

# Darien J. Morrow

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## EDUCATION

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### University of Wisconsin–Madison

2015 - summer 2020 [anticipated]

*PhD: Physical Chemistry. GPA: 4.0/4.0*

Madison, WI

- Adviser: John C. Wright.
- Dissertation title [anticipated]: Multidimensional Spectroscopy of Transition Metal Dichalcogenide Nanostructures and Heterostructures

### 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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### John C. Wright Research Group

2015 - Present

*Graduate Assistant*

Madison, WI

- Pioneering spectrally resolved harmonic generation as a probe of semiconductor excited state dynamics
- Using and developing a suite of ultrafast techniques to explore excited state dynamics of thin film semiconductors relevant to photovoltaics (lead halide perovskites and transition metal dichalcogenides)
- Developing open-source software packages for the collection, processing, and modeling of multidimensional spectra (see [github.com/wright-group](https://github.com/wright-group))
- Responsible for maintenance and furtherance of custom ultrafast laser systems including construction of new optomechanical & electronic hardware, training new users, and troubleshooting hardware & software

### Christopher G. Elles Research Group

2014

*REU Fellow*

Lawrence, KS

- Investigated the excited state dynamics of substituted thiophene photo-rearrangement reactions
- Developed and implemented reaction quantum yield measurement technique
- Used ultrafast transient absorption spectroscopy to probe singlet and triplet excited state manifolds

### Michael W. Ducey Research Group

2011 - 2012

*Undergraduate Assistant*

Saint Joseph, MO

- Investigated the solvatochromism of room temperature ionic liquids (RTILs) in common solvents
- Demonstrated the solvents can induce order in the alkyl side chains of methylimidazolium RTILs

### Morrow Contracting and Construction LLC

2011 - 2015

*Skilled Laborer*

Saint Joseph, MO

## PUBLICATIONS

*In preparation:* **Morrow, D. J.**; Kohler, D. D.; Zhao, Y.; Jin, S.; Wright, J. C. The optical Stark effect in optical harmonic generation from transition metal dichalcogenide screw dislocations.

*In preparation:* **Morrow, D. J.**; Kohler, D. D.; Zhao, Y.; Scheeler, J. M.; Jin, S.; Wright, J. C. Ultrafast, multidimensional pump-probe spectroscopy of atomically thin WS<sub>2</sub>-MoS<sub>2</sub> lateral heterostructures

*In preparation:* **Morrow, D. J.**; Hautzinger, M. P.; Lafayette, D. P.; Scheeler, J. M.; Dang, L.; Leng, M.; Kohler, D. D.; Wheaton, A. M.; Fu, Y.; Guzei, I. A.; Tang, J.; Jin, S.; Wright, J. C. Multidimensional Harmonic Generation as a Probe of Lead-Halide Perovskite Crystal Symmetry: Disentangling Second Harmonic Generation from Multiphoton Photoluminescence.

*Submitted:* Hautzinger, M. P.; Pan, D.; Piggs, A. K.; Fu, Y.; **Morrow, D. J.**; Leng, M.; Kuo, M.; Spitha, N.; Lafayette, D. P.; Kohler, D. D.; Wright, J. C.; Jin, S. Band Edge Tuning of 2D Ruddlesden-Popper Perovskites by A Cation Size Revealed through Nanocrystals.

· Code repository: DOI 10.17605/OSF.IO/m9dnw.

*Submitted:* Pan, D.; Fu, Y.; Luo, Z.; Zhao, Y.; **Morrow, D. J.**; Roy, C.; Liu, B.; Chen, S.; Wright, J. C.; Pan, A.; Jin, S. Deterministic fabrication of arbitrary 2D Ruddlesden-Popper halide perovskite heterostructures with emergent interlayer properties

6. **Morrow, D. J.**; Kohler, D. D.; Zhao, Y.; Jin, S.; Wright, J. C. Triple sum frequency pump-probe spectroscopy of transition metal dichalcogenides. *Physical Review B*. DOI: 10.1103/PhysRevB.100.235303. **2019**.

· Preprint: arXiv:1909.06445.

· Data and code repository: DOI 10.17605/OSF.IO/UMSXC.

5. Thompson, B. J.; Sunden, K. F.; **Morrow, D. J.**; Kohler, D. D.; Wright, J. C. WrightTools: a Python package for multidimensional spectroscopy *The Journal of Open Source Software*. DOI: 10.21105/joss.01141. **2019**.

4. **Morrow, D. J.**; Kohler, D. D.; Czech, K. J.; Wright, J. C. Communication: Multidimensional Triple Sum-Frequency Spectroscopy of MoS<sub>2</sub> and Comparisons with Absorption and Second Harmonic Generation Spectroscopies. *Journal of Chemical Physics*. DOI: 10.1063/1.5047802. **2018**.

· Preprint: arXiv:1805.06985.

· Data and code repository: DOI 10.17605/OSF.IO/2WF6G.

3. **Morrow, D. J.**; Kohler, D. D.; Wright, J. C. Group and phase velocity mismatch fringes in triple sum-frequency spectroscopy. *Physical Review A*. DOI: 10.1103/PhysRevA.96.063835. **2017**.

· Preprint: arXiv:1709.10476.

· Data and code repository: DOI 10.17605/OSF.IO/EMGTA.

2. Fu, Y.; Rea, M. T.; Chen, J.; **Morrow, D. J.**; Hautzinger, M. P.; Zhao, Y.; Manger, L. H.; Wright, J. C.; Goldsmith, R. H.; Jin, S. 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.**; Fu, Y.; Zheng, W.; Zhao, Y.; Dang, L.; Stolt, M. J.; Kohler, D. D.; Wang, X.; Czech, K. J.; Hautzinger, M. P.; Shen, S.; Guo, L.; Pan, A.; Wright, J. C.; Jin, S. Single-Crystal Thin Films of Cesium Lead Bromide Perovskite Epitaxially Grown on Metal Oxide Perovskite (SrTiO<sub>3</sub>). *J. Am. Chem. Soc.* DOI: 10.1021/jacs.7b07506. **2017**.

· Data and code repository: DOI 10.17605/OSF.IO/V5KZN.

## PATENTS

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

## POSTERS & PRESENTATIONS

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6. Poster. **Darien J. Morrow**, Daniel D. Kohler, John C. Wright. Development of sum-frequency and transient sum-frequency spectroscopies to study transition metal dichalcogenide nanostructures. ACS National Meeting, Philadelphia, PA, March 2020.
5. Poster. **Darien J. Morrow**, Daniel D. Kohler, John C. Wright. Multi-photon pump, multi-photon probe spectroscopies and their application to MX<sub>2</sub> nanostructures. CMDS 2018, Seoul, South Korea. June 2018.
4. Poster. **Darien J. Morrow**, Jenna M. Wasylenko, Christopher G. Elles. Kinetics and Dynamics of the Photorearrangement Reactions of Aryl-Substituted Thiophenes. ACS National Meeting, Denver, CO. March 2015.
3. Poster. Michael W. Ducey, **Darien J. Morrow**, Bethany Thornton, Varun Lahoti. Conformational behavior and applications of mixed room temperature ionic liquid solvent systems examined with a panel of solvatochromic probes. ACS Midwest Regional Meeting, Columbia, MO. November 2014.
2. Poster. **Darien J. Morrow**, Jenna M. Wasylenko, Christopher G. Elles. Kinetics and Dynamics of the Photorearrangements of Conjugated Thiophenes. Council on Undergraduate Research, Research Experiences for Undergraduates Symposium, Arlington, VA. October 2014.
1. Poster. Melanie Edlin, David J. Freeman, Nathan Harms, Xu Ho, Torin McKinley, Alexander Moore, **Darien J. Morrow**, Christopher Phillips, Jeffrey N. Woodford, Determination of Dimerization Constant of N-(isoquinolin-3-yl)Benzamide and N-(isoquinolin-2-yl)Benzamide. ACS Midwest Regional Meeting, Springfield, MO. October 2013.

## TEACHING EXPERIENCE

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<b>Physical Chemistry: Thermodynamics</b>	Fall 2016
<i>Teaching Assistant for Prof. Gilbert M. Nathanson</i>	Madison, WI
<b>General Chemistry</b>	Fall 2015 - spring 2016
<i>Teaching Assistant for Prof. Ive Herman and Dr. Paul Hooker</i>	Madison, WI
<b>Organic Chemistry II</b>	Fall 2013
<i>Teaching Assistant for Prof. Steven P. Lorimor</i>	Saint Joseph, MO

## FELLOWSHIPS & SCHOLARSHIPS

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- Link Foundation Energy Fellowship. July 2018 - June 2020.  
Two year full stipend for *Investigation of Coherent Charge Transfer in Transition Metal Dichalcogenide Heterostructures with Multiresonant Coherent Multidimensional Spectroscopy*.
- 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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- UW–Madison Department of Chemistry, Richard and Joan Hartl Award for Research Excellence in Physical Chemistry. 2020.
- UW–Madison Department of Chemistry, 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.

## 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 hardware into multidimensional spectrometers
  - attune (library): tuning/calibrating multidimensional spectrometers

## SERVICE ACTIVITIES & COMMUNITY INVOLVEMENT

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- Hosted "Detector Building" competition at the Science Olympiad Regional Tournament. Madison, Wisconsin. Winter 2020
- Organized weekly seminar for physical chemistry graduate students to present their research to fellow graduate students. 2018-2019
- Served as a moderator for the annual Wisconsin Middle School Science Bowl (sponsored by the DOE). 2017-present.
- Wisconsin Institute for Discovery volunteer. 2017-present.
- Taught/supervised electronics for a week to high schoolers in the PEOPLE program. Summer 2017.
- Served on panel to talk to REU students about experiences applying to and surviving graduate school. 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.
- Served as vice-president (2014-2015) and member of Missouri Western State University's ACS affiliated Chemistry club. 2011-2015.
- Aided in the organization and implementation of Super Science Saturday and Chemathon at Missouri Western State University. 2011-2015.

## REFERENCES

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- Prof. John C. Wright | [wright@chem.wisc.edu](mailto:wright@chem.wisc.edu) | 608-262-0351  
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The University of Kansas  
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