

Benjamin Bret Lane

DOCTORAL CANDIDATE · DEPARTMENT OF PHYSICS · MASSACHUSETTS INSTITUTE OF TECHNOLOGY
INTERESTED IN THE INTERSECTION OF QUANTUM INFORMATION, EMERGING TECHNOLOGIES, AND NATIONAL SECURITY

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Education

Massachusetts Institute of Technology

Cambridge, MA

PHD PHYSICS (EST. SPRING 2024)

Jun 2018 – Present

- *Dissertation title:* Conditional Mechanical Squeezing of a Micromechanical Oscillator in the Quantum Regime
- *Committee:* Dean Nergis Mavalvala (Chair), Prof. William Oliver, Prof. Paola Capellaro

Louisiana State University

Baton Rouge, LA

BS PHYSICS, BS MATHEMATICS

Aug 2014 – May 2018

- *Thesis:* Demonstration of an Optical Spring with a Beamsplitter
- *Advisors:* Prof. Thomas Corbitt, Prof. Gabriela González

Research Experience

Doctoral Candidate

Cambridge, MA

LIGO LABORATORY, DEPARTMENT OF PHYSICS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Jun 2016 - Present

- Led the modeling, design, and building of a mixed free-space/fiber quantum optics experiment to produce optically and mechanically squeezed states with the potential to explore anomalous decoherence mechanisms of massive quantum states
- Initiated and constructed a new method to measure and tomographically reconstruct quantum optical states with speed, precision, and ease via FPGA-mediated control
- Contributed to an international team of researchers designing the next generation of gravitational wave detectors by proposing and modeling a method using large earthworks to mitigate low-frequency, seismic Newtonian noise in an efficient and cost-effective manner

Undergraduate Research Assistant

Baton Rouge and Livingston, LA

EXPERIMENTAL GENERAL RELATIVITY GROUP, DEPARTMENT OF PHYSICS, LOUISIANA STATE

2017-2018

UNIVERSITY

- Contributed to a large team commissioning the LIGO Livingston Observatory for the 3rd observing run by implementing improvements to the angular and length sensing control systems
- Modeled and built an experiment to produce an optical spring-like effect using a novel no-cavity approach

Scientific Modeler

Baton Rouge, LA

HYPERLOOP POD DESIGN TEAM, LOUISIANA STATE UNIVERSITY

2015-2016

- Led a team of engineers and physicists in modeling and iteratively designing a pod for the SpaceX Hyperloop Pod Design competition in which we were finalists
- Oversaw the finite element modeling of the full system and all integrated subsystems and designed custom simulations for the dynamical aspects not included in finite element models

Professional Experience

Chair, External Affairs Board

Cambridge, MA

GRADUATE STUDENT COUNCIL, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

May 2022 - May 2023

- Led a team representing the approximately 7,000 graduate students of MIT in all matters pertaining to local, state, and federal government relations and media outreach
- Met with legislative and executive officials including the Mayor and Deputy Mayor of Cambridge, US Representatives and Senators, the Secretary of Commerce, and White House and Department of Defense officials to discuss topics including science funding and policy, national security, higher education policy, immigration, the STEM workforce, and sustainability
- Initiated collaborations between student governments, university administrations, professional societies, funding agencies, and lawmakers to discuss and tackle shared problems
- Organized and launched the Graduate Research and Development Caucus in the US House of Representatives, including writing and giving remarks to assembled lawmakers, media, and other interested parties

Vice Chair, External Affairs Board

Cambridge, MA

GRADUATE STUDENT COUNCIL, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

May 2020 - May 2022

- Assisted the Chair in implementing the GSC advocacy strategy by organizing internal meetings, coordinating public statements, and overseeing the federal and media portfolios
- Initiated cross-university collaborations both proactively and in response to time-sensitive issues resulting in amended legislation, an amicus brief to a federal lawsuit, improved public policy, and pieces in national outlets

Federal Affairs Chair, External Affairs Board

Cambridge, MA

GRADUATE STUDENT COUNCIL, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

May 2019 - May 2020

- Led the GSC's federal government relations subcommittee, interfacing with legislative, executive, and judicial branch officials on policy matters relevant to graduate students
- Organized workshops and trainings to educate members of the MIT community on the structure of the federal government, how science is funded, and how lawmaking works in practice

Teaching Experience

Lead Teaching Assistant

Natchitoches, LA

LOUISIANA SCHOOL FOR MATH, SCIENCE, AND THE ARTS

Summers, 2014 - 2017

- Led a team of teaching assistants across a variety of courses assisting lecturers for the Louisiana School for Math, Science, and the Arts summer school for advanced students
- Tutored students in topics including introductory biology, chemistry, algebra, integral and differential calculus, and differential equations and taught a section of trigonometry
- Taught and tutored introductory algebra for students from academically disadvantaged backgrounds

Assistant Director of Training

USAFA, CO

CADET SPACE OPERATIONS SQUADRON, UNITED STATES AIR FORCE ACADEMY

Oct 2013 - Feb 2014

- Led the operation of the ground station for FalconSat-3, a cadet designed and operated satellite
- Trained and certified other cadets and junior Air Force officers on satellite and ground stationing operations

Skills and Expertise

- Experimental physics, theoretical physics, quantum information, quantum sensing, quantum computation, quantum simulations, atomic and optical physics, freespace and fiber optic experiments, signal processing and analysis (digital and analog)
- Analog circuitry, vacuum systems, FPGAs, automation, basic machining, prototype design
- Python, MATLAB, Haskell, COMSOL, Photoshop, Illustrator, Premiere, Blender, Word, Powerpoint, Excel
- Technical writing, verbal presentations, policy analysis, science and innovation policy, higher education policy

Select Publications

For a full list including collaboration papers, please see [Google Scholar](#).

PUBLISHED

B.B. Lane, J. Chen, D. Shadmany, R. Lanza, and N. Mavalvala, "Continuously Tunable Modulation Scheme for Homodyne Detection and State Tomography," *Opt. Express* 31, 26378-26382 (2023)

J. Cripe, B. Danz, **B.B. Lane**, M.C. Lorio, J. Falcone, G.D. Cole, and T. Corbitt, "Observation of an Optical Spring With a Beam Splitter," *Opt. Lett.* 43, 2193-2196 (2018)

SUBMITTED

J. Chen, **B.B. Lane**, S. Direcki, V. Sudhir, Y. Chen, and N. Mavalvala, “Measurement Based State Preparation in the Quantum Regime,” (submitted)

IN PREP

B.B. Lane and E. Hall, “Seismic Newtonian Noise Reduction for Third Generation Gravitational Wave Detectors via Earthworks,” (in prep)

B.B. Lane, J. Chen, R. Pagano, S. Aronson, X. Yin, V. Sudhir, T. Corbitt, N. Mavalvala, “Preparation of a Conditionally Squeezed State of a Micromechanical Oscillator in the Quantum Regime,” (in prep)

Awards & Recognitions

- 2024 **Presidential Management Fellowship Finalist**, U.S. Office of Personnel Management
- 2020 **Spot Award**, School of Science, Massachusetts Institute of Technology
- 2018 **Undergraduate Presentation Award**, April Meeting, American Physical Society
- President’s Honor Roll**, Louisiana State University
- Dean’s List**, Louisiana State University

- 2017 **Undergraduate Presentation Award**, South East Section Regional Meeting, American Physical Society

- 2014 **Command Cadet Space Wings**, Cadet Space Operations Squadron, United States Air Force Academy

Presentations

CONTRIBUTED PRESENTATIONS

- Lane, BB.** 2023. “Conditionally Squeezed Mechanical States in the Quantum Regime”. Oral presentation: LIGO Lab. Cambridge, MA (virtual)
- Lane, BB.** 2022. “Universal Tunable Modulator for Optical Homodyne Tomography and Measurement-Based Mechanical Squeezing”. Poster: Gordon Research Conference, Mechanical Systems in the Quantum Regime. Ventura, CA
- Lane, BB.** 2021. “Optomechanics and Gravitational Decoherence”. Oral presentation: LIGO Lab. Cambridge, MA
- Lane, BB.** 2020. “Red Pitaya and PyRPL: Lab Instruments on FPGA Hardware”. Oral presentation: LIGO Lab Engineering Meeting (virtual)
- Lane, BB.** 2019. “Federal Science Funding and Policy in Brief”. Oral presentation: Center for Theoretical Physics Lunch Seminar. Cambridge, MA
- Lane, BB.** 2019. “Optomechanical Squeezing at LIGO MIT”. Oral presentation: Quantum Noise Working Group Teleconference, LIGO Scientific Collaboration (virtual)
- Lane, BB,** J. Cripe, B. Danz, G. Cole, and T. Corbitt. 2018. “Observation of an Optical Spring With a Beamsplitter”. Oral presentation: American Physical Society April Meeting. Columbus, OH
- Lane, BB,** J. Cripe, B. Danz, G. Cole, and T. Corbitt. 2017. “Observation of an Optical Spring With a Beamsplitter”. Poster: Southeast Section of the American Physical Society Regional Meeting. Milledgeville, GA
- Lane, BB,** J. Cripe, B. Danz, G. Cole, and T. Corbitt. 2017. “Observation of an Optical Spring With a Beamsplitter”. Poster: International Astronomical Union Symposium 338 on Gravitational Wave Astrophysics. Baton Rouge, LA

Outreach & Professional Development

SERVICE AND OUTREACH

- 2019–2020 **National Association of Graduate-Professional Students**, Northeast Regional Director
- 2019–2020 **Students for the Exploration and Development of Space, MIT**, Director of Outreach

PROFESSIONAL MEMBERSHIPS

American Association for the Advancement of Science

American Physical Society

LIGO Scientific Collaboration

Optica (formerly The Optical Society of America)