

# Blaise J Thompson

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## EDUCATION

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<b>University of Wisconsin-Madison</b> <i>PhD, Analytical Chemistry</i>	2011 - 2018 Madison WI
<b>Bates College</b> <i>BS, Chemistry; Minor, Philosophy; Concentration: Applying Mathematical Methods</i>	2007 - 2011 Lewiston ME

## RESEARCH EXPERIENCE

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<b>John C. Wright Group - ultrafast materials spectroscopy</b> <i>Graduate Assistant</i>	2011 - 2018 Madison WI
→ <i>Development of Frequency Domain Multidimensional Spectroscopy with Applications in Semiconductor Photophysics</i> [PDF]	
→ Used ultrafast spectroscopy to research semiconductor systems, with a focus on solar energy candidates.	
→ Designed and constructed software tools to collect and process multidimensional spectra.	
→ Designed and constructed optomechanical and electronic hardware.	
→ Developed novel algorithms to streamline optical parametric amplifier tuning procedures.	
→ Maintained and conducted experiments on a custom ultrafast laser system.	
→ Contributed to general-purpose multidimensional spectra modeling software.	
→ Taught younger students how to use instrumentation.	
<b>Matthew J. Cote Group - microscopy and plasmonics</b> <i>Undergraduate Researcher</i>	2009 - 2011 Lewiston ME
→ <i>Investigating Plasmons with Total Internal Reflection Microscopy</i> [PDF]	
→ Designed and constructed a combined total internal reflection / atomic force microscope.	
→ Coordinated work with my advisor and other staff and faculty.	
<b>Michael Dailey Group - neuroscience</b> <i>Undergraduate Researcher</i>	2008 Iowa City IA
→ Dissected and prepared mouse brain samples for in-vivo microglial imaging studies.	
→ Trained to utilize confocal microscopy setup.	
<b>Peter L. Nagy Group - epigenetics</b> <i>High School Researcher</i>	2007 Iowa City IA
→ Designed and created plasmid, taught myself techniques from reference materials.	
→ Inserted plasmid into yeast.	

## PUBLICATIONS

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9. *In preparation*: **Thompson, B. J.**; Sunden, K. F.; Morrow, D. K.; Neff-Mallon, N. A. & Wright, J. C. WrightTools: A Python Package for Multidimensional Spectroscopy.  
→ *Developed Python package as foundational tool for multidimensional data processing and analysis.*
8. *In preparation*: Kohler, D. D.; **Thompson, B. J.** & Wright, J. C. Global Analysis of Transient Grating and Transient Absorption of PbSe Quantum Dots.  
→ *Developed and used model encompassing multiple data types.*  
→ *Used model to conclusively identify new physics within PbSe Quantum Dots.*
7. *In preparation*: Handali, J. D.; Neff-Mallon, N.; Sunden, K. F.; **Thompson, B. J.**; Brunold, T. C & Wright, J. C. Mixed vibrational-electronic Coherent Multidimensional Spectroscopy Reveals the Electronic Structure of Co(III)balamins Cyanocobalamin and detuerated Aquacobalamin.  
→ *Three dimensional fully coherent frequency domain experiment.*  
→ *Experiment enabled by hardware and software enhancements.*
6. *In preparation*: Kohler, D. D., **Thompson, B. J.** & Wright, J. C. Coherent multidimensional spectroscopy and the role of solvent: colloidal PbSe quantum dots as an example.  
→ *Used standard dilution method to extract nonlinear optical constants quantitatively.*  
→ *Compared measurements with prior quantitative work.*
5. Horak, E. H.; Rea, M. T.; Heylman, K. D.; Gelbwaser-Klimovsky, D.; Saikin, S. K.; **Thompson, B. J.**; Kohler, D. D.; Knapper, K. A.; Wei, W.; Pan, F.; Gopalan, P.; Wright, J. C.; Aspuru-Guzik, A. & Goldsmith, Randall H. (2018) Exploring Electronic Structure and Order in Polymers via Single-Particle Microresonator Spectroscopy. *Nano Letters*, in press [doi:10.1021/acs.nanolett.7b04211](https://doi.org/10.1021/acs.nanolett.7b04211)  
→ *Performed three-pulse photon echo experiments on a conductive polymer.*  
→ *Developed model and performed lineshape analysis to interrogate ultrafast processes in the material.*  
→ *Raw data and code freely available at [osf.io/bs8pr](https://osf.io/bs8pr).*
4. Kohler, D. D.; **Thompson, B. J.** & Wright, J. C. (2017) Frequency-domain coherent multidimensional spectroscopy when dephasing rivals pulsewidth: Disentangling material and instrument response. *The Journal of Chemical Physics*, 147(8), 84202. [doi:10.1063/1.4986069](https://doi.org/10.1063/1.4986069)  
→ *Applied numerical model to simple system to explore artifacts of mixed-domain nonlinear spectroscopy.*  
→ *Defined new strategies to extract desired information despite these artifacts.*  
→ *Raw data and code freely available at [osf.io/ej2xe](https://osf.io/ej2xe)*
3. Czech, K. J.; **Thompson, B. J.**; Kain, S.; Ding, Q.; Shearer, M. J.; Hamers, R. J.; Jin, S. & Wright, J. C. (2015) Measurement of Ultrafast Excitonic Dynamics of Few-Layer MoS<sub>2</sub> Using State-Selective Coherent Multidimensional Spectroscopy. *ACS Nano*, 9(12), 12146–12157. [doi:10.1021/acs.nano.5b05198](https://doi.org/10.1021/acs.nano.5b05198)  
→ *Analyzed three-dimensional frequency-frequency-delay transient grating data.*
2. Fu, Y.; Meng, F.; Rowley, M. B.; **Thompson, B. J.**; Shearer, M. J.; Ma, D.; Hamers, R. J.; Wright J. C. & Jin, S. (2015) Solution Growth of Single Crystal Methylammonium Lead Halide Perovskite Nanostructures for Optoelectronic and Photovoltaic Applications. *Journal of the American Chemical Society*, 137(17), 5810–5818. [doi:10.1021/jacs.5b02651](https://doi.org/10.1021/jacs.5b02651)  
→ *Performed transient reflectance spectroscopy.*
1. Cabán-Acevedo, M.; Kaiser, N. S.; English, C. R.; Liang, D.; **Thompson, B. J.**; Chen, H.-E.; Czech, K. C.; Wright, J. C.; Hamers, R. J. & Jin, S. (2014) Ionization of High-Density Deep Donor Defect States Explains the Low Photovoltage of Iron Pyrite Single Crystals. *Journal of the American Chemical Society*, 136(49), 17163–17179. [doi:10.1021/ja509142w](https://doi.org/10.1021/ja509142w)  
→ *Performed transient reflectance spectroscopy.*

## PROJECTS (see my github at [github.com/untzag](https://github.com/untzag))

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### Creator: [WrightTools](#)

2014 - Present

*Tools for loading, processing, and plotting multidimensional spectroscopy data.*

- Single processing toolkit for wide variety of instrumental data, built to be extensible as more data-types become relevant.
- Offers specialized interactions, such as transformations, that are particularly suited to multidimensional spectroscopy.
- Online documentation through Sphinx and ReadTheDocs (<http://wright.tools>).
- Project managed with several graduate student and undergraduate contributors, active issue tracking, version control and an extensive testing suite.
- Central package used as a data management pipeline by other packages simulating and acquiring multidimensional spectra.

### Creator: [PyCMDS](#)

2015 - Present

*Unified software for controlling hardware and collecting data in the Wright group.*

- Supplies modular hardware control, calibration, and orchestration during complex, long-lasting CMDS experiments.
- Provides interface to optomechanical hardware from a variety of manufacturers, including National Instruments, Thorlabs, Horiba, Newport, and Aerotech. Also controls hardware built and customized in-house.
- Focuses on seamless user experience with advanced integrations such as automatic data backup and notification via Slack.
- In conjunction with contemporaneous hardware improvements, algorithmic improvements in acquisition strategy increased scan rate by up to two orders of magnitude over previous software.

### Creator: [automated filter wheel assembly](#)

2017

*Automated optical filter assembly.*

- Allows for new experimental degrees of freedom within the Wright group.
- Designed (using Autodesk Inventor) and constructed (in collaboration with the department machine, electronics shops) custom chassis.
- Designed custom circuit board using KiCad, ordered supplies from appropriate online retailers.
- Designed and implemented serial interface and Arduino firmware, including semi-synchronous motion low-level C++ string processing, and microstepping control for enhanced acquisition time efficiency.

### Creator: [tidy\\_headers](#)

2017

*Rapidly write data from python to plain text, and back again.*

- Dependency of larger projects like WrightTools, and used directly for custom applications.

### Cocreator: [WrightSim](#)

2017 - Present

*Efficient, flexible simulation package for multidimensional spectroscopy.*

- Uses Liouville's theorem to numerically simulate nonlinear spectroscopy.
- I was also a principle contributor to the predecessor of WrightSim, [NISE](#).

### Contributor: [InGaAs array](#)

2015 - 2016

*Quickly and cheaply acquire near-infrared pulse spectra.*

- Wrote firmware to handle serial communication between ADC, acquisition software.
- Used advanced features such as watchdog timers to handle unexpected timing and communication problems.

### Contributor: [osfclient](#)

2017

*A python library and command-line client for file storage within the Open Science Framework.*

- Added Windows functionality, assisted in various debugging efforts in early version of osfcli.

## PRESENTATIONS

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4. *Presentation: Thompson, B. J.* Nonlinear Multidimensional Spectroscopy. (2017) *Chaos and Complexity Seminar*. Madison, WI USA [\[PDF\]](#)
3. *Poster: Thompson, B. J.* A Robust, Fully Automated Algorithm to Collect High Quality OPA Tuning Curves. (2016) *CMDS 2016*. Groningen, the Netherlands [\[PDF\]](#)
2. *Poster: Thompson, B. J.* Utilizing Coherent Multidimensional Spectroscopy to Investigate Nanomaterials for Solar Energy Generation. (2012) *Midwest Universities Analytical Chemistry Conference*. Madison, WI USA
1. *Poster: Thompson, B. J.* Spectroscopic Investigation of Plasmonic Nanoparticles. (2011) *Bates College Mount David Summit*. Lewiston, ME USA

## AWARDS & HONORS

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- Roger Carlson Award** 2017  
→ Awarded by the University of Wisconsin Chemistry department for excellence in research.
- James W. Taylor Excellence in Teaching Award** 2016  
→ Selected by University of Wisconsin Chemistry students and faculty as one of the most outstanding Teaching Assistants of the 2015-2016 School Year.
- Rodney F. Johonnot Graduate Award** 2011  
→ Selected by Bates College faculty as most deserving of aid in furthering his or her studies in professional or postgraduate work.
- Bates College Key** 2011  
→ Awarded by Bates College faculty and staff to 20 students in each graduating class based on academic standing, character, campus and community service, leadership, and future promise.

## SKILLS & SPECIALTIES

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### Analytical Techniques

- Spectroscopy: Raman / IR / UV-VIS / NMR
- Ultrafast Spectroscopy: Pump Probe / CMDS
- General purpose analytical techniques: electrochemistry, mass spectrometry, chromatography

### Hardware

- Circuit prototyping (KiCad, ExpressPCB), construction
- Interconnect choice, enclosure design and construction
- Basic machining: milling machine, drill press, band/rotary saw
- Microprocessors: Arduino, MicroPython, AVR

### Software

- Python (SciPy, PyPI/Anaconda, micropython)
- git
- Qt
- LaTeX
- LabView
- Basic C, C++ (mostly in context of firmware or drivers)

## TEACHING EXPERIENCE

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### Fundamentals of Analytical Science (Quantitative Analysis)

2018

*Teaching Assistant, 1 semester*

UW-Madison

- Led laboratory and discussion sections for honors section.
- Prepared worksheets and homework keys.
- Contributed to staff notes for future teaching assistants.

### Graduate Chemical Instrumentation: Design & Control (Electronics)

2017

*Teaching Assistant, 1 semester*

UW-Madison

- Led laboratory section of course.
- Introduced graduate students to basic electronics skills such as bread-boarding, oscilloscope usage, component choice and enclosure design and construction.
- Assisted students during extended independent instrument design and construction.

### Graduate Instrumental Analysis

2012, 2015

*Teaching Assistant, 2 semesters*

UW-Madison

- Led laboratory section of course.
- Prepared homework assignments and led homework review sessions.
- Lectured in professor's absence.
- Switched course from mathcad to Python using Jupyter Notebooks, introducing first-year graduate students to scrip-based programming.
- Received James W. Taylor Excellence in Teaching Award.

### Undergraduate Research Mentor

2012 - 2013, 2015 - 2017

*6 semesters*

UW-Madison

- Designed appropriate experiments that were complementary to my own research.
- Introduced undergraduates to spectroscopy, programming, and instrument design.
- Advised students in coursework and future directions.

### General Chemistry II

2011, 2012

*Teaching Assistant, 2 semesters*

UW-Madison

- Coordinated two sections—total of ~ 50 students in each semester.
- Led labs.
- Designed and led discussion sections.

### General Chemistry I

2010, 2011

*Peer Science Leader, 2 semesters*

Bates College

- Designed and led class-wide review sessions for General Chemistry.
- Assisted in first trials of new peer leadership program at Bates College.
- Attended regular meetings to share teaching strategies with other peer leaders.

## SERVICE ACTIVITIES & COMMUNITY INVOLVEMENT

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### Plasma Group Python Introduction

2017

*Assistant*

UW-Madison

- Helped introduce a group of Faculty and Graduate Students in Physics to Python.
- Created lesson sections and chose topics.
- Group was switching to Python from IDL.
- Introduction consisted of weekly meetings across several months.

### Pre-college Enrichment Opportunity Program for Learning Excellence (PEOPLE)

2017

*Volunteer*

Madison WI

- Taught disadvantaged high school students about electronics, science and what it is like to be an analytical chemist.

### Wisconsin Middle School Science Bowl

2017

*Scientific Judge*

Madison WI

- Judged middle school students in statewide science-knowledge competition.
- Winning team proceeded to national competition.

### McElvain Committee

2013 - 2014

*Member*

UW-Madison

- Graduate student committee to choose seminar speakers.

### Freewill Folk Society

2008 - 2011

*President*

Bates College

- Contradance club, offering alcohol-free community-engaging social activity to the college.
- Reorganized club structure, recruited other students to new club positions.
- Organized monthly folk dances, bringing in bands and callers.