

Andi Gu

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EDUCATION

Harvard University

Quantum Science and Engineering (PhD)

Cambridge, MA

August 2022 -

University of California, Berkeley

Bachelor of Arts in Computer Science and Physics; GPA: 4.0/4.0 (Highest Distinction)

Berkeley, CA

August 2018 - May 2022

Thesis: Black Box Hamiltonian Learning

RESEARCH EXPERIENCE

Quantum Computing Research Fellowship

Advised by Prof. Patrick Coles

Los Alamos National Lab, Los Alamos, NM

May 2021 - May 2022

- **Optimizers for variational hybrid quantum-classical algorithms:** Developed novel adaptive, shot frugal optimizer and demonstrated its success on a number of chemical structure problems (VQE)
- **Hamiltonian learning:** Ongoing work on methods to learn the parameters for the Hamiltonian of a black box physical system using quantum and classical machine learning techniques

Quantum Nanoelectronics Lab

Advised by Prof. Irfan Siddiqi

UC Berkeley, Berkeley, CA

September 2020 - Present

- **Noise mitigation:** Applying restricted Boltzmann machines and Monte Carlo techniques to build accurate estimators for operator expectation values and tested these noise mitigation techniques to demonstrate shot frugality on VQE for H_2 , LiH , and BeH_2

Supernova Cosmology Project

Advised by Prof. Saul Perlmutter and Prof. Xiaosheng Huang

Lawrence Berkeley National Lab, Berkeley, CA

August 2019 - Present

- **Strong gravitational lens detection:** Designed, implemented, and tested various deep neural network architectures for the identification of gravitational lenses
 - * Developed models with fewer parameters and better performance than current state of the art models, and applied these models to discover over 1500 new strong lens candidates.
 - * Applied methodologies for learning with class imbalances and sparse data, such as adaptive discriminative domain adaptation (ADDA), generative adversarial networks (GANs), and variational autoencoders (VAEs)
- **Fast bayesian inference for lens modeling:** Developed a novel modeling code in TensorFlow that achieved a 100-fold speed increase over existing codes, and introduced a novel technique for uncertainty estimation using variational inference and Hamiltonian Monte Carlo
 - * Successfully applied the lensing code to 12 lenses observed using the Hubble Space Telescope, achieving unprecedented modeling speed

Lee Teng Fellowship

Advised by Dr. Uli Wienands

Argonne National Lab, Chicago, IL

May - August 2020

- * **Beamline simulation:** Ran simulations of Argonne's 'Advanced Photon Source' (APS) to better understand behavior of high charge ($\sim 20nC$) particle beams
 - Developed a new workflow for the APS Upgrade team to run parallel simulations with varying parameter configurations
 - Analyzed simulation outputs to characterize necessary conditions for beam stability and high accelerator efficiency

PUBLICATIONS

1. **A. Gu**, X. Huang, W. Sheu, G. Aldering, A. S. Bolton, K. Boone, A. Dey, A. Filipp, E. Jullo, S. Perlmutter, D. Rubin, E. F. Schlafly, D. J. Schlegel, Y. Shu, and S. H. Suyu. "GIGA-Lens: Fast Bayesian Inference for Strong Gravitational Lens Modeling." [ArXiv:2202.07663](#) [Astro-Ph], Aug. 2021.
2. **A. Gu**, A. Lowe, P. Dub, P. Coles, and A. Arrasmith. "Adaptive Shot Allocation for Fast Convergence in Variational Quantum Algorithms." [ArXiv:2108.10434](#) [Quant-Ph], Aug. 2021.
3. J. Calvey, T. Berenc, A. Brill, L. Emery, T. Fors, **A. Gu**, K. Harkay, T. Madden, N. Sereno, and U. Wienands. "Plan for Operating the APS-Upgrade Booster with a Frequency Sweep", in Proc. IPAC'21, Campinas, SP, Brazil, May 2021, pp. 201-204. [doi:10.18429/JACoW-IPAC2021-MOPAB046](#)
4. X. Huang, C. Storfer, **A. Gu**, et al. "Discovering New Strong Gravitational Lenses in the DESI Legacy Imaging Surveys." The Astrophysical Journal, vol. 909, no. 1, Mar. 2021, p. 27. [doi:10.3847/1538-4357/abd62b](#)
5. **A. Gu** "A Method for Single-Image Identification of Graphene." URL <https://andigu.github.io/static/pdf/GrapheneIdentification.pdf>, Sep. 2019.

WORK EXPERIENCE

Phasecraft

Quantum Software Intern

Bristol, UK

May 2021 - August 2021

Received a perfect rating for teaching effectiveness from all end-of-semester survey respondents

UC Berkeley Physics 111A Instrumentation Lab Undergraduate Teaching Assistant

Berkeley, CA

Supervised by course instructors Dr. Amin Jazaeri and Dr. Mathias Reinsch

May 2021 - August 2021

Received a perfect rating for teaching effectiveness from all end-of-semester survey respondents

UC Berkeley Course Grader

Math 104 Real Analysis, Physics 89 Mathematical Physics, Physics 5A Introduction to Mechanics

UC Berkeley, Berkeley, CA

August 2020 - May 2021

Gridware

Research Intern

San Francisco, CA

December 2019 - February 2020

Salesforce

Software Engineer Intern

San Francisco, CA

May - August 2019

PRESENTATIONS AND POSTERS

Invited Talk at the QED-C Poster Sessions

Adaptive Shot Allocation for Fast Convergence in Variational Quantum Algorithms

Arlington, VA

June 2022

Invited Talk at the KIPAC Cosmology Seminar

GIGA-Lens: A Fast Differentiable Bayesian Lens Modeling Framework

Stanford, CA

April 2022

Invited Talks at the LBNL NERSC Machine Learning and Data Seminar

GIGA-Lens: A Fast Differentiable Bayesian Lens Modeling Framework

Berkeley, CA

April 2022

Presented Poster for the UC Berkeley Undergraduate Physics Poster Session

Hamiltonian Learning with Unitary Dynamics

Berkeley, CA

March 2022

Invited Talk at the Supernova Cosmology Project Undergraduate Research Forum

Modeling Strong Gravitational Lenses Discovered in DESI Legacy Imaging Surveys with the Hubble Space Telescope

Berkeley, CA

September 2021

Presentation for the Information Science & Technology Institute Summer School Symposium

Learning Properties of Physical Systems from Quantum Circuit Data

Los Alamos, NM

August 2021

Presented Poster for the UC Berkeley Undergraduate Physics Poster Session

Restricted Boltzmann Machines for Quantum State Tomography

Berkeley, CA

May 2021

Presentation for the 2020 Lee Teng Symposium

Tracking Studies with Frequency Ramp for the APS-U Booster

Chicago, IL

August 2020

OUTREACH

Presentation for the 'Physics in and Through Cosmology' Workshop

What Can Gravitational Lenses Teach Us About Nature?

Berkeley, CA

June 2022

Presented to high school students and teachers as part of a Lawrence Berkeley National Laboratory workshop series to introduce students to cosmology research.

AWARDS & HONORS

- UC Berkeley Physics Department Citation, awarded to the top graduating senior in the physics department (Spring 2022)
- Phi Beta Kappa Member
- H2H8 Research Grant (Spring 2021 – Spring 2022)
- Electrical Engineering & Computer Science Departmental Award (Fall 2021)
- Berkeley Physics Undergraduate Research Scholar (Spring 2021, Fall 2021)
- Western Union Foundation Global Scholarship (Fall 2019 – Spring 2020)
- Grand prize winner (from over 100 participants) at Jane Street's San Francisco ETC (Summer 2019)
- Overall third place winner (from over 700 participants) at CalHacks 2018, as well as the winner of best Google hack. Collaborated with Google on a case study for Google Cloud Platform.
- Edward Frank Kraft Award (Fall 2018)
- Broadridge Scholarship (Fall 2018 – Spring 2022)

TECHNICAL SKILLS

- Machine learning and probabilistic programming: TensorFlow, JAX, TensorFlow Probability, and NumPyro
- Computational quantum physics: Qiskit, QuTiP, PennyLane, Cirq, TensorFlow Quantum
- General purpose scientific computing: NumPy, SciPy, scikit-learn, Matplotlib, MPI
- Web development: React.js, React Native, Node.js, Flask, Django