David A. Hopper, Ph.D.

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OVERVIEW

Postdoctoral researcher in applied physics specializing in quantum sensing and quantum dynamics of spin defects in semiconductors.

EXPERIENCE

Postdoctoral Researcher 11/2019 - Present
University of Pennsylvania, Philadelphia PA

- Developing an Ultra-High Vacuum compatible confocal microscope for spectroscopy of single-photon emitters in 2D materials.
- Leading the experimental design on an interdisciplinary team to build a compact, low-power, CMOS device capable of performing sophisticated qubit control operations.

Ph.D. Candidate 2014 - 2019
University of Pennsylvania, Philadelphia PA

- Implemented advanced initialization and readout protocols for the nitrogen-vacancy center in diamond to explore multi-qubit registers
- Developed multi-color confocal microscopes by integrating optics, RF electronics, real-time control, and a versatile software suite in MATLAB.

Research Assistant 2012 - 2014
The Pennsylvania State University, University Park PA

- Developed a protocol for exfoliating Bi_2Se_3, a candidate topological insulator, via the scotch-tape method.
- Patterned exfoliated flakes of Bi_2Se_3 into Aharonov-Bohm rings and deposited metal contacts using a focused ion beam.

EDUCATION

Ph.D. Physics 2014-2019
University of Pennsylvania, Philadelphia PA
Advisor: Professor Lee C. Bassett
Dissertation: *Preparing and Measuring Single Spins in Diamond*

B.S. Physics 2010-2014
The Pennsylvania State University, University Park PA
Research Advisor: Professor Nitin Samarth
Thesis: *Fabrication of Nanoscale Aharonov-Bohm Rings of Bismuth Selenide*

PUBLICATIONS [Google Scholar][arXiv]

10. **D. A. Hopper**, J. D. Lauigan, T.-Y. Huang, and L. C. Bassett, "Real-Time Charge Initialization of Diamond Nitrogen-Vacancy Centers for Enhanced Spin Readout", *Physical Review Applied* **13**, 024016 (2020).

9. S. A. Breitweiser, A. L. Exarhos, R. N. Patel, J. Saouaf, B. Porat, **D. A. Hopper**, and L. C. Bassett, "Efficient Optical Quantification of Heterogeneous Emitter Ensembles", *ACS Photonics* **7**, 288-295 (2019).

8. K. J. Brown, E. Chartier, E. M. Sweet, **D. A. Hopper**, and L. C.Bassett, "Cleaning diamond surfaces using boiling acid treatment in a standard laboratory chemical hood", *Journal of Chemical Health and Safety* **26**, 40-44 (2019).

7. T.-Y. Huang, R. R. Grote, S. A. Mann, **D. A. Hopper**, A. L. Exarhos, G. G. Lopez, G. R. Kaighn, E. C. Garnett, and L. C. Bassett, "A monolithic immersion metalens for imaging solid-state quantum emitters", *Nature Communications* **10**, 2392 (2019).

6. A. L. Exarhos, **D. A. Hopper**, R. N. Patel, M. W. Doherty, and L. C. Bassett, "Magnetic-field-dependent quantum emission in hexagonal boron nitride at room-temperature", *Nature Communications* **10**, 222 (2019).

5. **D. A. Hopper**, H. J. Shulevitz, and L. C. Bassett, "Spin Readout Techniques of the Nitrogen-Vacancy Center in Diamond", *Micromachines (Invited)* **9**, 437 (2018).

4. **D. A. Hopper**, R. R. Grote, S. M. Parks, and L. C. Bassett, "Amplified snsitivity of nitrogen-vacancy spins in nanodiamonds using all-optical charge readout", *ACS Nano* **12**, 4678-4686 (2018).

3. S. M. Parks, R. R. Grote, **D. A. Hopper**, and L. C. Bassett, "Fabrication of (111)-faced single-crystal diamond plates by laser nucleated cleaving", *Diamond and Related Materials* **84**, 20-25 (2018).

2. A. L. Exarhos, **D. A. Hopper**, R. R. Grote, A. Alkauskas, L. C. Bassett, "Optical signatures of quantum emitters in suspended hexagonal boron nitride", *ACS Nano* **11**, 3328-3336 (2016).

1. **D. A. Hopper**, R. R. Grote, A. L. Exarhos, and L. C. Bassett, "Near-infrared-assisted charge control and spin readout of the nitrogen-vacancy center in diamond", *Physical Review B* **94**, 241201 (2016).

PATENTS

1. L. C. Bassett, S. M. Parks, R. R. Grote, and **D. A. Hopper**, "Systems and methods for laser cleaving diamonds", US Patent App. 16/613,410 (2020).

INVITED TALKS

1. Princeton-GIA Diamond Symposium, Princeton, NJ — January 2019

SUBMITTED CONFERENCE ABSTRACTS

6. OSA Quantum 2.0, Virtual — September 2020
5. APS March Meeting, Boston, MA — March 2019
4. New Diamond and Nano Carbons Conference, Flagstaff, AZ — May 2018
3. CLEO, San Jose, CA — May 2017
2. MRS Fall Meeting, Boston, MA — December 2016
1. APS March Meeting, Baltimore, MD — March 2016

SEMINARS AND COLLOQUIA

3. Fall ESE Ph.D. Seminar, University of Pennsylvania — October 2018
2. Fall ESE Ph.D. Seminar, University of Pennsylvania — October 2017
1. Fall ESE Ph.D. Colloquium, University of Pennsylvania — October 2016

HONORS AND AWARDS

Chairman's Teaching Award 2018
For outstanding performance in the Physics department teaching program.

Brickwedde Research Award 2014
Recognizing undergraduate research that culminated in a written thesis.

TEACHING

Graduate Experiences 2014-2019
University of Pennsylvania, Philadelphia PA

- TA for Quantum Engineering (ESE 523). Assisted in the development of the course material and problem sets for this graduate level survey course. 3 semesters experience.
- Active learning TA for Introductory Physics (PHYS 151). In-class resource for students working on group problems. Participated in the SAIL TA training provided by the Center for Teaching and Learning at Penn. One semester of experience.
- Mentored one masters thesis, four undergraduate research experiences, and two high school interns.
- Mentor for Conestoga High School's (Berwyn, PA) Science Olympiad team. Held bi-weekly meetings that covered introductory optics material and laser-shoot competitions.

Undergraduate Experiences 2010-2014
Pennsylvania State University, University Park PA

- Learning assistant for Calculus I and II. Provided three comprehensive, interactive review sessions for three mid-terms and finals. Participated all four years.
- Initial participant in a pilot learning assistant program for introductory physics. Provided in class feedback and support during group discussions. Attended a semester long class on teaching methodologies.