

# Huan Q. Bui

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## Education

**B.A., Colby College ('21), Waterville, ME**

Majors: Physics and Mathematics

Minor: Statistics

GPA: 4.17/4.30, Class rank: 1/560

**Summer school, Perimeter Institute for Theoretical Physics, June 2020**

Topics in Theoretical Physics: Quantum Information & Thermodynamics, Numerical Methods & Condensed Matter Physics, Path Integrals, Symmetries

**Relevant Coursework:** (\*) denotes "Independent Study"

- **Physics:** experimental atomic physics (thesis), quantum field theory\*, quantum information, massive gravity\*, classical field theory\*, quantum mechanics, general relativity, experimental soft matter physics, classical mechanics, E&M, thermo & statmech
- **Mathematics:** applied mathematics/analysis and ODE (thesis), functional analysis, real analysis, complex analysis, algebraic geometry, abstract algebra, matrix analysis, linear algebra, ordinary differential equations, partial differential equations, probability theory, vector calculus, honors calculus
- **Statistics:** mathematical statistics/statistical inference, statistical modeling, applied longitudinal data analysis

## Theses

**Honors in Physics, Colby College** (*in preparation*)

Advisor: Charles Conover

Title:

**Honors in Mathematics, Colby College** (*in preparation*)

Advisor: Evan Randles

Title:

## Research

**Undergraduate Researcher, Perimeter Institute for Theoretical Physics, May–Aug 2020**

- Area(s): Quantum information, Condensed matter physics
- Principal Investigator: Timothy Hsieh
- Quantum many-body physics on quantum hardware.
  - Studied variational simulation of non-trivial quantum states (QAOA-based,  $O(N)$  time)
  - Studied measurement-assisted algorithms as a candidate for sublinear depth simulation
  - Found numerically that ground states of the disordered 1D quantum Ising model can be simulated exactly by an  $L/2$ -depth QAOA ansatz.

**Research Assistant, Colby College Dept. of Mathematics & Statistics, Oct 2019–Present**

- Area(s): Applied mathematics, Analysis, ODEs
- Principal Investigator: Evan Randles
- Convolution powers of complex functions on  $\mathbb{Z}^d$  whose attractors involve oscillatory integrals.
  - Computed convolution powers & associated attractors that are highly oscillatory integrals and generated examples indicative of a new local limit theorem
  - Constructing surface-carried measures of level sets of polynomials associated with these attractors and studying the decay of their Fourier transform

**Research Assistant, Joint Quantum Institute, College Park, Summer 2019, Jan 2020**

- Area(s): Experimental atomic physics
- Principal investigator: Steven Rolston
- Studying infinite-range interactions and finding evidence of superradiance and super-superradiance between two Rb ensembles trapped around an optical nanofiber via measuring their collective decay.

**Research Assistant, Colby College Dept. of Physics & Astronomy, Nov 2017–Present**

- Area(s): Experimental atomic physics
- Principal Investigator: Charles Conover
- Precision measurements on ultracold  $^{39}\text{K}$  in Rydberg states, 2017-2019
- Lifetime measurements of ultracold  $4p\ ^{39}\text{K}$ , 2019–

**Conferences/  
Presentations**

**Perimeter Institute Undergrad Intern Symposium, July 2020**

Measurement-assisted variational simulation of non-trivial quantum states ([pdf](#))

**DAMOP 20, May 2020**

Measurements of  $f$ -,  $g$ -, and  $h$ -state quantum defects in Rydberg states of potassium

**DAMOP 19, May 2019**

Millimeter-wave precision spectroscopy of  $d$ - $d$  transitions in  $^{39}\text{K}$  Rydberg states ([pdf](#))

**CLAS 2019, May 2019**

Matrices in Quantum Computing: A 2-qubit entanglement circuit ([pdf](#))

**CUSRR 2018, Jul 2018**

Precision measurement of potassium energy levels at highly excited states ([pdf](#))

**Projects**

**Personal Website/Archive, GitHub, [huanqbui.com](http://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

**Awards/  
Honors/  
Fundings**

**Williams A. Rogers Prize in Physics and Astronomy, Colby College, May 2020**

**Phi Beta Kappa, April 2020**

**Mu Sigma Rho, April 2020**

**Honorable Mention, COMAP Mathematical Contest in Modeling, S'20**

**Linda K. Cotter Internship Fund, Jan 2020**

for Jan 2020 internship at the Joint Quantum Institute (JQI), College Park, MD

**Phi Beta Kappa Scholastic Achievement Award, Sep 2019**

**Julius Seelye Bixler Scholar, Sep 2018, Sep 2019**

**Meritorious Winner, COMAP Mathematical Contest in Modeling, S'19**

Top 8% out of more than 10,000 teams

**Dean's List, F'17, S'18, F'18, S'19, F'19, (S'20),**

## Teaching Assistantship

### Teaching Assistant, Colby College Dept. of Physics & Astronomy

- Current courses: Quantum Mechanics; Electricity and Magnetism
- Instructor: Kelly Patton, Dale Kocovski (resp.)
- Grade weekly problem sets
- Past courses: 2×Modern Physics II (quantum; instructor: Robert Bluhm), 2×Modern Physics I (relativity & early quantum; instructor: Duncan Tate), Introduction to Electricity-Magnetism & Optics (instructor: Charles Conover), Introduction to Mechanics (instructor: Jonathan McCoy)

### Teaching Assistant, Colby College Dept. of Mathematics & Statistics

- Current course: Linear Algebra
- Instructor: Leo Livshits
- Grade problem sets & hold weekly TA sessions
- Past courses: Linear Algebra (instructor: Otto Bretscher), Ordinary Differential Equations (instructor: Evan Randles)

### Mathematics & Physics Tutor, Colby College Deans of Studies

- Provide academic assistance through reviewing course material and solving problems

## Skills

**Physics experience:** quantum simulation, condensed matter physics, massive gravity, general relativity, optics, precision atomic spectroscopy, Ramsey spectroscopy, fabricating & polarization control in optical nanofibers, magneto-optical & optical dipole trapping, constructing external-cavity diode lasers & frequency-stabilizing electronics, programming arbitrary waveform generators, data acquisition & analysis, general relativity in Mathematica (**xACT**, **xPert**)

**Mathematics experience:** harmonic analysis (elementary), measure theory (elementary), real analysis, estimating highly oscillatory integrals, computing convolution powers of complex-valued functions on  $\mathbb{Z}^d$  in Python and MATLAB.

**Programming/Scripting Languages:** R, Python, MATLAB, Mathematica, HTML & CSS,  $\text{\LaTeX}$

**Softwares:** IGOR Pro, MATLAB, NI-MAX, PicoHarp & TimeHarp (photon-counting modules), MS Office, Adobe Illustrator, Adobe Lightroom

## Languages

English (fluent & primary), Vietnamese (native),

## Other Activities

Math Mentor, Colby Dept. of Mathematics & Statistics  
Colby Society of Physics Students, Photography, Ultimate Frisbee, Classical guitar

## References

[Professor Robert Bluhm](#)

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[Professor Charles Conover](#)

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[Professor Evan Randles](#)

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