

# Darien J. Morrow

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I build computationally reproducible acquisition, analysis, simulation, and representation pipelines using Python. I am interested in spectroscopy, nonlinear optics, lasers, magnetic resonance, and algorithm development.

## EDUCATION & WORK

### Center for Nanoscale Materials at Argonne National Laboratory

2020 - Present

*Postdoctoral Appointee supervised by Xuedan Ma*

Lemont, IL

- Researching doped low-dimensional materials as RF to NIR transducers for Quantum Information Science.
- Building a cryogenic, paramagnetic spin resonance microscope.
- Modeling nanolasers, noise sources & transients in single-photon detectors, exciton trapping, and RF antennas

### University of Wisconsin–Madison

2015 - 2020

*PhD: Physical Chemistry. Advised by John C. Wright. GPA: 4.0/4.0*

Madison, WI

- Pioneered harmonic generation as an ultrafast probe of semiconductor symmetry and excited state dynamics. Work culminated in *U.S. Patent 10,823,664 Ultrafast, multiphoton-pump, multiphoton-probe spectroscopy*.
- Analyzed/modeled data for wide variety of materials chemistry projects in collaboration with Song Jin group.
- Contributed to open source software projects. c.f. `wright.tools` and DOI: 10.21105/joss.01141
- Responsible for maintenance and furtherance of custom ultrafast laser systems including construction of new optomechanical & electronic hardware, training new users, and troubleshooting hardware & software

### Missouri Western State University

2011-2015

*BS (Honors): Chemistry; Minors: Mathematics & Physics. GPA: 4.0/4.0*

Saint Joseph, MO

## PUBLICATIONS

- *In preparation:* Morrow, D. J.; Room temperature paramagnetic spins in carbon nanotubes with  $sp^3$  defects.
  - *In preparation:* Morrow, D. J.; Coherent modulation of broadband optical harmonic generation in graphene.
  - *In preparation:* Morrow, D. J.; Ferrimagnetic states with tunable, chiral emission in layered  $BaFMn_{0.5}Te$ .
  - *In preparation:* Morrow, D. J.; Modulation of carbon nanotube emission with GHz split ring resonators.
  - *In preparation:* Morrow, D. J.; Ultrafast dynamics of  $WS_2$ - $MoS_2$  Lateral Heterojunctions.
  - *Submitted:* Kohler, D. D.; Morrow, D. J.; Spatially Resolved Spectroscopy Reveals the Disorder of  $WS_2$ - $MoS_2$  Lateral Heterojunctions.
  - *Submitted:* Lu, S.<sup>†</sup>; Morrow, D. J.<sup>†</sup>; et. al. Encapsulating Semiconductor Quantum Dots in Supramolecular Cages Enables Ultrafast Guest-Host Electron and Vibrational Energy Transfer. <sup>†</sup>: equal author contribution
  - *Submitted:* Morrow, D. J.; Ma, X. Noisy detectors with unmatched detection efficiency thwart identification of single photon emitters via photon coincidence correlation. [arXiv:2204.07654](https://arxiv.org/abs/2204.07654).
  - *Submitted:* Morrow, D. J.; Ma, X. Facile reconstruction of time-resolved fluorescence data with exponentially modified Gaussians. [arXiv:2201.03561](https://arxiv.org/abs/2201.03561).
13. Chen, J-S.; et. al. Room Temperature Lasing from Semiconducting Single-Walled Carbon Nanotubes. *ACS Nano*. DOI: 10.1021/acsnano.2c06419. **2022**.
  12. Morrow, D. J.; Ma, X. Trapping Interlayer Excitons in van der Waals Heterostructures by Potential Arrays. *PRB*. DOI: 10.1103/PhysRevB.104.195302. **2021**.
  11. Lohmann, S.; et. al. Brightening of Dark States in  $CsPbBr_3$  Quantum Dots Caused by Light-Induced Magnetism. *Small*. DOI: 10.1002/smll.202101527. **2021**
  10. Pan, D.; et. al. Deterministic fabrication of arbitrary vertical heterostructures of 2D Ruddlesden-Popper halide perovskites. *Nature Nanotechnology*. DOI:10.1038/s41565-020-00802-2. **2020**
  9. Morrow, D. J.; et. al. Quantum interference between the optical Stark effect and resonant harmonic generation in  $WS_2$ . *PRB*. DOI: 10.1103/PhysRevB.102.161401. **2020**.

8. **Morrow, D. J.**; et. al. Disentangling Second Harmonic Generation from Multiphoton Photoluminescence in Halide Perovskites using Multidimensional Harmonic Generation. *JCPL*. DOI:10.1021/acs.jpclett.0c01720. **2020**
7. Hautzinger, et. al. Band Edge Tuning of 2D Ruddlesden-Popper Perovskites by A Cation Size Revealed through Nanoplates. *ACS Energy Lett.* DOI:10.1021/acsenerylett.0c00450. **2020**.
6. **Morrow, D. J.**; et. al. Triple sum frequency pump-probe spectroscopy of transition metal dichalcogenides. *PRB*. DOI: 10.1103/PhysRevB.100.235303. **2019**.
5. Thompson, B. J.; et. al. WrightTools: a Python package for multidimensional spectroscopy *JOSS*. DOI: 10.21105/joss.01141. **2019**.
4. **Morrow, D. J.**; et. al. Multidimensional Triple Sum-Frequency Spectroscopy of MoS<sub>2</sub> and Comparisons with Absorption and Second Harmonic Generation Spectroscopies. *JCP*. DOI: 10.1063/1.5047802. **2018**.
3. **Morrow, D. J.**; et. al. Group and phase velocity mismatch fringes in triple sum-frequency spectroscopy. *PRA*. DOI: 10.1103/PhysRevA.96.063835. **2017**.
2. Fu, Y.; et. al. Selective Stabilization and Photophysical Properties of Metastable Perovskite Polymorphs of CsPbI<sub>3</sub> in Thin Films. *Chem. Mater.* DOI: 10.1021/acs.chemmater.7b02948. **2017**.
1. Chen, J.; **Morrow, D. J.**; et. al. Single-Crystal Thin Films of Cesium Lead Bromide Perovskite Epitaxially Grown on Metal Oxide Perovskite (SrTiO<sub>3</sub>). *JACS* DOI: 10.1021/jacs.7b07506. **2017**.

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## SERVICE ACTIVITIES & COMMUNITY INVOLVEMENT

- Member of ANL's Nanoscience and Technology Diversity, Equity, and Inclusion Working Group. 2021-present
- Volunteer with the Palos Restoration Project and the Forest Preserves of Cook County. 2021-present
- Reviewer for *Journal of Chemical Physics* and *Physical Review Letters*
- Hosted "Detector Building" at the Wisconsin Science Olympiad Regional Tournament. 2020
- Organized physical chemistry seminar series. 2018-2019
- Moderated the annual Wisconsin Middle School Science Bowl (sponsored by the DOE). 2017-2020
- Taught/supervised electronics for a week to high schoolers in the PEOPLE program. 2017
- Served on panels for UW & KU REU students to discuss graduate school and careers. 2017 & 2022
- Served as vice-president (2014-2015) and member of MWSU's ACS affiliated Chemistry club. This included organizing community events like Super Science Saturday and Chemathon at MWSU. 2011-2015

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## FELLOWSHIPS, AWARDS, & HONORS

- (One of three finalists) APS Justin Jankunas Doctoral Dissertation Award in Chemical Physics. 2021.
- Richard and Joan Hartl Award for Research Excellence in Physical Chemistry. 2020.
- Roger Carlson Memorial Award for Excellence in Analytical Chemistry. 2018.
- Link Foundation Energy Fellowship (full graduate school stipend). July 2018 - June 2020.
- NSF Graduate Research Fellowship Program, Honorable mention. 2017.
- MWSU Department of Chemistry, Edgar C. Little Outstanding Student Award. 2015.
- ACS Division of Analytical Chemistry, Undergraduate Award in Analytical Chemistry. 2015.
- ACS Division of Inorganic Chemistry, Undergraduate Award in Inorganic Chemistry. 2013.
- MWSU President's Honor's List. Fall 2011 - spring 2015.
- NSF funded Midwest Apex Project scholarship. Fall 2011 - spring 2015.
- Golden Griffon Honors scholarship. Fall 2011 - spring 2015.