

Alexander E. Kossak

EDUCATION

Massachusetts Institute of Technology Ph.D. Materials Science & Engineering	Cambridge, Massachusetts <i>August 2019 – Present</i>
Johns Hopkins University M.S.E. Materials Science & Engineering M.A. Chemistry B.A. Chemistry – Honors	Baltimore, Maryland <i>May 2018</i> <i>May 2018</i> <i>May 2018</i>

RESEARCH EXPERIENCE

Max Planck Institute for Intelligent Systems <i>Visiting Research Assistant</i> <i>Advisor: Gisela Schütz – Modern Magnetic Systems</i> <ul style="list-style-type: none">• Design and carry out synchrotron-based experiments including Scanning Transmission X-ray Microscopy (STXM) and Photoemission Electron Microscopy (PEEM).• Fabricate and characterize magnetic-memory nanodevices through materials growth, e-beam lithography, MOKE microscopy, and 4-point probe measurements.	Stuttgart, Germany <i>January 2022 – Present</i>
MIT Department of Materials Science and Engineering <i>Research Assistant</i> <i>Advisor: Geoffrey S. D. Beach – Spin Dynamics Laboratory</i> <ul style="list-style-type: none">• Explore the fundamental underpinnings of new concepts in spin-based data storage, computation, and communications.• Grow complex heterostructures to study the underlying physics of exchange interaction, anisotropy, and external stimuli.• Analysis with MOKE microscopy, 4-point probe measurements, X-ray synchrotron techniques, VSM, XRD, and micromagnetics simulations.	Cambridge, Massachusetts <i>December 2019 – Present</i>
Max Planck Institute for Solid State Research (Festkörperforschung) <i>Fulbright Fellow</i> <i>Advisor: Klaus Kern – Nanoscale Science Department</i> <ul style="list-style-type: none">• Investigate novel quantum phenomena of nanomaterials & devices through spectroscopic and electrical transport measurements.• Explore the structure and interfaces of two-dimensional nanoelectronics.• Fabricate and characterize nanodevices through exfoliation techniques, e-beam lithography, RIE, Raman spectroscopy, SPCM, AFM.	Stuttgart, Germany <i>September 2018 – August 2019</i>
Johns Hopkins University Department of Chemistry <i>Research Assistant</i> <i>Advisor: Thomas J. Kempa – Physical Materials Chemistry</i> <ul style="list-style-type: none">• Use solid state and materials chemistry to make new and exotic phases, architectures, and topologies for applications in human health, energy conversion, and sustainability.• Synthesize nanostructures through air-free, solution-phase, and gas-phase techniques.• Characterize and analyze nanostructures with a myriad of electron microscopy, electron diffraction, and surface scanning methods (HR-TEM, SEM, EDS, AFM).• Designed and constructed a custom chemical vapor deposition (CVD) reactor system for synthesis of metal-oxide, perovskite, and Group IV and III/V materials.	Baltimore, Maryland <i>January 2016 – May 2018</i>

Johns Hopkins University Department of Chemistry*Research Assistant**Advisor: John P. Toscano – Synthetic Organic Chemistry***Baltimore, Maryland***June 2015 – January 2016*

- Performed multi-step total organic synthesis reactions to create various protective photoremovable scaffolds to study the kinetic release of thiol and perthiol functional groups to help understand the role of hydrogen sulfide in biological signaling.
- Measured speed and reactivity of various terminal functional groups with time-resolved infrared spectroscopy (TRIR).
- Purified and characterized compounds through various solution phase spectroscopic techniques (HPLC, NMR, UV-Vis).

MENTORSHIP**MIT Office of Graduate Education***Graduate Community Fellow - Financial Literacy***Cambridge, Massachusetts***November 2020 – Present*

- Support the OGE's efforts to promote MIT graduate student financial literacy and health through organizing workshops from graduate fellowships to investing to credit building. Maintain the Financial Literacy Initiative's website and social media.

DMSE Application Assistance Program*Mentor***Cambridge, Massachusetts***September 2020 – Present*

- A student-run program that aids MIT DMSE applicants from underrepresented groups. We provide feedback on application materials and guide applicants through the MIT application process based on training from the Graduate Admissions Committee on admissions criteria.

German American Conference*Head of Logistics***Cambridge, Massachusetts***2020*

- As part of the leadership team of the German American Conference organizing committee, we aimed to create a platform where leaders from different industries and next generation decision-makers meet, discuss, and look ahead to strengthen the transatlantic relationship.

NetPals*PAUS 7th Grade Mentor***Cambridge, Massachusetts***November 2019 – Present*

- A partnership program between MIT DMSE and Cambridge School Volunteers which provides a sustainable way for students and mentors to develop a 1:1 relationship around an academic focus.

German-American Institute*Citizen Diplomat***Tübingen, Germany***October 2018 – July 2019*

- Engaged in cross-cultural communication with middle and high school students in the local community through the sharing of life in American and STEM education opportunities available for foreigners.

Johns Hopkins University Post-Baccalaureate Premedical Program*Introductory Chemistry and Organic Chemistry Tutor***Baltimore, Maryland***August 2017 – May 2018*

- Semiweekly tutoring tailored to students returning to school and those dramatically changing their field towards apply to medical school. Provided studying techniques and in-depth tutoring in fundamental chemistry along with mathematics.

Johns Hopkins University Center for Student Success*Natural Sciences and Mathematics Tutor***Baltimore, Maryland***January 2017 – May 2018*

- Personalized academic tutoring in various subjects including: chemistry, physics, and calculus for student athletes. Provide studying techniques and scheduling practices to help the student athletes excel in their respective varsity sport without comprising their rigorous academic schedule.

STEM Achievement in Baltimore Elementary Schools

STEM Mentor

Baltimore, Maryland

September 2016 – May 2018

- Volunteer weekly through an NSF-funded afterschool STEM program at Dallas F. Nicholas Senior Elementary School with 4th-grade students designing and constructing an engineering project. Prepare students for a STEM showcase along with numerous other classes and schools in Baltimore.

Johns Hopkins University Department of Chemistry

Teaching Assistant: Organic Chemistry

Baltimore, Maryland

Summer 2017

- Led 200+ students with a team of teaching assistants through an intensive four-week introduction to organic chemistry. Covered fundamental chemical structure, molecular properties, and reaction mechanisms. Held weekly office hours to guide students through understanding the theory and developing problem-solving techniques.

HONORS & AWARDS

- MISTI Germany Fellowship | Max Planck Institute for Intelligent Systems 2022
- David V. Ragone (1951) Endowed Fellowship | MIT 2019 – 2020
- Fulbright Study/Research Award | Max Planck Institut für Festkörperforschung 2018
- ACS Student Award | Most outstanding Johns Hopkins chemistry student 2018
- Omicron Delta Kappa | National Leadership Honors Society 2017
- American Chemical Society Scholars Program | \$1000/yr for conference travel 2014 – 2017
 - Selected as a 2016 & 2017 Merck ACS Scholar
- Dean's List for Academic Excellence 2014 – 2017
- NCAA Division III Track & Field Centennial Conference Champions Winter & Spring 2014 – 2016
 - Silver Medalist in Pole Vault
- Phi Gamma Delta Academic Achievement Award | \$250 2016
- Dean's Undergraduate Research Award | \$3,000 to study nanotubes as biological probes 2016
- Johns Hopkins Track & Field Freshman of the Year 2015
- Eagle Scout | Bronze, Gold & Silver Palms 2012

PUBLICATIONS

2. **Kossak, A. E.**, Huang, M., Reddy, P., Beach, G. S. D. Voltage Control of Magnetic Order in RKKY Coupled Multilayers *In Preparation* (2022).

1. **Kossak, A. E.**, Stephens, B. O., Tian, T., Liu, P., Chen, M., Kempa T. J. Anisotropic and Multi-Component Nanostructures by Controlled Symmetry Breaking of Metal Halide Intermediates. *Nano Lett.* **18**, 2324–2328 (2018).

PRESENTATIONS

Kossak, A. E., Huang, M., Reddy, P., Beach, G. S. D. Voltage-Controlled Field-Free Switching of RKKY Coupled Multilayers. Contributed Talk presented at the APS March Meeting 2022, Chicago, LA, March 16, 2022.

Kossak, A. E., Hasan, M. U., Huang, M., Reddy, P., Sheffels, S., Beach, G. S. D. Voltage Modulated RKKY Interaction through Magneto-Ionic Gating. Contributed Talk presented at the 15th Joint MMM-INTERMAG Conference, New Orleans, LA, January 13, 2022, 312.

Kossak, A. E., Hasan, M. U., Huang, M., Reddy, P., Sheffels, S., Beach, G. S. D. Voltage Modulated RKKY Interaction through Magneto-Ionic Gating. Contributed Talk presented at the 2021 Around-the-Clock Around-the-Globe Magnetism Conference IEEE Magnetics Society, Zoom, August 24, 2021, 101.

Kossak, A. E., Hasan, M. U., Huang, M., Reddy, P., Sheffels, S., Beach, G. S. D. Voltage Modulated RKKY Interaction through Solid-State Hydrogen Ion Gating Synthetic Antiferromagnets. Contributed Talk presented at the 2020 Around-the-Clock Around-the-Globe Magnetism Conference IEEE Magnetics Society, Zoom, August 27, 2020, 107.

Kossak, A. E., Stephens, B. O., Kempa T. J. Synthesis of anisotropic nanostructures through controlled symmetry breaking. Contributed Talk presented at the 255th ACS National Meeting, New Orleans, LA, March 18, 2018; 2867694.

Kossak, A. E., Kempa, T. J. *Multi-Component Transition-Metal Nanotubes as Biological Probes*. Poster presented at Day of Undergraduate Research in Engineering, the Arts & Humanities, Medicine, and the Sciences, Johns Hopkins University, Baltimore, MD, April 2017.

INVITED TALKS

Helmholtz-Zentrum Berlin | Magnetism and Coherent X-Ray Imaging

Dec. 2021

TECHNICAL SKILLS & INTERESTS

- Research: High Resolution (Scanning) Transmission Electron Microscopy (HR-(S)TEM), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS), Atomic Force Microscopy (AFM), Time-Resolved Infrared Spectroscopy (TRIR), Nuclear Magnetic Resonance Spectroscopy (NMR), Ultraviolet–Visible Spectroscopy (UV-Vis), Scanning Photocurrent Microscopy (SPCM), Electron-Beam Lithography, Raman Spectroscopy, Magneto-Optical Kerr Effect (MOKE) Microscopy, Magnetron Sputtering, Vibrating Sample Magnetometry (VSM), Scanning Transmission X-ray Microscopy (STXM), Brillouin Light Scattering Spectroscopy (BLS), Photoemission Electron Microscopy (PEEM), Superconducting Quantum Interference Device (SQUID) Magnetometry
- Languages: mumax3, MATLAB, Mathematica, Python, LabVIEW, Intermediate German, Intermediate Spanish