Generation from Cavity Quantum Materials*, [arXiv:2411.08964 \(2024\)](#).

- [17] *Polariton Bonanza: Light Coupling to Collective Matter Modes*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 30 Oct. 2025.
- [16] *Tensor Network Simulations of Open Quantum Systems*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 14 May 2024.
- [15] *Floquet Lindbladians?*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 30 Jan. 2024.
- [14] *Dissipation and Thermal States on a Quantum Computer*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 27 Nov. 2023.
- [13] *Symmetries of Lindbladians*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 9 Oct. 2023.
- [12] *Simulability of Dissipative Systems*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 14 Jun. 2023.
- [11] *Level Statistics of Thermalization and Many-Body Localization*
University of Pennsylvania, Physics 662 Final, Philadelphia Pennsylvania, 25 April 2023.
- [10] *Driving the Dark Space: Response of the Bloch Ness Monster*
UPenn Physics Visiting Day, Philadelphia Pennsylvania, 24 Mar. 2023.
- [9] *Magic Without a Twist: The Dark Space*
UPenn School of Arts & Sciences Grad Talks, Philadelphia Pennsylvania, 24 Feb. 2023.
- [8] *Quantum-Mania: Learning Quantum Mechanics from Marvel's Ant-Man*
Science Education Academy, Popular Science Talk, Philadelphia Pennsylvania, 18 Feb. 2023.
- [7] *Four Perspectives on Anderson Localization*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 12 Jan. 2023.
- [6] *Introduction to Keldysh Field Theory* (with Brandon Monsen)
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 16 Dec. 2023.
- [5] *Introduction to Fractons* (with Han Yan)
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 28 June 2022.
- [4] *Non-Abelian Fundamental Groups, the Second Homotopy Group, and Exact Sequences*
University of Pennsylvania, Topology Seminar, Philadelphia Pennsylvania, 20 June 2022.
- [3] *Continuum Field Theories for Fractons*
University of Pennsylvania, Physics 632 Final, Philadelphia Pennsylvania, 29 April 2022.
- [2] *Abelian Lattice Gauge Theories and Classical Electromagnetism* (with Brandon Monsen)
University of Pennsylvania, Physics 612 Final, Philadelphia Pennsylvania, 3 & 24 March 2022.
- [1] *Chern-Simons Theory of the Fractional Quantum Hall Effect*
University of Pennsylvania, Physics 601 Final, Philadelphia Pennsylvania, 14 December 2021.

- [24] *Terahertz Photonic Nonlinearity from Cavity Higgs Polaritons*
QUIEST Forum on Quantum Systems, Philadelphia Pennsylvania, 20 April 2026.
- [23] *Keldysh Approach to Input States for Cavity Quantum Materials*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 20 Aug 2025.
- [22] *Weak Localization and Universal Conductance Fluctuations in Twisted Bilayer Graphene*
EP2DS-26/MSS-22 Conference, St. Louis Missouri, 28 July 2025.
- [21] *Tensor Network Approaches to Nuclear Noise in Semiconducting Qubits*
QUIEST Quantum Seminar Series, Philadelphia Pennsylvania, 15 April 2025.
- [20] *Cavity quantum material correlations from Keldysh field theory*
APS March Meeting, Los Angeles California, 20 March 2025.
- [19] *Tensor Network Approaches to Nuclear Noise in Semiconducting Qubits*
University of Pennsylvania TI Group Meeting, Philadelphia Pennsylvania, 29 August 2024.
- [18] *Dissipative Engineering of Open Quantum Systems*
Thesis Proposal, Philadelphia Pennsylvania, 21 May 2024.
- [17] *Keldysh Input-Output Theory for Cavity Quantum Materials*
UPenn Physics Symposium, Philadelphia Pennsylvania, 6 May 2024.
- [16] *Probing Quantum Materials with Quantum Light*
QUIEST Forum on Quantum Systems, Philadelphia Pennsylvania, 3 May 2024.
- [15] *Keldysh Input-Output Theory for Cavity Quantum Materials*
Capri School on Non-Unitary Many-Body Quantum Dynamics, Capri Italy, 18 April 2024.
- [14] *Effective Action for Cavity Input-Output Theory*
University of Pennsylvania, Quantum CMT Meeting, Philadelphia Pennsylvania, 27 March 2024.
- [13] *Dynamic Response of Dissipative Spin Chains*
APS March Meeting, Minneapolis Minnesota, 5 March 2024.
- [12] *Dissipative Ising Models*
University of Pennsylvania TI Group Meeting, Philadelphia Pennsylvania, 30 August 2023.
- [11] *Linear and Non-Linear Optics of Lindbladian Systems*
Boulder School on Non-Equilibrium Quantum Dynamics, Boulder Colorado, 6 July 2023.
- [10] *Linear Response Theory of Fermionic Lindbladian Systems*
APS March Meeting, Las Vegas Nevada, 7 March 2023.
- [9] *Electric Field Tunable Band Gap in Commensurate Twisted Bilayer Graphene*
APS Mid-Atlantic Section Meeting, State College Pennsylvania, 2 December 2022.
- [8] *Long Lived Flat Bands in Fermionic Lindbladian Systems*
Topological Matter School, San Sebastián Spain, 24 August 2022.
- [7] *Dissipation Induced Flat Bands in Two Dimensions*
APS March Meeting, Chicago Illinois, 17 March 2022.
- [6] *Dissipation Induced Fermionic Flat Bands*
University of Pennsylvania TI Group Meeting, Philadelphia Pennsylvania, 10 March 2022.
- [5] *Electronic Localization-Length Transition in a “Zero-Quadratic” Model of Quantum Hall States*
UCLA Undergraduate Research Week, Los Angeles California (Remote), 25 May 2021.
- [4] *Localization in Two-Dimensional Trivial and Chern Insulators: Transfer Matrix Methods*
APS March Meeting, Denver Colorado (Remote), 2 March 2020.
- [3] *Efficient Unitary Method for Simulation of Driven Quantum Information Systems*
APS Far West Conference, Stanford California, 2 November 2019.
- [2] *Secondary Coherent Oscillations in Quantum Dot Systems*
UCLA Physics REU Symposium, Los Angeles California, 22 August 2019.
- [1] *Chern Numbers and Critical Exponents in Tight-Binding and Related Models*
UCLA Undergraduate Research Week, Los Angeles California, 21 May 2019.

TEACHING
EXPERIENCE

Teaching Assistant

UPenn Department of Physics and Astronomy, Mathematics

August 2022 - Present

- Spring 2026: Physics 518 – Introduction to Condensed Matter Physics
- Spring 2025: Physics 518 – Introduction to Condensed Matter Physics
- Spring 2024: Physics 518 – Introduction to Condensed Matter Physics
- Spring 2024: Math 312 – Linear Algebra
- Spring 2023: Math 312 – Linear Algebra
- Spring 2023: Physics 518 – Introduction to Condensed Matter Physics
- Fall 2022: Physics 141/151 – Principles of Physics II: Electromagnetism and Radiation
- Fall 2022: Math 312 – Linear Algebra

Peer Learning Facilitator, Physics

UCLA Academic Advancement Program

September 2019 - June 2021

- Guided students, and answered questions during six hours of problem solving sessions per week
- Developed worksheets, practice midterms/finals, and lead additional midterm review sessions
- Created and updated websites with session materials and solution sets, ex. [1B-S20](#), [1C-S21](#)
- Teaching schedule:
 - Fall 2020 - Spring 2021: Physics 1C – Electrodynamics, Optics, and Special Relativity
 - Fall 2019 - Spring 2020: Physics 1B – Oscillations, Waves, Electric and Magnetic Fields

SCIENTIFIC
OUTREACH

Elementary School Physics Lecturer

Science Education Academy - Philadelphia

January 2022 - February 2024

- Lead demonstrations and discussions of physics concepts with elementary school students

Graduate Student Mentor, Physics

University of Pennsylvania Department of Physics

August 2021 - May 2023

- Guided 3 students majoring in physics by discussing how to reach goals through course selection, involvement in organizations, participation in research, and applications for scholarships and jobs

Middle School Physics Lecturer

Marin School for Gifted Education

May 2020 - August 2021

- Prepared and lead weekly activities for seventh and eighth grade students on topics ranging from cosmology and fundamental particles to electronic circuits, biophysics, and semiconductors

SCIENTIFIC
SERVICE

Referee

- American Physical Society (APS) Journals
 - Physical Review B: Condensed Matter and Materials Physics (23 papers)
 - Physical Review Letters (12 papers)
 - Physical Review Materials (4 papers)
 - Physical Review A: AMO Physics and Quantum Information (2 papers)
 - Physical Review Research (2 papers)
 - Physical Review Applied (2 papers)
 - Physical Review X (1 paper)
- Institute of Physics (IOP) Journals (Recognized as an “outstanding reviewer”)
 - Journal of Physics: Condensed Matter (4 papers)
 - Physica Scripta (4 papers)
 - Other IOP Journals, including Rep. Prog. Phys. (7 papers)
- Other Journals (Springer-Nature, ACS, etc) (4 papers)

Reviewer

- UCLA Alumni Foundation Freshman Scholarship Applications (2022, 2023)
- UCLA Alumni Foundation Transfer Scholarship Applications (2022, 2023)
- UCLA True Bruin Distinguished Senior Award Scholarship Applications .. (2022, 2023, 2024)

Werner Teutsch Memorial Prize

September 2022

- “Awarded annually by the faculty of the Department of Physics at the University of Pennsylvania to the graduate student who shows the most promise for outstanding achievement in research.”

John F. Frazer Fellowship

February 2022

- One of two first-year physics graduate students at UPenn awarded a supplemental fellowship to “accelerate study toward the PhD degree” by enabling exclusive focus on research projects.

NSF Graduate Research Fellowship Program Fellowship

March 2021

- One of 2074 graduate students (18 in condensed matter physics) in the United States selected from a pool of over 13000 students to receive an NSF GRFP Fellowship, on the basis of “excellent intellectual merit and broader impacts.”
- “The NSF GRFP recognizes and supports outstanding graduate students in STEM disciplines who are pursuing research-based doctoral degrees at accredited US institutions.” (citation)

Goldwater Scholarship

March 2020

- One of 396 students (40 physics majors) in the United States selected from a pool of over 5000 students to receive a Goldwater Scholarship, on the basis of: “strong commitment to a research career in the natural sciences, mathematics, and engineering, effective display of intellectual intensity, and potential for a significant future contribution to research in his/her chosen field.”
- “The Goldwater Scholarship Program seeks to identify and support college sophomores and juniors who show exceptional promise of becoming this Nation’s next generation of research leaders in the natural sciences, engineering and mathematics.” (citation)

Clay Trust Physical Science Scholarship

February 2020

- Awarded for “strong academic record” and nomination for the Goldwater Scholarship by UCLA.
- “This award indicates confidence in the student’s potential to become a vital and contributing member of the physical sciences community during their undergraduate years.”

APS Helen Quinn Award

November 2019

- Awarded Best Undergraduate Research in Theoretical Physics for presenting, “*Efficient unitary method for simulation of driven quantum information systems*” at the APS Far West Conference.
- “Awarded each year [by the American Physical Society] to a student from California, Nevada or Hawaii for the outstanding work performed by the recipient.” (citation)

UCLA Library Prize for Undergraduate Research

May 2019

- Awarded First Prize in STEM for the research paper, “*Numerical determination of Chern numbers and critical exponents for Anderson localization in tight-binding and related models*”.
- “The UCLA Library Prize for Undergraduate Research recognizes and honors excellence in undergraduate research at UCLA.” (citation)

UCLA Undergraduate Research Fellows Program Scholarship

December 2018

- “This award indicates the College of Letters and Science’s confidence in the student’s academic record and their ability to engage in significant research endeavors.”

Outstanding Reviewer (Journal of Physics A - Math. and Theoretical)	Institute of Physics (U.K.)
Trusted Reviewer	Institute of Physics (U.K.)
Peer Learning Facilitator Recognition Award	UCLA Academic Advancement Program
Chancellor’s Service Award	UCLA Dean of Students
Highest Departmental Honors	UCLA Department of Physics and Astronomy
College Honors	UCLA College of Letters and Science
Latin Honors, Cum Laude	UCLA College of Letters and Science
UCLA Dean’s Honors List (<i>nine times</i>)	UCLA College of Letters and Science