

# JACOB BECKEY

## CURRICULUM VITAE

University of Illinois Urbana-Champaign  
Department of Mathematics  
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## HIGHLIGHTS

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### 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

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### Postdoctoral Fellow, University of Illinois, Urbana-Champaign

2024-PRESENT

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

## EDUCATION

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### 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)

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“\*” 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](https://arxiv.org/abs/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](https://arxiv.org/abs/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](https://arxiv.org/abs/2311.07270), Nov 2024. (Under Review at SciPost Physics Reviews)

## PRESENTATIONS

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### 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 Algorithm 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

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### 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

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### 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, Urbana-Champaign; Fall 2024-Present

### FELLOWSHIPS AND AWARDS

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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

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#### Committee Service

**CUbIt Education & Workforce Development Steering Committee**, University of Colorado  
*Helping develop quantum education and workforce development initiatives across campus.*

2023-2024

#### 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

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**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

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**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).