# Huan Q. Bui

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## Education

*PhD in Experimental Atomic, Molecular, and Optical Physics*

*BA in Physics with Honors, BA in Mathematics with Honors*
Colby College, GPA: 4.18/4.30 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

Experimental Atomic Physics, 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

- 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