

Alexandra Brumberg

Postdoctoral Researcher at UC Santa Barbara

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Research Interests: Structural and electronic dynamics of optoelectronic inorganic (nano)materials, combining synthesis with ultrafast optical and structural characterization such as transient absorption, time-resolved photoluminescence, and transient X-ray diffraction

Education

- 2021 **Northwestern University**
Ph.D. in Chemistry (Solid State & Materials)
- 2016 **Tufts University**
B.S. in ACS-certified Chemistry and Mathematics, *summa cum laude*

Research Experience

- 2022 - present **University of California, Santa Barbara**
Materials Research Laboratory (MRL)
Advisors: Profs. **Ram Seshadri** and **Michael Chabinyc**
- Structure-Property Relationships of Metal Halide Perovskites
- 2021 - 2022 **University of California, Berkeley**
Department of Materials Science & Engineering
Advisor: Prof. **Ting Xu**
- Self-Assembly of Polymer Nanocomposites Under External Fields
- 2016 - 2021 **Northwestern University**
Department of Chemistry
Advisor: Prof. **Richard Schaller**
- Photophysics of Colloidal, Two-Dimensional Semiconductor Nanocrystals
- 2013 - 2016 **Tufts University**
Department of Chemistry
Advisor: Prof. **Mary Jane Shultz**
- Interfacial Energies and Surface Structure of Single-Crystal Hexagonal Ice, *highest thesis honors*

Awards and Scholarships

- 2021 **Gelewitz Award**
Award presented annually to two outstanding senior graduate students in the Northwestern chemistry department who demonstrate excellence in research and are active in the department and greater science community
- 2021 **University of California President's Postdoctoral Fellowship – Finalist**
Postdoctoral research fellowship intended to support outstanding women and minority Ph.D. recipients interested in academic careers who will contribute to diversity and equal opportunity in higher education at the University of California through their teaching, research, and service
- 2019 **Ryan Fellowship**
Supports Northwestern graduate students dedicated to the exploration of fundamental nanoscale science and to advancing this knowledge into practical applications of benefit to society
- 2018 **3M Graduate Research Fellowship**
Graduate research fellowship, awarded to two students at Northwestern each year, that provides support towards stipend and research costs

2018	CNM Invited Student Talk Award Award given to one graduate student each year by the Argonne Center for Nanoscale Materials (CNM); includes an invitation to give a talk at the plenary session of the APS/CNM Users Meeting
2016	National Science Foundation Graduate Research Fellowship Nationally competitive graduate research fellowship that covers tuition and stipend for three years
2016	National Defense Science & Engineering Fellowship (declined award in favor of accepting NSF GRFP) Nationally competitive graduate research fellowship that covers tuition and stipend for three years
2016	Andrew B. Kaufman Family Scholarship Tufts University named scholarship, awarded for high academic achievement and worthwhile extracurricular activities
2015	Tufts University Summer Research Scholarship Research funding and stipend awarded to fifty students each year to conduct summer research
2015, 2014	Parisis and Bessie Georgian Scholarship Tufts University named scholarship, awarded for high academic achievement and worthwhile extracurricular activities
2014	Audrey Butvay Gruss Science Award Tufts University academic award given annually (with preference to a female student) for outstanding academic work in any of the sciences

Publications

† Indicates equal contribution

Postdoctoral Research

25. Elusive Double Perovskite Iodides: Structural, Optical and Magnetic Properties

G. T. Kent, E. Morgan, K. R. Albanese, A. Kallistova, **A. Brumberg**, L. Kautzsch, G. Wu, P. Vishnoi, R. Seshadri, and A. K. Cheetham
Angew. Chem. **2023**. doi: 10.1002/ange.202306000

Graduate Research

24. Light-Induced Transient Lattice Dynamics and Metastable Phase Transition in CH₃NH₃PbI₃ Nanocrystals

A. A. Leonard, B. T. Diroll, N. C. Flanders, S. Panuganti, **A. Brumberg**, M. S. Kirschner, S. A. Cuthriell, S. M. Harvey, N. E. Watkins, J. Yu, M. R. Wasielewski, M. G. Kanatzidis, W. R. Dichtel, X. Zhang, L. X. Chen, and R. D. Schaller
ACS Nano **2023**, *17* (6), 5306–5315.

23. Non-Equilibrium Lattice Dynamics in Photo-Excited Two-Dimensional Perovskites

S. A. Cuthriell, S. Panuganti, C. C. Laing, M. A. Quintero, B. Guzelurk, N. Yazdani, B. Traore, **A. Brumberg**, C. D. Malliakas, A. M. Lindenberg, V. Wood, C. Katan, J. Even, X. Zhang, M. G. Kanatzidis, and R. D. Schaller
Adv. Mater. **2022**, *34* (44), 2202709

22. Acceleration of Biexciton Emission at Low Temperatures in CdSe Nanoplatelets

A. Brumberg, N. E. Watkins, B. T. Diroll, and R. D. Schaller
Nano Lett. **2022**, *22* (17), 6997–7004.

21. Compositionally Tuning Electron Transfer from Photoexcited Core/Shell Quantum Dots via Cation Exchange

N. Nagelj, **A. Brumberg**, S. Peifer, R. D. Schaller, and J. H. Olshansky
J. Phys. Chem. Lett. **2022**, *13* (14), 1309–1316.

20. Gain Roll-Off in Cadmium Selenide Colloidal Quantum Wells Under Intense Optical Excitation

B. T. Diroll, **A. Brumberg**, and R. D. Schaller
Sci. Rep. **2022**, *12*, 8016.

19. Very Robust Spray-Synthesized CsPbI₃ Quantum Emitters with Ultrahigh Room-Temperature Cavity-Free Brightness and Self-Healing Ability

B.-W. Hsu, Y.-T. Chuang, C.-Y. Cheng, C.-Y. Chen, Y.-J. Chen, **A. Brumberg**, L. Yang, Y.-S. Huang, R. D. Schaller, L.-J. Chen, C.-S. Chuu, and H.-W. Lin
ACS Nano **2021**, *15* (7), 11358–11368.

- 18. Signatures of Coherent Phonon Transport in Ultralow Thermal Conductivity Two-Dimensional Ruddlesden-Popper Phase Perovskites**
A. D. Christodoulides, P. Guo, L. Dai, J. M. Hoffman, X. Li, X. Zuo, D. Rosenmann, **A. Brumberg**, M. G. Kanatzidis, R. D. Schaller, and J. A. Malen
ACS Nano **2021**, *15* (3), 4165–4172.
- 17. Photothermal Behaviour of Titanium Nitride Nanoparticles Evaluated by Transient X-Ray Diffraction**
B. T. Diroll[†], **A. Brumberg**[†], A. A. Leonard, S. Panuganti, N. E. Watkins, S. A. Cuthriell, S. M. Harvey, E. D. Kingstein, J. Yu, X. Zhang, M. G. Kanatzidis, M. R. Wasielewski, L. X. Chen, and R. D. Schaller
Nanoscale **2021**, *13*, 2658–2664.
- 16. Anisotropic Transient Disordering of Colloidal, Two-Dimensional Semiconductor Nanoplatelets Upon Optical Excitation**
A. Brumberg, M. S. Kirschner, B. T. Diroll, K. R. Williams, N. C. Flanders, S. M. Harvey, A. A. Leonard, N. E. Watkins, C. Liu, E. D. Kingstein, J. Yu, A. M. Evans, Y. Liu, S. A. Cuthriell, S. Panuganti, W. R. Dichtel, M. G. Kanatzidis, M. R. Wasielewski, X. Zhang, L. X. Chen, and R. D. Schaller
Nano Lett. **2021**, *21* (3), 1288–1294.
- 15. Transient Lattice Response Upon Photoexcitation in CuInSe₂ Nanocrystals with Organic or Inorganic Surface Passivation**
S. M. Harvey, D. W. Houck, M. S. Kirschner, N. C. Flanders, **A. Brumberg**, A. A. Leonard, N. E. Watkins, R. L. Li, L. X. Chen, W. R. Dichtel, X. Zhang, B. A. Korgel, M. R. Wasielewski, and R. D. Schaller
ACS Nano **2020**, *14* (10), 13548–13556.
- 14. Area and Thickness Dependence of Auger Recombination in Nanoplatelets**
J. P. Philbin, **A. Brumberg**, B. T. Diroll, W. Cho, D. V. Talapin, R. D. Schaller, and E. Rabani
J. Chem. Phys. **2020**, *153*, 054104.
- 13. Bright Silicon Nanocrystals from a Liquid Precursor: Quasi-Direct Recombination with High Quantum Yield**
T. A. Pringle, K. I. Hunter, **A. Brumberg**, K. Anderson, J. A. Fagan, S. A. Thomas, R. J. Petersen, M. Sefannaser, Y. Han, S. L. Brown, D. S. Kilin, R. D. Schaller, U. R. Kortshagen, P. Boudjouk, and E. K. Hobbie
ACS Nano **2020**, *14* (4), 3858–3867.
- 12. Emissive Single-Crystalline Boroxine-Linked Colloidal Covalent Organic Frameworks**
A. M. Evans, I. Castano, **A. Brumberg**, L. R. Parent, A. R. Corcos, R. L. Li, N. C. Flanders, D. J. Gosztola, N. C. Gianneschi, R. D. Schaller, and W. R. Dichtel
J. Am. Chem. Soc. **2019**, *141* (50), 19728–19735.
- 11. Determination of the In-Plane Exciton Radius in 2D CdSe Nanoplatelets via Magneto-Optical Spectroscopy**
A. Brumberg, S. M. Harvey, J. P. Philbin, B. T. Diroll, B. Lee, S. A. Crooker, M. R. Wasielewski, E. Rabani, and R. D. Schaller
ACS Nano **2019**, *13* (8), 8589–8596.
- 10. Disphenoidal Zero-Dimensional Lead, Tin, and Germanium Halides: Highly Emissive Singlet and Triplet Self-Trapped Excitons and X-ray Scintillation**
V. Morad, Y. Shynkarenko, S. Yakunin, **A. Brumberg**, R. D. Schaller, and M. V. Kovalenko
J. Am. Chem. Soc. **2019**, *141* (25), 9764–9768.
→ JACS Most Highly Cited Publication, 2018-19
- 9. Synthesis of Type I PbSe/CdSe Dot-on-Plate Heterostructures with Near-Infrared Emission**
K. R. Williams, B. T. Diroll, N. E. Watkins, X. Rui, **A. Brumberg**, R. F. Klie, and R. D. Schaller
J. Am. Chem. Soc. **2019**, *141* (13), 5092–5096.
- 8. Photoinduced, Reversible Phase Transition in All-Inorganic Perovskite Nanocrystals**
M. S. Kirschner, B. T. Diroll, P. Guo, S. M. Harvey, W. Helweh, N. C. Flanders, **A. Brumberg**, N. E. Watkins, A. A. Leonard, A. M. Evans, W. R. Dichtel, X. Zhang, L. X. Chen, and R. D. Schaller
Nat. Commun. **2019**, *10*, 504.
- 7. Semiconductor Nanoplatelet Excimers**
B. T. Diroll, W. Cho, I. Coropceanu, S. M. Harvey, **A. Brumberg**, N. Holtgrewe, S. A. Crooker, M. R. Wasielewski, V. B. Prakapenko, D. V. Talapin, and R. D. Schaller
Nano Lett. **2018**, *18* (11), 6948–6953.
- 6. Optical Signatures of Transiently Disordered Semiconductor Nanocrystals**
M. S. Kirschner, B. T. Diroll, **A. Brumberg**, A. A. Leonard, D. C. Hannah, L. X. Chen, and R. D. Schaller
ACS Nano **2018**, *12* (10), 10008–10015.

5. **Material Dimensionality Effects on Electron Transfer Rates between CsPbBr₃ and CdSe Nanoparticles**
A. Brumberg, B. T. Diroll, G. Nedelcu, M. E. Sykes, Y. Liu, S. M. Harvey, M. R. Wasielewski, and R. D. Schaller
Nano Lett. **2018**, *18* (8), 4771–4776.

Undergraduate Research

4. **Homogeneous Ice Nucleation Rates and Crystallization Kinetics in Transiently-Heated, Supercooled Water Films from 188 K to 230 K**
G. A. Kimmel, Y. Xu, **A. Brumberg**, N. G. Petrik, R. S. Smith, and B. D. Kay
J. Chem. Phys. **2019**, *150*, 204509.
3. **Single Crystal Ice Surface: Connecting Macroscopic Etch Pits and Molecular Structure**
A. Brumberg, K. Hammonds, I. Baker, E. H. G. Bakus, P. J. Bisson, M. Bonn, C. P. Daghljan, M. Mezger, and M. J. Shultz
Proc. Natl. Acad. Sci. U.S.A. **2017**, *114* (21), 5349–5354.
2. **Producing Desired Ice Faces**
M. J. Shultz, **A. Brumberg**, P. J. Bisson, and R. Shultz
Proc. Natl. Acad. Sci. U.S.A. **2015**, *112* (45), E6096–E6100.
1. **Best Face Forward: Crystal Face Competition at the Ice-Water Interface**
M. J. Shultz, P. J. Bisson, and **A. Brumberg**
J. Phys. Chem. B **2014**, *118* (28), 7972–7980.

Presentations

Invited Talks

11. Postdoc-to-PI Symposium, Department of Chemistry, The Pennsylvania State University; July 2023
10. Department of Chemistry, Purdue University; Feb. 2023
9. Atomically Precise Nanochemistry Gordon Research Conference; Oct. 2022
8. Materials Science Division, Lawrence Livermore National Laboratory; Aug. 2022
7. Materials Department, University of California, Santa Barbara; June 2022
6. High Pressure Physics Division, Lawrence Livermore National Laboratory; June 2022
5. Ultrafast X-ray Techniques for Monitoring Dynamic Structural and Electronic Responses at the Nanoscale, APS/CNM Users Meeting; May 2021
4. News in Nanocrystals (NiNC) Seminar; Apr. 2021
3. SPIE Student Seminar Series, Northwestern University; Jan. 2021
2. Just Another (Chemistry) Webinar Series (JAWS Chem); Dec. 2020
1. APS/CNM Users Meeting; May 2018 (through the **CNM Invited Student Talk** award)

Contributed Presentations

12. Colloidal Semiconductor Nanocrystals Gordon Research Seminar & Conference; July 2022 (poster)
11. Materials Research Society (MRS) Spring Meeting; Apr. 2021 (talk)
10. Materials Research Society (MRS) Spring Meeting; Apr. 2021 (talk)
9. COLL LiveStream Programming, American Chemical Society (ACS) National Meeting; Aug. 2020 (talk)
8. Shape-Controlled Nanocrystals: Synthesis, Characterization Methods, and Applications (ShapeNC); May 2020 (poster)
7. Atomically Precise Nanochemistry Gordon Research Conference; Feb. 2020 (poster)
6. SPIE Focus: Light and Matter; Oct. 2019 (talk, awarded **Best Student Presentation**)
5. APS/CNM Users Meeting; May 2019 (poster, awarded **CNM Best Student Poster**)
4. American Chemical Society (ACS) National Meeting; Apr. 2019 (talk)
3. American Chemical Society (ACS) National Meeting; Apr. 2019 (talk)
2. American Chemical Society (ACS) National Meeting; Aug. 2015 (poster)
1. International Conference on the Physics and Chemistry of Ice (PCI); Mar. 2013 (poster)

Teaching Experience

Northwestern University

- 2020 - 2021 **Chemistry for Nanomaterials**
Developed a course curriculum for a new course, "Chemistry of Nanomaterials," through the Teaching Certificate Program. Course documents available online at brumberg.weebly.com/teaching
- Spring 2020 **CHEM 220: Introductory Instrumental Analysis**
Developed online activities for the FTIR/Raman and HPLC experiments
- Winter 2018 **CHEM 350-2: Advanced Laboratory Course**
Primary teaching assistant for a week-long atomic spectroscopy experiment (20 contact hrs)
- Winter 2017 **CHEM 350-2: Advanced Laboratory Course**
Shadow teaching assistant for a week-long atomic spectroscopy experiment (20 contact hrs)
- Spring 2017 **CHEM 123: General Physical Chemistry Laboratory**
Teaching assistant (40 contact hours)
- Winter 2017 **CHEM 182: Accelerated General Physical Chemistry Laboratory**
Teaching assistant (20 contact hours)
- Fall 2016 **CHEM 181: Accelerated General Inorganic Chemistry Laboratory**
Teaching assistant (40 contact hours)

Tufts University

- Spring 2016 **CHEM 1: Chemistry Fundamentals Laboratory**
Teaching assistant (33 contact hours)
- Tufts Literacy Corps**
- 2013 - 2016 Math tutor for grades 2-9
- 2015 - 2016 Math tutoring coordinator, responsible for leading biweekly tutoring meetings to discuss tutoring progress and strategies and coordinating tutoring between 30+ tutors and 50+ families

Grants

2022 Atomically Precise Nanochemistry Gordon Research Conference and Gordon Research Seminar

Department of Energy, DE-SC0023071, 9/1/2022 – 8/31/2023: \$12,800

2022 Gordon Research Conferences

Air Force Office of Scientific Research, FA9550-22-1-0079, 12/17/2021 – 12/16/2022: \$7,950

Professional Development

- 2023 **Penn State Postdoc-to-PI Symposium**
Two day future faculty workshop/symposium for postdocs in which invited participants deliver a research seminar and chalk talk and meet with Penn State faculty in preparation for applying for faculty jobs
- 2022 **NextProf Science**
Week-long future faculty workshop design to encourage talented scientists with a demonstrated commitment to diversity to consider academia
- 2020 - 2021 **Teaching Certificate Program**
Year-long certificate program through the Searle Center at Northwestern University in which participants learn about pedagogy, compose a teaching statement, and design their own course
- 2019 **Management for Scientists and Engineers**
Certificate program through the Kellogg School of Management at Northwestern University
- 2017 **ComSciCon-Chicago**
Weekend-long regional scientific communication conference and workshop

Service

Outreach

- 2023 - 2026 **Pre-Scientist, Inc. Board of Directors**
Member of the board of directors for Pre Scientist, Inc., a non-profit organization that operates the Letters to a Pre-Scientist (LPS) program. LPS pairs STEM professionals with students in low-income schools as pen pals (20 hrs/yr)
- 2018 - 2026 **Letters to a Pre-Scientist (LPS) Advisory Board**
Member of the advisory board for the Letters to a Pre-Scientist (LPS) program. Helped support, evaluate, and develop the LPS program, particularly through individual and corporate fundraising and donor retention (30 hrs/yr)
- 2017 - present **Letters to a Pre-Scientist (LPS) Pen Pal**
Wrote 4 letters a year to middle school students about science, higher education, and life in general (6 hrs/yr)
- 2023 **Materials Research Laboratory (MRL) Outreach**
Participated in various outreach events hosted by the UC Santa Barbara Materials Research Laboratory (MRL), such as the Build-a-Buckyball and Solar Racecars workshops, for middle school and high school students (4 hrs)
- 2022 **Science Accelerating Girls Engagement (SAGE)**
Helped refine professional development workshops for SAGE, a girls' summer camp at Lawrence Berkeley National Laboratory, and read applications (10 hrs)
- 2018 - 2020 **Science with Seniors**
Prepared and delivered presentations on science topics relevant to policy at senior homes in the Chicago area (2-3 presentations/yr)
- 2017 - 2020 **Skype a Scientist**
Skyped with middle- or high-school classrooms about what it is like to work as a scientist (4 hrs/yr)
- 2019 **Expanding Your Horizons (EYH) Winter - Chicago**
Volunteered with set-up and registration at EYH, where high school students from the Chicago north side came to Northwestern to learn about and engage with science for half a day (6 hrs)
- 2018 **HerStory**
Led a group of students around the Museum of Science & Industry to learn about successful women in science throughout history (herstory!) (6 hrs)

Mentorship

- Graduate students Owen Kuklinski (2022 - present); Alexandra Zele (2022 - present)
- Undergraduate students Yunyan Lai (2023 - present); Shoshanna Peifer (2021)
- 2021 - 2022 **DisabledinSTEM**
Mentored two graduate students who identify as disabled in STEM (10 hrs)
- 2022 **POWER**
Mentored a community college student majoring in science regarding the transfer process to a four-year college, pursuing research, and applying to graduate school (6 hrs)
- 2017 - 2021 **ChemUnity**
Peer mentor to incoming first-year graduate students in the Northwestern chemistry department (4 hrs/yr)
- 2019, 2021 **Cientifico Latino**
Mentored a URM student on her graduate school applications and fellowships (10 hrs)

Conference Service

- 2020 - 2022 **Gordon Research Symposium (GRS) Chair**
Chair for the 2022 Atomically Precise Nanochemistry GRS
- 2015 - 2016 **Tufts Undergraduate Research & Scholarship Symposium (URSS)**
One of four student organizers for the annual undergraduate research symposium (20 hrs)

University Service

- 2022 **Science Leadership and Management (SLAM)**
Member of the organizing committee for SLAM, seminar/workshop series developed by graduate students and postdoctoral researchers focused on understanding the many interpersonal interactions critical for success in a scientific lab, as well as some practical aspects of lab management
- 2017 - 2020 **Women in Science and Engineering Research (WISER)**
President (2019-20) and webmaster (2017-19) of WISER, a graduate student organization for female-identifying graduate students in STEM at Northwestern that focuses on professional development and community building

Department Service

- 2018 - 2020 **Phi Lambda Upsilon (PLU)**
Awards chair (2019-20) and secretary (2018-19) of PLU, a graduate student organization in the chemistry department focused on service
- 2019, 2022 **Gelewitz Award Committee**
Helped select the finalists for the Gelewitz Award, which is given to two students every year for outstanding senior research in the Northwestern chemistry department (*7 hrs/yr*)
- 2013 - 2016 **American Chemical Society (ACS) Student Chapter**
President (2015-16), treasurer (2013-15), and founding member (2013) of the Tufts University ACS student chapter

Peer Review

- ACS ACS Central Science (1)
Chemistry of Materials (1)
Journal of Physical Chemistry (1)
- APS Physical Review Materials (1)

Affiliations

- 2013 - present American Chemical Society (ACS)
- 2015 - 2021 American Association for the Advancement of Science (AAAS)
- 2016 - present Phi Beta Kappa
- 2020 - present Materials Research Society (MRS)