

---

CONTACT INFORMATION	B15/19-29 Marco Ave Revesby, NSW 2212 Australia	<i>E-mail:</i> laszlo@laszlofrazer.com <i>Mobile:</i> +61(401)648-058
	Publications: [23]	Courses Taught: 1
	Citizenship: United States	
AWARDS	<ul style="list-style-type: none"><li>• National Science Foundation Integrative Graduate Education and Research Traineeship Fellowship, Northwestern University, 2009–2014.</li><li>• Conference Travel Grants, Northwestern University, 2012 and 2014.</li><li>• Patrick G. and Shirley W. Ryan Fellowship in Fundamental Nanoscale Science, Northwestern University, 2009–2011.</li><li>• James Franck Institute Fellowship, University of Chicago, 2008.</li><li>• Research Experiences for Undergraduates, Kansas State University, 2007.</li><li>• Acceleration to Excellence Program merit scholarship, Bard College at Simon's Rock, 2005–2007.</li></ul>	
POSITIONS	<b>UNSW</b> , Sydney, Australia Research Associate, School of Chemistry, 2016-present <ul style="list-style-type: none"><li>• Adviser: Timothy Schmidt, Professor of Chemistry</li></ul> <b>Temple University</b> , Philadelphia, Pennsylvania Adjunct Assistant Professor, Department of Chemistry, 2016 Postdoctoral Fellow, Department of Chemistry, 2015 <ul style="list-style-type: none"><li>• Nonlinear Spectroscopy and Dynamics at Interfaces</li><li>• Center for the Computational Design of Functional Layered Materials</li><li>• Adviser: Eric Borguet, Professor of Chemistry</li></ul>	
EDUCATION	<b>Northwestern University</b> , Evanston, Illinois Ph.D., <b>Physics</b> and Astronomy, September 2014 <ul style="list-style-type: none"><li>• Dissertation Topic: <i>Excitons in Cuprous Oxide: Photoionization and Other Multiphoton Processes</i></li><li>• Adviser: John B. Ketterson, Fayerweather Professor of Physics, Astronomy, and EECS</li><li>• Area of Study: Semiconductor Optics</li></ul> M.S., Physics and Astronomy, June 2011 <b>The University of Chicago</b> , Chicago, Illinois A.B., Physics, June 2009 <ul style="list-style-type: none"><li>• Research Mentor: Heinrich M. Jaeger, Friedman Professor of Physics</li><li>• Area of Study: Nanomaterial mechanical properties</li></ul> <b>Bard College at Simon's Rock</b> , Great Barrington, Massachusetts A.A., <i>with distinction</i> , May 2007	

## TEACHING

### **Graduate Teaching Certificate**, Searle Center for Advancing Learning & Teaching, Northwestern, 2012–2013

I learned to

- Design an undergraduate course
- Include diverse teaching methods
- Assess students
- Evaluate teaching and programs
- Work with teachers from other disciplines
- Teach multiculturally
- Approach teaching as research

through seminars, workshops, classroom experience, observations, and mentoring by Professor Michael Schmitt.

### Classical Mechanics

- Adjunct instructor, Oakton Community College, Summer 2013
- Designed and used a variety of teaching methods
- Created course materials
- Assessed student learning
- Student evaluations and department chair's classroom observation are available

Guest Instructor, Physical Chemistry Laboratory, 20 and 27 March 2017

### Solid State Physics Graduate Workshop, Spring 2015

- Four sessions for chemistry graduate students
- Team taught with Dr. Loranne Vernisse at Temple University

### Teaching as Research, Fall 2014

- Center for the Integration of Research, Teaching, and Learning online course
- Professor Freeman, Iowa State University
- Professor Slane, University of Wisconsin-Madison

### Preparing Future STEM Faculty to Meet the Needs of Culturally and Linguistically Diverse Populations, Fall 2013

- Center for the Integration of Research, Teaching, and Learning online course
- Professor Rivera, University of Houston

### Mentored Discussions of Teaching

- Center for the Integration of Research, Teaching, and Learning on campus program
- Electrical Engineering focus, Spring 2013
- Product Design focus, Fall 2013

## Physics GRE Preparation Program

- Created new professional development program for department undergraduates, Fall 2012

## Electricity and Magnetism

- Recitation Teaching Assistant, Northwestern University, Winter 2012

## MENTORING

### **Honors Year Researchers** (similar to senior thesis)

- Max Elias,<sup>†</sup> Energy Transfer, 2017. UNSW.
- Timothy Sanderson,<sup>†</sup> Quantum Dot Coupling, 2016. UNSW.
- Cameron Dover,<sup>†</sup> Singlet Fission, 2016. UNSW.

### **Undergraduate Researchers**

- Jason Tran,\* Thin Film Spectroscopy, Summer 2015. Temple University.
- Johanna Schwartz,\* Copper Vacancy Removal in Cuprous Oxide, 2012. Bard College at Simon's Rock, now a doctoral student at the University of Washington, Chemistry, Boydston Group with NSF Graduate Research Fellowship.
- Stephen Okoniewski,\* Laser Tweezing, 2011–2013. Northwestern University, now a doctoral student at the University of Colorado, Physics, Perkins Group with NSF Graduate Research Fellowship.
- Aaron Williams,\* Copper Oxidation, 2011. Iowa State University.

### **Ph.D. Students**

- Vineeth Yasarapudi,<sup>†</sup> Ultrafast spectroscopy for luminescent solar concentration, 2016-2017. UNSW.
- Natalia Molina,\* Coherent Phonon Oscillations, Summer 2015. Temple University.

### **In-Service Teacher Researchers**

- Richard Witt,\* Oxygen Vacancies in Cuprous Oxide, 2013.
- Azucena Carney,\* Cuprous Oxide Photovoltaics, 2013.
- Danielle Wisniewski,\* Polymer Synthesis, 2012. Teach for America, now a doctoral student at Northwestern University, Chemistry, Geiger Group.

### **High School Researchers**

- Pranjali Rathi,\* Photopolymerization, 2013. Now an undergraduate at Carnegie Mellon.
- Andrew Arceo,\* Photopolymerization, 2013. Now an undergraduate at Johns Hopkins.

<sup>†</sup> with the Schmidt group.

\* with the Borguet group.

\* with the Ketterson group.

- [1] **Frazer, L.**, Schaller, R. D., Chang, K. B., Chernatynskiy, A., & Poepelmeier, K. R. (2017). Seeing the invisible plasma with transient phonons in cuprous oxide. *Physical Chemistry Chemical Physics*, 19, 1151–1157.
- [2] **Frazer, L.**, Chang, K. B., Schaller, R. D., Poepelmeier, K. R., & Ketterson, J. B. (2017). Vacancy Relaxation in Cuprous Oxide ( $\text{Cu}_{2-x}\text{O}_{1-y}$ ). *Journal of Luminescence*, 183, 281–290.
- [3] **Frazer, L.**, Chang, K. B., Poepelmeier, K. R., & Ketterson, J. B. (2015). Cupric oxide inclusions in cuprous oxide crystals grown by the floating zone method. *Science and Technology of Advanced Materials*, 16, 034901.
- [4] **Frazer, L.**, Lenferink, E. J., Chang, K. B., Poepelmeier, K. R., Stern, N. P., & Ketterson, J. B. (2015). Evaluation of cuprous oxide defects through exciton luminescence imaging. *Journal of Luminescence*, 159, 294–302.
- [5] **Frazer, L.**, Chang, K. B., Poepelmeier, K. R., & Ketterson, J. B. (2014). Photoionization cross section of *1s* orthoexcitons in cuprous oxide. *Physical Review B*, 89(24), 245203.
- [6] **Frazer, L.**, Schaller, R. D., Chang, K. B., Ketterson, J. B., & Poepelmeier, K. R. (2014). Third-harmonic generation in cuprous oxide: efficiency determination. *Optics Letters*, 39(3), 618–621.
- [7] **Frazer, L.**, Schaller, R. D., & Ketterson, J. B. (2013). Unexpectedly slow two particle decay of ultra-dense excitons in cuprous oxide. *Solid State Communications*, 170, 34–38.
- [8] Narayanan, A., Cao, D., **Frazer, L.**, Blackburn, A. K., Tayi, A. S., Sue, A. C.-H., Ketterson, J. B., Stoddart, J. F., & Stupp, S. I., (2017). Ferroelectric Polarization and Second Harmonic Generation in Supramolecular Co-Crystals with Two Axes of Charge-Transfer. *Journal of the American Chemical Society*, 139(27), 9186–9191.
- [9] Jia, Z., Li, H., Zhao, Y., **Frazer, L.**, Qian, B., Borguet, E., Ren, F., & Dikin, D. A., (2017). Electrical and Mechanical Properties of Poly(dopamine) Modified Copper/Reduced Graphene Oxide Composites. *Journal of Materials Science*, 52(19), 11620–11629.
- [10] **Frazer, L.**, Gallaher, J., Schmidt, T., (2017). Optimizing the Efficiency of Solar Photon Upconversion. *ACS Energy Letters*, 2, 1346–1354.
- [11] Li, H., Aulin, Y. V., **Frazer, L.**, Borguet, E., Kakodhar, R., Feser, J., Chen, Y., Ke, A., Dikin, D. A., & Ren, F. (2017). Structure evolution and thermoelectric properties of carbonized polydopamine thin films. *ACS Applied Materials & Interfaces*, 9(8), 6655–6660.

- [12] Haynes, A. S., Liu, T.-K., **Frazer, L.**, Lin, J.-F., Wang, S.-Y., Ketterson, J. B., Kanatzidis, M. G., & Hsu, K.-F. (2017). Second Harmonic Generation Response of the Cubic Chalcogenides  $\text{Ba}_{6-x}\text{Sr}_x[\text{Ag}_{4-y}\text{Sn}_{y/4}](\text{SnS}_4)_4$ . *Journal of Solid State Chemistry*, 248, 119–125.
- [13] Thenuwara, A., Cerkez, E., Shumlas, S., Attanayake, N., McKendry, I., **Frazer, L.**, Borguet, E., Kang, Q., Remsing, R., Klien, M., Zdilla, M., & Strongin, D. (2016). Nickel Confined in the Interlayer Region of Birnessite: an Active Electrocatalyst for Water Oxidation. *Angewandte Chemie International Edition*, 55, 10381–10385.
- [14] Chang, K. B., Edwards, B. W., **Frazer, L.**, Lenferink, E. J., Stanev, T., Stern, N. P., Nino, J. C., & Poepelmeier, K. R. (2016). Hydrothermal Crystal Growth, Piezoelectricity, and Triboluminescence of  $\text{KNaNbOF}_5$ . *Journal of Solid State Chemistry*, 236, 78–82.
- [15] Thenuwara, A., Shumlas, S., Attanayake, N., Cerkez, E., McKendry, I., **Frazer, L.**, Borguet, E., Kang, Q., Zdilla, M., Sun, J., & Strongin, D. (2015). Copper intercalated birnessite as a water oxidation catalyst. *Langmuir*, 31(46), 12807–12813.
- [16] Stoumpos, C., **Frazer, L.**, Clark, D., Kim, Y., Rhim, S., Freeman, A., Ketterson, J., Jang, J., & Kanatzidis, M. (2015). Hybrid Germanium Iodide Perovskite Semiconductors: Active Lone Pairs, Structural Distortions, Direct and Indirect Energy Gaps, and Strong Nonlinear Optical Properties. *Journal of the American Chemical Society*, 137(21), 6804–6819.
- [17] Lai, W.-H., Haynes, A., **Frazer, L.**, Chang, Y.-M., Liu, T.-K., Lin, J.-F., Liang, I.-C., Sheu, H.-S., Ketterson, J., Kanatazidis, M., & Hsu, K.-F. (2015). Second Harmonic Generation Response Optimized at Various Optical Wavelength Ranges through a Series of Cubic Chalcogenides  $\text{Ba}_6\text{Ag}_{2.67+4\delta}\text{Sn}_{4.33-\delta}\text{S}_{16-x}\text{Se}_x$ . *Chemistry of Materials*, 27(4), 1316–1326.
- [18] Mesbah, A., Stojko, W., Lebègue, S., Malliakas, C., **Frazer, L.**, & Ibers, J. (2015). The  $\text{U}^{5+}$  compound  $\text{Ba}_9\text{Ag}_{10}\text{U}_4\text{S}_{24}$ : synthesis, structure, and electronic properties. *Journal of Solid State Chemistry*, 221, 398–404.
- [19] Okoniewski, S.,<sup>‡</sup> Wisniewski, D.,<sup>‡</sup> **Frazer, L.**, Mu, W., Arceo, A.,<sup>‡</sup> Rathi, P.,<sup>‡</sup> & Ketterson, J. B. (2014). Optorheological thickening under the pulsed laser photocrosslinking of a polymer. *Journal of Applied Polymer Science*, 131(17), 40690.
- [20] Chang, K. B., **Frazer, L.**, Schwartz, J. J.,<sup>‡</sup> Ketterson, J. B., & Poepelmeier, K. R. (2013). Removal of Copper Vacancies in Cuprous Oxide Single Crystals Grown by the Floating Zone Method. *Crystal Growth & Design*, 13(11), 4914–4922.

- [21] Jang, J. I., Park, S., **Frazer, L.**, Ketterson, J. B., Lee, S., Roy, B. K., & Cho, J. (2012). Strong P-band emission and third harmonic generation from ZnO nanorods. *Solid State Communications*, 152(14), 1241–1243.
- [22] He, J., Kanjanaboos, P., **Frazer, L.**, Weis, A., Lin, X. M., & Jaeger, H. M. (2010). Fabrication and Mechanical Properties of Large-Scale Free-standing Nanoparticle Membranes. *Small*, 6(13), 1449–1456.
- [23] Kramer, E. M., **Frazer, L.**, & Baskin, T. I. (2007). Measurement of diffusion within the cell wall in living roots of *Arabidopsis thaliana*. *Journal of Experimental Botany*, 58(11), 3005–3015.

‡ Mentee coauthor

SUBMITTED

- [1] Steiner, C. P., **Frazer, L.**, Yoon, Y., Chang, K. B., Poepelmeier, K. R., & Nelson, K. A., Two quantum  $1s$  “yellow” bi-orthoexciton coherences in cuprous oxide.
- [2] Dover, C. B.,<sup>‡</sup> Gallaher, J. K., **Frazer, L.**, Petty, A. J., Crossley, M. J., Anthony, J. E., & Schmidt, T. W., Endothermic singlet fission does not proceed via an excimer intermediate.
- [3] Tuladhar, A., Piontek, S., **Frazer, L.**, Borguet, E., The effect of halide ions on the structure and dynamics of water next to alumina surface.

‡ Mentee coauthor

INVITED TALKS

- [1] Nonlinear Physics Center, Research School of Physics and Engineering, Australian National University, February 12, 2016
- [2] Bard High School Early College, July 6, 2017

CONFERENCE TALKS

- [1] **Frazer, L.**, Gallaher, J., Schmidt, T. W., Sensitizing Triplets with Metalloporphyrins and Metalloiodoporphyrins, *RACI National Centenary Congress*, August 23–August 28, 2017.
- [2] **Frazer, L.**, Chang, K. B., Poepelmeier, K. R., & Ketterson, J. B., Photon/Exciton-Polariton Scattering Cross Section in Cuprous Oxide, *International Conference on the Physics of Semiconductors*, August 10–August 15, 2014.
- [3] **Frazer, L.**, Chang, K. B., Ocola, L., Stan, L., Rosenmann, D., Poepelmeier, K. R., & Ketterson, J. B., Fast optoelectronic spectroscopy of a cuprous oxide/copper Schottky barrier photovoltaic device, *Nanoscience and Spectroscopy 8*, July 28–July 31, 2014.
- [4] **Frazer, L.**, Chang, K. B., Poepelmeier, K. R., & Ketterson, J. B., Luminescence-Based Characterization of Copper Vacancies in Optical Float

Zone Refined Cuprous Oxide, *APS March Meeting*, February 27–March 2, 2012.

- [5] **Frazer, L.**, Schaller, R. D., Jang, J. I., Mani, S. E., & Ketterson, J. B., Polariton Formation Enhances Lifetimes of Dense Exciton Gasses in Cuprous Oxide by Suppressing Two-Exciton Decay, *APS March Meeting*, March 21–25, 2011.

CONFERENCE  
POSTERS

- [1] **Frazer, L.**, Schaller, R. D., Chang, K. B., Chernatynskiy, A., Poepelmeier, K. R., Phonon Induced Sub-Bandgap Absorption in Cuprous Oxide Captures a Bit More Sunlight *RACI National Centenary Congress*, August 23–August 28, 2017.
- [2] **Frazer, L.**, Gallaher, J., Schmidt, T. W., Controlling Sunlight to Achieve Practical Photochemical Upconversion Devices, *RACI National Centenary Congress*, August 23–August 28, 2017.
- [3] **Frazer, L.**, Photon Recycling in Photochemical Upconverters for Solar Energy: A Supplement to Solar Concentration, *RACI Physical Chemistry Student Conference*, September 25–26, 2016.
- [4] **Frazer, L.**, McKendry, I., Pellegrino, A., Shumlas, S., Thenuwara, A., Trainer, D., Iavarone, M., Karapetrov, G., Strongin, D., Wolak, M., Zdilla, M., Borguet, E., Optical Characterization of Functional Layered Materials, *International Conference on Nanoscience and Nanotechnology*, February 7–February 11, 2016.
- [5] **Frazer, L.**, Lenferink, E., Chang, K., Poepelmeier, K., Stern, N., Ketterson, J., Evaluation of Defects in Cuprous Oxide Through Exciton Luminescence Imaging: Strain, Vacancy Site, and Phonon Microscopy, *International Conference on Nanoscience and Nanotechnology*, February 7–February 11, 2016.
- [6] **Frazer, L.**, Schaller, R. D., Chang, K. B., Ketterson, J. B., & Poepelmeier, K. R., Efficiency Determination of Optical Third Harmonic Generation in Cuprous Oxide, *Argonne Users Meeting*, May 12–May 15, 2014.
- [7] **Frazer, L.**, Schaller, R. D., Chang, K. B., Poepelmeier, K. R., & Ketterson, J. B., Third Harmonic Generation in Cuprous Oxide, *Sixth International Conference on Spontaneous Coherence in Excitonic Systems*, August 27–August 31, 2012.

SERVICE

Reviewed for the journals *Optics Express* (2), *Journal of Photonics for Energy* (3), *Journal of Luminescence*, *Crystals* (2), *Materials Science in Semiconductor Processing*, *Matters*, and *Applied Physics A*.  
Reviewed for the funding agency NCN Poland (2).

Created professional development programming while on the Early Career Researcher's Committee, Center for Computational Design of Functional Layered Materials, 2015.

Conference session chair, RACI Physical Chemistry Student Conference, 2016.

Alumni Advisory Group, Bard Academy at Simon's Rock, 2014–2015.

Laboratory safety manager, 2011–2014.

Panelist giving graduate school advice to undergraduates for Northwestern *Ph.D. Preparation Program* (twice) and SPS.

#### OUTREACH

Volunteer judge, *Chicago Area Undergraduate Research Symposium*, 2014, *Undergraduate Research Symposium*, Temple University, 2015.

Created Northwestern Splash! program *Physics of Figure Skating* for high school students, 2011.

Lab tours for outreach programs with various audiences on five occasions.

Materials Research Center outreach volunteer at Evanston elementary and middle schools. Activities included synthesizing nanoparticles and polymer densification. 2009–2011.

*Physics with a Bang!* volunteer, 2008.

#### PROPOSALS ALLOCATED

[1] Borguet, E. (PI/Spokesperson), **Frazer, L.**, Aulin, Y., Tuladhar, A., Trainer, D., Iavarone, M., Control of exciton and trion dynamics in a semiconductor monolayer with interfacial dielectrics and dopants, *Center for Nanoscale Materials*, Fall 2015.

[2] **Frazer, L.** (PI/Spokesperson), Chang, K. B., Ketterson, J. B., Energy, phase, and beam mixing in centrosymmetric cuprous oxide, *Center for Nanoscale Materials*, Fall 2012.

[3] **Frazer, L.** (PI/Spokesperson), Chang, K. B., Ketterson, J. B., Electron beam lithography on cuprous oxide for measurement of exciton properties, *Center for Nanoscale Materials*, Fall 2012.

[4] **Frazer, L.** (PI/Spokesperson), Joon, J. I., Ketterson, J. B., High density exciton dynamics in cuprous oxide: elastic scattering and Auger processes, *Center for Nanoscale Materials*, Summer 2012.

[5] Ketterson, J. B. (PI/Spokesperson), **Frazer, L.**, Two-photon time resolved exciton-polariton studies in cuprous oxide, *Center for Nanoscale Materials*, Summer 2011.

#### REFERENCES AVAILABLE TO CONTACT

##### **John B. Ketterson**

- Fayerweather Professor of Physics, Astronomy, and EECS, Northwestern University
- ◇ 2145 Sheridan Road, Evanston, IL, 60208, USA



- ▷ e-mail: [j-ketterson@northwestern.edu](mailto:j-ketterson@northwestern.edu); phone: +1(847)491-5468
- ★ *My Ph.D. adviser and condensed matter guru.*

#### **Eric Borguet**

- Professor of Chemistry, Temple University
- ◇ 1901 North 13th Street, Philadelphia, PA, 19122, USA
- ▷ e-mail: [eborguet@temple.edu](mailto:eborguet@temple.edu); phone: +1(215)204-9696
- ★ *Postdoctoral mentor.*

#### **Richard D. Schaller**

- Scientist, Center for Nanoscale Materials, Argonne National Laboratory, U.S. Department of Energy
- Professor of Chemistry, Northwestern University
- ◇ 9700 South Cass Avenue, Building 440, Argonne, IL, 60439, USA
- ▷ e-mail: [schaller@anl.gov](mailto:schaller@anl.gov); phone: +1(630)525-1423
- ★ *Time resolved optics mentor and collaborator.*

#### **Kenneth R. Poeppelmeier**

- Associate Division Director for Science, Chemical Sciences & Engineering, Argonne National Laboratory, U.S. Department of Energy
- Charles E. & Emma H. Morrison Professor of Chemistry, Northwestern University
- ◇ 2145 Sheridan Road, Evanston, IL, 60208, USA
- ▷ e-mail: [krp@northwestern.edu](mailto:krp@northwestern.edu); phone: +1(847)491-3505
- ★ *Synthesis mentor.*