

ALEXANDER UNGAR

EDUCATION

- Massachusetts Institute of Technology** Expected May 2027
Ph.D. Candidate in Quantum Engineering, Department of EECS GPA: 5.0/5.0
- 2021-2026 National Science Foundation Graduate Research Fellow
 - Minor in RF Integrated Circuits – Cadence layout & simulation of 1.8 GHz low-noise receiver chain with IBM Bicomos PDK
- Massachusetts Institute of Technology** Sept 2021 - Sept 2023
M.S. in Electrical Engineering, Department of EECS GPA: 5.0/5.0
- Concentration: Applied Quantum, Statistical, and Solid-State Physics
- University of California, Berkeley** Aug 2016 - Dec 2020
B.S. in Engineering Physics GPA: 3.78/4.0
- 2020 Berkeley Physics Undergraduate Research Scholar
- University of Sydney** Feb 2019 - June 2019
International Student Exchange Program GPA: 4.0/4.0

RESEARCH AND PROFESSIONAL EXPERIENCE

- MIT Quantum Engineering Group** Jan 2022 - present
– Graduate researcher under Prof. Paola Cappellaro
- Leading project on controlling electron-nuclear spin defects in diamond to perform quantum-enhanced sensing of nanoscale magnetic fields
 - Developed and experimentally demonstrated a novel method to increase coherence volume of a quantum register of spins around single Nitrogen-Vacancy (NV) centers [[PRX Quantum paper](#)]
 - Built a laser confocal microscope setup to detect and image single NV centers, incorporating microwave control for electron and nuclear spin resonance experiments
- UC Berkeley Department of Physics** Sept 2020 - Apr 2021
– Undergraduate and post-baccalaureate researcher under Prof. Norman Yao
- Numerically modeled and experimentally tested ion implantation into 2D hexagonal boron nitride (hBN) to generate spin defects for quantum sensing
 - Performed optically-detected magnetic resonance (ODMR) to characterize defect energy level structure
- Undergraduate researcher under Prof. Alex Zettl Jan 2017 - Dec 2020
- Fabricated and performed electron transport characterization of a graphene-sealed field emission device that could operate at ambient pressure
 - Optimized material transfer process and electrical contact of graphene membrane for the gate electrode
- Sandia National Labs Combustion Research Facility, Livermore, CA** June 2020 - Aug 2020
– Department of Energy Summer Undergraduate Lab Internship (SULI) Program
- Developed computational scripts to analyze combustion reactions from in-situ Raman fluorescence signals
 - Performed simulations of Raman cross-sections for gases present in methanol oxidation
- Raytheon Space and Airborne Systems, El Segundo, CA** June 2019 - Aug 2019
– Electrical engineering intern
- RF hardware testing for low-noise amplifier (LNA) stage on radar receiver module

- Developed computational scripts to analyze foundry wafer-probe data for LNA gain and power-consumption

Astrophotonics Group, University of Sydney Department of Physics

Feb 2019 - June 2019

– Undergraduate researcher under Prof. Joss Bland-Hawthorne

- Built camera metrology system for robotic positioning of optical fiber bundles in integral field spectrograph
- System integrated onto the Anglo-Australian Telescope (AAT)

RESEARCH PUBLICATIONS AND PRESENTATIONS

Journal Papers

- [1] **A. Ungar**, P. Cappellaro, A. Cooper, and W.K.C. Sun, “Control of an Environmental Spin Defect beyond the Coherence Limit of a Central Spin”, *PRX Quantum* **5**, 010321 (2024). [\[DOI\]](#) [\[MIT News Research Highlight\]](#) [\[McKinsey Report Highlight\]](#)
- [2] C. Su, F. Zhang, S. Kahn, B. Shevitski, J. Jiang, C. Dai, **A. Ungar**, J. Park, K. Watanabe, T. Taniguchi, J. Kong, Z. Tang, W. Zhang, F. Wang, M. Crommie, S.G. Louie, S. Aloni, and A. Zettl, “Tuning colour centres at a twisted hexagonal boron nitride interface”, *Nat. Mater.* **21**, 896-902 (2022). [\[DOI\]](#)
- [3] B. Zhou, E. Huang, R. Almeida, S. Gurses, **A. Ungar**, J. Zetterberg, A. Kulkarni, C.X. Kronawitter, D.L. Osborn, N. Hansen, and J. H. Frank, “Near-surface imaging of the multicomponent gas phase above a silver catalyst during partial oxidation of methanol”, *ACS Catal.* **11**, 155-168 (2020). [\[DOI\]](#)

Other Publications

- [1] A. Ungar, “Scaling up a quantum register of dark electronic spins in diamond”, Master’s Thesis, MIT (2023). [\[Link\]](#)
- [2] A. Ungar, “Using Raman scattering to study reacting gas flow over a catalyst”, OSTI Technical Report SAND-2020-8130R, 689776 (2020). [\[DOI\]](#)

Presentations

- [2] (Co-author for conference invited talk) A. Ungar, W.K.C. Sun, A. Cooper, and P. Cappellaro, “Electron-Nuclear Spin Register Beyond the Coherence Limit of a Central Spin”, *Materials Research Society (MRS) Fall Meeting*, Boston, MA, December 2024.
- [1] (Invited seminar) A. Ungar, “Experimental setups for NV centers 101”, UMass Boston Physics Graduate Club Minh-Thi Memorial Lecture Series on NV Centers, Boston, MA, October 2024.
- [2] (Conference contributed talk) A. Ungar, W.K.C. Sun, A. Cooper, and P. Cappellaro, “Control of spin chains to extend an electronic spin register in diamond”, *Conference on Quantum Information and Quantum Control (CQIQC-X)*, The Fields Institute, Toronto, ON, August 2024.
- [3] (Conference lightning talk) A. Ungar, “Control of an environmental spin defect beyond the coherence limit of a central spin”, *MIT Quantum Science and Engineering Consortium (QSEC) Annual Research Conference*, Bretton Woods, NH, January 2024.
- [4] (Nominated department retreat talk) A. Ungar, “Extending an electronic spin register via control of spin chains in diamond”, Harvard-MIT Center for Ultracold Atoms (CUA) Retreat, Plymouth, NH, January 2024.
- [5] (Conference poster) A. Ungar, W.K.C. Sun, A. Cooper, and P. Cappellaro, “Control of an environmental spin defect beyond the coherence limit of a central spin”, *15th Italian Quantum Information Science (IQIS) Conference*, Trieste, Italy, September 2023.
- [6] (Conference poster) A. Ungar, W.K.C. Sun, A. Cooper, and P. Cappellaro, “Characterizing the Interaction Graph of a Multi-Spin Network in Diamond”, *American Physical Society (APS) March Meeting*, Las Vegas, NV, March 2023.
- [7] (Conference poster) A. Ungar, W.K.C. Sun, A. Cooper, and P. Cappellaro, “Characterizing the Interaction Graph of a Multi-Spin Network in Diamond”, *MIT Quantum Science and Engineering (QSEC) Annual Research Conference*, Bretton Woods, NH, January 2023.
- [8] (Poster) A. Ungar, J. Kruppe, C. Zu, C. Dui, N. Yao, and A. Zettl, “Generating quantum emitters in hexagonal boron nitride for nanoscale ultra-sensitive magnetometry”, Berkeley Physics Undergraduate Research Scholars Symposium, Berkeley, CA, May 2021.
- [9] (Talk) A. Ungar, “Raman spectroscopy to probe reacting gas flow over a silver catalyst”, Sandia National Labs Summer Intern Research Symposium, August 2020.

[10] (Poster) A. Ungar, N. Deka, S.M. Gilbert, K. Pister, V. Subramanian, and A. Zettl, “Fabricating a MEMS ionocraft with a graphene-gate field emission device”, UC Berkeley College of Engineering Undergraduate Research Symposium, October 2018.

TEACHING AND OUTREACH EXPERIENCE

MIT QSEC Annual Research Conference (QUARC)

January 2023 - Present

Conference Co-Chair for QuARC-2025 & upcoming 2026 event

- Co-led the organization of a two-day conference on quantum science and technology, attended by over 200 participants and featuring 90 presentations at the Bretton Woods Ski Resort, NH, with a budget exceeding \$160k [[Conference webpage](#)]
- Managed executive committee of 15 graduate students, postdocs, and administrative staff
- Oversaw all planning and on-site operations including soliciting abstract submissions, organizing student academic sessions and keynote talks, industry networking and panel events, and hotel and transportation arrangements
- 2023 & 2024 Conference Social Chair, responsible for organizing casino night, skiing, and social activities
- 2024 Session Chair for Solid-State Devices

MIT Advanced Electricity and Magnetism I (8.022)

Fall 2022

Primary Graduate Teaching Assistant for Prof. Ray Ashoori

- Led weekly discussion lectures, exam review sessions, and office hours
- Developed homework and exam materials; designed and led a new hands-on laboratory series
- Managed undergraduate grading team of 3 TA's

UC Berkeley Nuclear Reactions and Radiation (NE101)

Spring 2021

Undergraduate Teaching Assistant for Prof. Lee Bernstein

- Held weekly office hours for homework assistance, and graded biweekly problem sets

Mentoring and Volunteering Activities

- December 2024, Symposium Assistant for two half-day sessions on quantum technology at the 2024 MRS Fall Meeting
- Summer 2024, MIT Summer Research Program (MSRP), supervised third-year undergraduate student on the design, COM-SOI, modeling, and fabrication of a microwave coplanar waveguide for single NV array control
- Fall 2022, MIT Undergraduate Research Opportunities Program (UROP), supervised first-year student on the development of computational scripts to improve imaging and tracking stability of NV centers in diamond
- April 2023, Boston Museum of Science Quantamazing Weekend, led hands-on demo of a transmission electron microscope
- September 2022 and 2023, Cambridge Science Festival, led demo for younger children experimenting with liquid nitrogen
- Spring 2019, Berkeley Community Resources for Science “Be a Scientist” Program, guided class of 7th grade students at Willard Middle School in designing and running individual science experiments

SCHOLARSHIPS AND AWARDS

- 2024 MIT Graduate Student Council Conference Grant Recipient for CQIQC-X, Toronto
- 2024 McKinsey Quantum Technology Monitor research highlight of PRX Quantum paper for “technological breakthrough in quantum sensing” [[Report](#)]
- 2022 MIT Department of Physics Outstanding TA Award, Fall semester
- 2021-2026 National Science Foundation Graduate Research Fellowship in Quantum Engineering
- 2021 MIT Jacobs Presidential Fellowship (funds not accepted)
- 2021 MIT School of Engineering Henry Ford II Fellowship (funds not accepted)
- 2020 Berkeley Physics Undergraduate Research Scholarship
- 2019 University of Sydney Faculty of Engineering High Distinction Student
- 2018 UC Berkeley College of Engineering Dean's Honors List