

Huan Q. Bui

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Education

PhD in Experimental Atomic, Molecular, and Optical Physics
Massachusetts Institute of Technology 2021–

BA in Physics with Honors, Mathematics with Honors, and Statistics (minor)
Colby College (GPA: 4.18/4.30, class rank: 1/516) 2017–2021

- Honors Thesis in Physics (advisor: Charles Conover)
MOT-based lifetime measurements of $5P_{1/2}$ and $5P_{3/2}$ in ^{39}K
- Honors Thesis in Mathematics (advisor: Evan Randles)
A generalized polar-coordinate integration formula with applications in estimating oscillatory integrals and convolution powers of complex-valued functions on \mathbb{Z}^d

Summer school, Perimeter Institute for Theoretical Physics Jun 2020

Research Interests

Ultracold atom experiments, Mathematical physics

Research Experience

Undergraduate Researcher, Perimeter Institute for Theoretical Physics May 2020–Present
PI: Timothy Hsieh

Area(s): Quantum information, Condensed matter physics

- Variational simulation of non-trivial quantum states (QAOA-based, $O(L)$ time)
- Measurement-assisted algorithms as a candidate for sublinear depth simulation
- Found numerically that ground states of the quantum Ising model with nonuniform field and couplings can be simulated exactly by a depth $O(L)$ QAOA ansatz

Research Assistant, Colby College Dept. of Mathematics & Statistics Oct 2019–Present
PI: Evan Randles

Area(s): Applied mathematics, Analysis, ODEs

- Computed convolution powers & associated attractors that are highly oscillatory integrals and generated examples indicative of a new local limit theorem
- Constructed a generalized polar-coordinate integration formula with applications to sup-norm-type estimates of convolution powers of complex functions on \mathbb{Z}^d

Research Assistant, Joint Quantum Institute, College Park Summer 2019, Jan 2020
PI: Steven Rolston

Area(s): Experimental atomic physics

- Studied infinite-range interactions among ultracold Rb atoms trapped around an optical nanofiber via measuring their collective decay

Research Assistant, Colby College Dept. of Physics & Astronomy Nov 2017–Present
PI: Charles Conover

Area(s): Experimental atomic physics

- Precision measurements on ultracold ^{39}K in Rydberg states 2017–2019
- Lifetime measurement of $5P_{1/2}$ and $5P_{3/2}$ in ^{39}K 2019–

Teaching Experience

Teaching Assistant, Colby College Dept. of Physics & Astronomy Sep 2017–Present

- Current course: Thermodynamics and Statistical Mechanics
- Grade weekly problem sets
- Past courses: Quantum Mechanics; Electricity and Magnetism, 2×Modern Physics II, 2×Modern Physics I (relativity & early quantum physics), Introduction to Electricity-Magnetism & Optics, Introduction to Mechanics

Teaching Assistant, Colby College Dept. of Mathematics & Statistics

Sep 2018–Present

- Current course: Partial Differential Equations
- Grade problem sets & hold weekly TA sessions
- Past courses: 2×Linear Algebra, Ordinary Differential Equations

Mathematics & Physics Tutor, Colby College Deans of Studies

Sep 2018–May 2020

Publications/Preprint

1. **Huan Q. Bui**, Evan Randles (2021). *A generalized polar-coordinate integration formula with applications to the study of convolution powers of complex-valued functions on \mathbb{Z}^d* . [arXiv:2103.04161](#) (submitted to The Journal of Fourier Analysis and Applications)

Presentations

1. **Huan Q. Bui**, Evan Randles (2021), *A generalized polar-coordinate integration formula with applications to convolution powers and local (central) limit theorems* ([pdf](#)), Joint Mathematics Meetings
2. **Huan Q. Bui** (Jun 2020), *Measurement-assisted variational simulation of non-trivial quantum states* ([pdf](#)), Perimeter Institute Undergrad Intern Symposium
3. C. Conover, A. Hill, **HQ Bui** (May 2020), *Measurements of f -, g -, and h -state quantum defects in Rydberg states of potassium* ([abstract](#)), DAMOP 20
4. C. Conover, **HQ Bui** (May 2019), *Measurements of p -state fine structure and quantum defects for Rydberg states of potassium* ([abstract](#)), DAMOP 19
5. C. Conover, **HQ Bui** (May 2019), *Millimeter-wave precision spectroscopy of d - d transitions in ^{39}K Rydberg states* ([pdf](#)), DAMOP 19
6. **Huan Q. Bui** (May 2019), *Matrices in Quantum Computing: A 2-qubit entanglement circuit* ([pdf](#)), CLAS 2019
7. **Huan Q. Bui** (Jul 2018), *Precision measurement of potassium energy levels at highly excited states* ([pdf](#)), CUSRR 2018

Awards/Honors/Fundings

- Senior Prize in Physics and Astronomy, Colby College, 2021
- Sigma Pi Sigma NHS, 2021
- Williams A. Rogers Prize in Physics and Astronomy, Colby College, 2020
- Phi Beta Kappa, 2020
- Mu Sigma Rho, 2020
- Honorable Mention, COMAP Mathematical Contest in Modeling, 2020
- Linda K. Cotter Internship Fund, 2020
for Jan 2020 internship at the Joint Quantum Institute (JQI), College Park, MD
- Phi Beta Kappa Scholastic Achievement Award, 2019
- Julius Seelye Bixler Scholar, 2018, 2019, 2020
- Meritorious Winner (top 8% of 10,000 teams), COMAP Mathematical Contest in Modeling, 2019
- Dean's List, F'17, S'18, F'18, S'19, F'19, (S'20, F'20 – canceled due to COVID-19)

Projects

Personal Website/Archive, [huanqbui.com](#), Oct 2019–Present

Notes from class, independent readings, and research projects.

Classical Field Theory, Advisor: Robert Bluhm, Feb 2019–May 2020
Theoretical Aspects of Massive Gravity