Jacob L. Beckey

Curriculum Vitae

Univ. of Illinois, U-C
Dept. of Mathematics
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Highlights

Research

- Areas of interest: Mathematical aspects of entanglement theory and quantification, quantum statistical learning/testing, representation theoretic methods in quantum information, and quantum sensing
- 11 peer-reviewed publications, 3 pre-print article (Google Scholar Page)(Papers on arXiv)

Fellowships and Awards

- National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship
- Illinois Quantum Information Science and Technology Center Postdoctoral Fellowship
- U.S. Department of Energy – Office of Science Graduate Research Award
- National Science Foundation Graduate Research Fellowship
- Fulbright – University of Birmingham Postgraduate Award

Teaching and Outreach

- MATH416: Abstract Linear Algebra, Fall 2025
- MATH595: Quantum Learning Theory, Spring 2026 (upcoming)
- Co-founder & Vice President of the Idealized Science Institute, a STEM education non-profit
- Co-founder & Lead of the Central Illinois Math Teacher Circle

Employment

Postdoctoral Fellow, Univerity of Illinois, Urbana-Champaign 2024-Present

NSF Mathematical Sciences Research and IQUIST Postdoctoral Fellow. Supervisor: Felix Leditzky.

Education

University of Colorado, Boulder, Boulder, CO 2019-2024

M.S. Physics (May 2022), Ph.D. Physics (May 2024)

- **Advisor:** Graeme Smith
- **Thesis:** *Theoretical Tools for Quantum Sensor Optimization & Entanglement Quantification*

University of Birmingham, Birmingham, UK 2018-2019

Master of Research, Translational Quantum Technology

- **Advisors:** Haixing Miao and Vincent Boyer
- **Thesis:** *Broadband Quantum Noise Reduction in Future Long Baseline Gravitational-wave Detectors via EPR Entanglement and The Quantum Limits of Beam Displacement Measurements*

Clarion University of Pennsylvania, Clarion, PA 2015-2018

B.S Physics and B.S. Mathematics

PUBLICATIONS (GOOGLE SCHOLAR PAGE) (PAPERS ON ARXIV)

"⋆" indicates the technical research mentorship of undergraduate student(s)

PEER-REVIEWED ARTICLES

[PP11] Tsai-Chen Lee, **Jacob L. Beckey**, Giacomo Marocco, and Daniel Carney. Impulse measurements enhanced with squeezed readout light. Phys. Rev. Research 7, 033041, Jul 2025

[PR10] ⋆ Luke Coffman, Akshay Seshadri, Graeme Smith, and **Jacob L. Beckey**. Local measurement strategies for multipartite entanglement quantification. Phys. Rev. A **110**, 012454, Jul 2024.

[PR9] **Jacob L. Beckey**, Gregory Pelegrí, Steph Foulds, Natalie J. Pearson. Multipartite entanglement measures via Bell basis measurements. Phys. Rev. A **107**, 062425, Jun 2023.

[PR8] Anthony M. Polloreno, **Jacob L. Beckey**, Joshua Levin, Ariel Shlosberg, James K. Thompson, Michael Foss-Feig, David Hayes, Graeme Smith. Opportunities and Limitations in Broadband Sensing. Phys. Rev. Applied 19, 014029, Jan 2023.

[PR7] E. Fradgley, C. French, L. Rushton, Y. Dieudonné, L. Harrison, **J. L. Beckey**, H. Miao, C. Gill, P.G. Petrov, V. Boyer. Quantum limits of position-sensitive photodiodes. Optics Express, Vol. 30, Issue 22, pp. 39374-39381 (2022).

[PR6] **Jacob L. Beckey**, Akira Sone, M. Cerezo, Patrick J. Coles. Variational Quantum Algorithm for Estimating the Quantum Fisher Information. Phys. Rev. Research 4, 013083, Feb 2022.

[PR5] Akira Sone, M. Cerezo, **Jacob L. Beckey**, Patrick J. Coles. A Generalized Measure of Quantum Fisher Information. Phys. Rev. A 104, 062602, Dec 2021.

[PP4] **Jacob L. Beckey**, N. Gigena, Patrick J. Coles, and M. Cerezo. Computable and operationally meaningful multipartite entanglement measures. Phys. Rev. Lett., 127:140501, Sept 2021.

[PR3] M. Cerezo, Akira Sone, **Jacob L. Beckey**, Patrick J. Coles. Sub-Quantum Fisher Information. Quantum Sci. Technol. 6 035008, Jun 2021.

[PR2] R. C. Pooser, N. Savino, E. Batson, **J. L. Beckey**, J. Garcia, and B. J. Lawrie. Truncated nonlinear interferometry for quantum-enhanced atomic force microscopy. Phys. Rev. Lett., 124:230504, Jun 2020.

[PR1] **Jacob L. Beckey**, Yiqiu Ma, Vincent Boyer, and Haixing Miao. Broadband quantum noise reduction in future long baseline gravitational-wave detectors via EPR entanglement. Phys. Rev. D, 100:083011, Oct 2019.

PRE-PRINT ARTICLES

[PP3] **Jacob Beckey**, Louis Schatzki, Luke Coffman, Ariel Shlosberg, and Felix Leditzky. Product testing with single-copy measurements. arXiv:2510.07820, Oct 2025.

[PP2] ⋆ Chris Vairogs, Akanksha Chablani, Hanyang Sha, Leo Leo, Abbie Vaughan-Lee, and **Jacob L. Beckey**. Localizing entanglement in high-dimensional states. arXiv:2510.08501, Oct 2025.

[PP1] **Jacob L. Beckey**, Daniel Carney, and Giacomo Marocco. Quantum measurements in fundamental physics: a user's manual. arXiv:2311.07270, Nov 2024. (Under Review at SciPost Physics Reviews)

PRESENTATIONS

INVITED TALKS

- Physics Department Colloquium, California State University – East Bay, Feb 2024
  - "Entanglement Quantification in Large Quantum Systems"
- QOQMS Group Seminar, University of Strathclyde, Jan 2022
  - "Controlled-SWAP Test and Entanglement Monotones"
- Quantum Light and Matter Group Seminar, Durham University, Jan 2022
  - "Controlled-SWAP Test and Entanglement Monotones"
- QuFITS Seminar, University of York, Jan 2022

  - "Controlled-SWAP Test and Entanglement Monotones"
- Quantum Information Group Seminar, Universitat Autònoma de Barcelona, Jan 2022
  - "Controlled-SWAP Test and Entanglement Monotones"
- Aliro Technologies Seminar, Feb 2021
  - "Near-term Quantum Algorithm for Quantum Sensor Evaluation"

Contributed Talks

- American Physical Society's March Meeting, 2021
  - "Near-term Quantum Algorithm for Quantum Sensor Evaluation"
- American Physical Society's March Meeting, 2016
  - "First-order Error Corrections in Introductory Physics Labs"

Posters

- Southwest Quantum Information and Technology (SQuInT), 2024
  - "Impulse measurements beyond the standard quantum limit"
- Theory of Quantum Computation, Cryptography, and Communication (TQC), 2023
  - "Local strategies for multipartite entanglement quantification"
- Quantum Information Processing (QIP), 2023
  - "Multipartite entanglement measures via Bell basis measurements"
- Quantum Information Processing (QIP), 2022
  - "Computable and operationally meaningful multipartite entanglement measures"
- Quantum Science Center's Postdoctoral and Graduate Student Association Inaugural Poster Session, 2021
  - "Near-term Quantum Algorithm for Quantum Sensor Evaluation"
- Quantum Information Processing (QIP), 2021
  - "Variational Quantum Algorithim for Quantum Sensor Evaluation"
- Les Houches Ecole des Physique Pre-doctoral School, 2019
  - "Broadband Quantum Noise Reduction in Einstein Telescope via EPR Entanglement"
- ORNL Summer Research Participant Poster Session, 2018
  - "Generalization of Interferometry and Beam Position Measurement Equivalence"
- American Astronomical Society's 231st Meeting, 2018
  - "Modeling Ponderomotive Squeezed Light in Gravitational-wave Interferometers"

Teaching

University of Illinois, Urbana-Champaign

Abstract Linear Algebra, MATH 416. Fall 2025
32 students; primarily math majors.

University of Colorado, Boulder

Introduction to Quantum Computing, PHYS/CSCI 3090. Spring 2022
75 students across physics, comp. sci, math, and engineering.

The Fundamentals of Scientific Inquiry, PHYS 1400. Fall 2022
18 students primarily under-represented in STEM.

Technical Supervision

Undergraduate students

Akanksha Chablani, Math and Computer Science; University of Illinois, Urbana-Champaign; Spring 2025- Present.

Abbie Lee-Vaughan-Lee, Math and Computer Science; University of Illinois, Urbana-Champaign; Spring 2025- Present.

Hanyang Sha, Math; University of Illinois, Urbana-Champaign; Spring 2025- Present.

Leo Lee, Math; University of Illinois, Urbana-Champaign; Spring 2025- Present.

Luke Coffman, Physics and Math; University of Colorado, Boulder; Fall 2022- Spring 2024.

Masters students

Yulie Arad, Computer Science; University of Illinois, Urbana-Champaign; Fall 2024-Present

Mayank Bhatia, Computer Science; Univ. of Illinois, Ubrana-Champaign; Fall 2024-Present

Fellowships and Awards

Title	Duration
National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship	2024-2027
Illinois Quantum Information Science and Technology Center Postdoctoral Fellowship	2024-2027
Figueroa Family Fellowship for Commitment to Diversity, Equity, and Inclusion	Spring 2024
CU Physics Award for TA Excellence	Spring 2023
U.S. DOE Office of Science Graduate Research Award (SCGSR)	Spring 2023
LANL Quantum Computing Summer School Fellowship	Summer 2020
NSF Graduate Research Fellowship	2019-2021
Fulbright - University of Birmingham Postgraduate Award	2018-2019
France-Allison Honors Scholarship	2017-2018
Clarion International Scholar Award	Summer 2017
William and Elizabeth Hart STEM Scholarship	2017-2018
Helen and Lawrence Smith STEM Scholarship	2017-2018
Clarion Honors Foundation Scholarship	2015-2018
Clarion Academic Scholarship	2015-2018
Board of Governors Full Tuition Scholarship	2015-2018
David C. Smith Honors Scholarship	2015-2018
Karl Sendler Freshman Physics Award	2015-2016

Academic Service

Committee Service

CUbit Education & Workforce Development Steering Committee, University of Colorado 2023-2024

Helping develop quantum education and workforce development initiatives across campus.

Referee Service

Journals: Quantum, European Physics Letters, Phys. Rev. A, Nature Physics, Nature Communications, Advanced Quantum Technologies

Conferences: Quantum Information Processing (QIP), Phys. Rev. A, Symposium on Theory of Computing (STOC), Computational Complexity Conference (CCC)

Schools and Workshops

Kavli Institute for Theoretical Physics, Santa Barbara, California 2023
New Directions in Quantum Metrology

University of Copenhagen, Copenhagen, Denmark 2023
QMath Masterclass: Quantum Learning Theory

University of Colorado, Boulder, Boulder, Colorado 2023
Meeting of the Simons Collaboration on Ultra-Quantum Matter

University of Illinois, Urbana-Champaign, Chicago, Illinois 2022
Quantitative Linear Algebra meets Quantum Info Theory II

Les Houches Ecole des Physique, Les Houches, France 2019
Light-matter interaction in dilute media and individual quantum systems

Outreach

Co-founder and Lead Facilitator, Central Illinois Math Teacher Circles 2025-Present
Champaign, IL

- Fostering a community of practice among pre- and in-service math teachers in Central Illinois through professional development meetings.

Co-founder and Vice President, Idealized Science Institute 2023-Present
Pittsburgh, PA

- Educational non-profit empowering physics educators across the country to engage in research-backed educational practices through educational videos, a podcast breaking down education research for in-service educators, and in-person professional development.

Mentor, Partnerships for Informal Science in the Community (PISEC) Fall 2023
Boulder, CO

- Guiding elementary students through informal, exploratory science activities weekly

Mentor, Graduate Association of Students in Physics (GASP) 2021-2024
Boulder, CO

- Closely mentoring graduate students to help them transition to graduate physics education and research. Running mentorship program as of May 2023.

Mentor, CU Prime 2019-Present
Boulder, CO

- Mentor undergraduate physics students on a monthly basis
- Mentored a small group of students in an introductory nature of science course (Fall 2019).