

# Darien J. Morrow

Postdoctoral Appointee at Argonne National Laboratory's Center for Nanoscale Materials

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## EDUCATION

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### University of Wisconsin–Madison

2015 - 2020

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

Madison, WI

- Dissertation title: Development of multidimensional spectroscopies to investigate transition metal dichalcogenide and lead halide perovskite semiconductors

### Missouri Western State University

2011-2015

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

Saint Joseph, MO

## RESEARCH & WORK EXPERIENCE

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### Center for Nanoscale Materials at Argonne National Laboratory

2020 - Present

*Postdoctoral Appointee supervised by Xuedan Ma*

Lemont, IL

- Researching excitonic, polaronic, and electronic properties of doped low-dimensional materials as photonic sources for Quantum Information Science
- Developing cryogenic magneto-optical microscopy techniques

### John C. Wright Research Group

2015 - 2020

*Graduate Assistant*

Madison, WI

- Pioneered spectrally resolved harmonic generation as a probe of semiconductor excited state dynamics
- Developed a suite of ultrafast techniques to explore excited state dynamics of thin film semiconductors relevant to photovoltaics (lead halide perovskites and transition metal dichalcogenides)
- Responsible for maintenance and furtherance of custom ultrafast laser systems including construction of new optomechanical & electronic hardware, training new users, and troubleshooting hardware & software

## SOFTWARE SKILLS

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- Python and the scientific Python software stack (numpy, matplotlib, scipy, h5py)
- Working knowledge: Arduino, Git, Latex, Autodesk Inventor
- Active contributor/maintainer of open source projects:
  - WrightTools (library): loading, processing, and plotting of multidimensional spectroscopy data
  - PyCMDS (application): orchestrating many pieces of hardware into multidimensional spectrometers
  - attune (library): tuning/calibrating multidimensional spectrometers

## PATENTS

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- *U.S. Patent awarded, filed 2019-06-20* **Morrow, D. J.**; Kohler, D. D.; Wright, J. C. Ultrafast, multiphoton-pump, multiphoton-probe spectroscopy.

## PUBLICATIONS

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- *In preparation:* **Morrow, D. J.**; Ma, X. Understanding interlayer exciton trapping in two-dimensional heterostructures with discrete, random-walk simulations
  - *In preparation:* **Morrow, D. J.**; et. al. Ultrafast, multidimensional pump-probe spectroscopy of atomically thin WS<sub>2</sub>-MoS<sub>2</sub> lateral heterostructures
10. Pan, D.; Fu, Y.; Spitha, N.; Zhao, Y.; Roy, C.; **Morrow, D. J.**; 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.**; Kohler, D. D.; Zhao, Y.; Scheeler, J. M.; Jin, S.; Wright, J. C. Quantum interference between the optical Stark effect and resonant harmonic generation in  $WS_2$ . *Physical Review B*. 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. *Journal of Physical Chemistry Letters*. DOI:10.1021/acs.jpclett.0c01720. **2020**
7. Hautzinger, M. P.; Pan, D.; Piggs, A. K.; Fu, Y.; **Morrow, D. J.**; et. al. Band Edge Tuning of 2D Ruddlesden-Popper Perovskites by A Cation Size Revealed through Nanoplates. *ACS Energy Letters*. DOI:10.1021/acsenerylett.0c00450. **2020**.
6. **Morrow, D. J.**; et. al. Triple sum frequency pump-probe spectroscopy of transition metal dichalcogenides. *Physical Review B*. DOI: 10.1103/PhysRevB.100.235303. **2019**.
5. Thompson, B. J.; Sunden, K. F.; **Morrow, D. J.**; et. al. WrightTools: a Python package for multidimensional spectroscopy *The Journal of Open Source Software*. DOI: 10.21105/joss.01141. **2019**.
4. **Morrow, D. J.**; et. al. Communication: Multidimensional Triple Sum-Frequency Spectroscopy of  $MoS_2$  and Comparisons with Absorption and Second Harmonic Generation Spectroscopies. *Journal of Chemical Physics*. DOI: 10.1063/1.5047802. **2018**.
3. **Morrow, D. J.**; et. al. Group and phase velocity mismatch fringes in triple sum-frequency spectroscopy. *Physical Review A*. DOI: 10.1103/PhysRevA.96.063835. **2017**.
2. Fu, Y.; Rea, M. T.; Chen, J.; **Morrow, D. J.**; et. al. Metastable Perovskite Polymorphs of  $CsPbI_3$  in Thin Films. *Chemistry of Materials* 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 ( $SrTiO_3$ ). *J. Am. Chem. Soc.* DOI: 10.1021/jacs.7b07506. **2017**.

## FELLOWSHIPS & SCHOLARSHIPS

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- Link Foundation Energy Fellowship (full graduate school stipend). July 2018 - June 2020.
- Pei Wang Fellowship. Fall 2015 - spring 2016.
- Golden Griffon Honors scholarship. Fall 2011 - spring 2015.
- NSF funded Midwest Apex Project scholarship. Fall 2011 - spring 2015.
- Missouri Bright Flight scholarship. Fall 2011 - spring 2015.

## AWARDS & HONORS

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- Richard and Joan Hartl Award for Research Excellence in Physical Chemistry. 2020.
- Roger Carlson Memorial Award for Excellence in Analytical Chemistry. 2018.
- 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.

## SERVICE ACTIVITIES & COMMUNITY INVOLVEMENT

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- Hosted "Detector Building" competition at the Science Olympiad Regional Tournament. Winter 2020
- Organized weekly seminar series physical chemistry graduate students. 2018-2019
- Served as a moderator for the annual Wisconsin Middle School Science Bowl. 2017-present.
- Taught/supervised electronics for a week to high schoolers in the PEOPLE program. Summer 2017.
- Talked and demonstrated to Institute of Chemical Education summer camp attendees about my research, renewable energy, and how solar cells work. Summer 2017.
- Vice-president (2014-2015) and member of MWSU's ACS affiliated Chemistry club. 2011-2015.
- Aided in the organization of Super Science Saturday and Chemathon at MWSU. 2011-2015.