# Hannah Shay (Hannah Toru)

hannahts@mit.edu (530) 402-5741

## EDUCATION

**Massachusetts Institute of Technology** Cambridge, MA
PhD in Chemistry August 2021 - Current

**University of Illinois at Urbana-Champaign** Urbana, IL
MS in Chemistry August 2018 – May 2021

**University of California, Davis** Davis, CA
BS in Chemistry September 2009 - August 2014

## RESEARCH EXPERIENCE

**Department of Chemistry, Massachusetts Institute of Technology** Cambridge, MA
*Graduate Research Assistant*, Advisor: Professor Brett McGuire November 2021 – Current

- Developed and began investigating molecules of astrochemical and biological interest with high resolution spectroscopic studies.
- Calculated preliminary spectra for molecules of astronomical interest, as predicted by machine learning model.
- Assisted in initial design of chirped pulse Fourier transform microwave instrument for group

**NASA Goddard Space Flight Center – SubLIME Lab** Greenbelt, MD
*Visiting Scholar*, Advisor: Dr. Stefanie Milam January 2023 – February 2023

- Assist in setting up HCN for vapor deposition of ice samples
- Take preliminary measurements of HCN/HNC using rotational spectroscopy

**Department of Chemistry, University of Illinois at Urbana-Champaign** Urbana, IL
*Graduate Research Assistant*, Advisor: Professor Thomas Johnson (Geology) July 2019 – May 2021

- Conducted geochemical experiments into the isotopic fractionation behavior of antimony and measured results on inductively coupled plasma mass spectrometer.
- Studied isotopic fractionation of antimony with molecular mechanical and density functional theory techniques.
- Thesis: "*Developing Antimony Stable Isotope Methods As A New Geochemical Redox Indicator: Computational Isotopic Fractionation Studies*"

**Department of Chemistry, University of California, Davis** Davis, CA
*Research Assistant,* Advisor: Professor Kyle Crabtree July 2016 – July 2018

- Designed and built high voltage microwave spectrometer instrument component for studies to investigate kinetic rate constants.
- Assisted in building and testing group's Fourier transform microwave spectrometer.

**Graduate School of Engineering, Osaka University** Osaka, Japan
*FrontierLab Visiting Researcher,* Advisor: Professor Shinobu Itoh April 2014 – August 2014

- Improved methods of nickel (II) and other metal complexes with phenol ligand formation.
- Investigated the catalytic abilities of complexes in benzene oxidation via monitoring GC results.
- Thesis: "*Phenol Formation by Catalytic Oxidation of Benzene with $Ni^{II}$ and $Cu^{II}$ Complexes Supported by Phenol Containing Ligands"*

**Department of Chemistry, University of California, Davis** Davis, CA
*Undergraduate Researcher,* Advisor: Professor Donald Land September 2013 – March 2014

- Optimized surfaces for nanolipoprotein particle immobilization under different conditions and environments.
- Analyzed samples with Fourier transform infrared spectroscopy.

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## RESEARCH EXPERIENCE (cont.)

**Department of Chemistry, University of California, Davis** Davis, CA
*Undergraduate Researcher,* Advisor: Professor Mark Kurth March 2011 – September 2012

- Created novel triazolobithiazoles shown to have cystic fibrosis corrector activity.
- Developed an environmentally benign one-pot synthesis of quinazolinotriazolobenzodiazepines.

## PUBLICATIONS AND CONFERENCE PROCEEDINGS

- Cooke, I.R.; Xue, C.; Changala, P.B.; **Toru Shay, H**.; + 11 co-authors (including B. A. McGuire). "Detection of Interstellar E-1-cyano-1,3-butadiene in GOTHAM Observations of TMC-1." Submitted December 2022.
- **Toru, H**. (2019, November) *Applications of Mass-Independent Isotope Fractionation to Extraterrestrial Topics*. Review presented at the UIUC 2019 Graduate Physical Chemistry Literature Seminar Series.
- **Toru, H.** (2014, August) *Phenol Formation by Catalytic Oxidation of Benzene with $Ni^{II}$ and $Cu^{II}$ Complexes Supported by Phenol Containing Ligands.* Paper presented at the Frontierlab@OsakaU International Conference.
- Moore, J.*; Towns, E.; **Shay, H.;** Blanchette, C.; Land, D. (2014, April*) Using Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy to Optimize Surfaces for the Immobilization of Nanolipoprotein Particles*. Poster presented at IGPS 2014. *Presenter
- Guggenheim, K.G.; **Toru, H**.; Kurth, M.J. "One-Pot, Two-Step Cascade Synthesis of Quinazolinotriazoloenzodiazepines." *Org. Let.* **2012**, *14*, pp 3732-3735
- Donald, M.B.; Rodriguez, K.X.; **Shay, H**.; Phuan, P.; Verkman, A.S.; Kurth, M.J. "Click-based synthesis of triazolobithiazole F508-CFTR correctors for cystic fibrosis." *Bioorg. & Med. Chem*. **2012**, 20*,* pp 5247-5253

## FELLOWSHIPS AND AWARDS

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|---|---|
| MathWorks Fellowship | September 2022 – Current |
| MIT Graduate Student Career Exploration Grant | January 2023 – February 2023 |
| MIT Department of Chemistry Award for Outstanding Teaching | August 2022 |
| Dr. Michael J. Sofia Fellowship | August 2020 – May 2021 |
| Women in Chemistry Inclusive Leadership Runner-Up Award | August 2020 |
| List of Teachers Ranked as Excellent by Their Students at UIUC | June 2020 |
| Virginia Bartow Scholar | August 2018 – May 2019 |
| Hannum Fellowship | August 2018 |
| Japan Student Services Organization Honors Scholarship | April 2014 – August 2014 |

## TEACHING EXPERIENCE

**Research and Communication in Chemistry** January 2022 – May 2022
*Massachusetts Institute of Technology,* Department of Chemistry
Worked closely with and mentored undergraduate senior student researchers. Taught presentation, writing and literary techniques to build science communication skills.

**Principles of Chemical Science** August 2021 – December 2021
*Massachusetts Institute of Technology,* Department of Chemistry
Prepared and held bi-weekly lectures to reinforce general chemistry principles. Graded problem sets for over 200 students weekly. Held exam preparation assistance and maintained efficient learning through class and website maintenance.

**Instrumental Characterization** January 2021 – May 2021
*University of Illinois at Urbana-Champaign,* Department of Chemistry
Wrote and graded novel problem sets, mentored students in chemical analysis.

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## TEACHING EXPERIENCE (cont.)

**Physical Chemistry Principles** January 2020 – May 2020
*University of Illinois at Urbana-Champaign,* Department of Chemistry
Prepared and held lecture-style discussions, and graded problem sets, quizzes and exams for over 40 senior undergraduates.

**Physical Principles Lab Teaching Assistant** August 2019 – December 2019
*University of Illinois at Urbana-Champaign,* Department of Chemistry
Led small groups on extended lab experiments in x-ray diffraction on organic and inorganic materials and Fourier transform IR on gas and biological samples.

**Instrumental Chem Systems Lab Teaching Assistant** January 2019 – May 2019
*University of Illinois at Urbana-Champaign,* Department of Chemistry
Designed tutorial course and prepared theoretical lecture on Fourier transform IR experiment and assisted in instrument troubleshooting in instrument repair and optimization of FTIR, UV-vis and mass spectrometer.

**Physical Chemistry I Teaching Assistant** August 2018 – December 2018
*University of Illinois at Urbana-Champaign,* Department of Chemistry
Facilitated undergraduate learning in topics in quantum mechanics. Prepared and gave lectures as needed, and graded problem sets and exams for over 40 senior undergraduate and graduate students.

**Observational Astronomy Lab Teaching Assistant** September 2012 – June 2013
*University of California, Davis*, Department of Physics
Maintained and set up various experimental equipment for undergraduate labs, including telescopes and polarizers. Provided general and topic-specific support and one-on-one assistance for pupils.

## SELECTED LEADERSHIP, OUTREACH AND DIVERSITY, EQUITY AND INCLUSION WORK

**Symposium Committee** November 2022
*MIT Women in Chemistry+/Chemistry Alliance for Diversity and Inclusion*
Planned and facilitated symposium proceedings, including mentor/mentee matching between graduate students and postdoctoral scholars, acting as liaison between committee and institute bodies.

**Guest Writer** August 2020
*ChemBites.org*
Invited writer for ChemBites. Wrote highlight biographical piece for BlackInChem Week. "#BlackInChem: The Unstoppable Ashley Walker."

**Co-Vice Chair, Co-Founder** September 2019 – December 2020
*OUT in Chemistry*
Founded new graduate organization in the chemistry department. Established organization with campus diversity-oriented groups, planned lecture series, educational workshops and other events related to goals and initiatives of the group.

**Social Events Chair** December 2019 – December 2020
*Women Chemists Committee*
Organized events related to the social and community aspect of WCC goals and initiatives, both department-wide and group-based. Collaborated with other diversity, equity and inclusion organizations to start a series of CV and other professional development writing workshops.

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**SELECTED LEADERSHIP, OUTREACH AND DIVERSITY, EQUITY AND INCLUSION WORK (cont.)**

**Inform Committee Chair** May 2019– January 2020

*Science Policy Group*

Organize events, lectures and seminars related to inform members about science policy topics. Planned, managed and held city-wide seminar and discussion from the Governor of Illinois and city councilors and other local and state representatives on proposed Illinois state green energy bills attended by both community members and students.

**Symposium Assistant** June 2019

*International Symposium on Molecular Spectroscopy*

Prepared technology for over 50 presentations and plenaries, coordinated with assistant session chairs, addressed technical issues during conference, and aided Symposium Chair and Coordinator.

**Telescope Assistant** Sept 2015– Sept 2016

*Hulbe Observatory at Sacramento City College*

Led star talks at community outreach astronomy events, assisted in equipment setup and maintenance both at the Hulbe Observatory and off-site, facilitated class visits ranging from elementary to college students.