Blaise J Thompson

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EDUCATION

University of Wisconsin-Madison   2011 - 2018

→ PhD, Analytical Chemistry

Bates College   2007 - 2011

→ Major: Chemistry
→ Minor: Philosophy
→ Concentration: Applying Mathematical Methods

EXPERIENCE

Instrumentation Technologist   2018 - Present

→ Worked in the instrumental shop space of the Chemistry Department.

John C. Wright Group - ultrafast materials spectroscopy   2011 - 2018
Graduate Assistant   Madison WI

→ *Development of Frequency Domain Multidimensional Spectroscopy with Applications in Semiconductor Photophysics* [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.
→ Mentored fellow students.

Matthew J. Cote Group - microscopy and plasmonics   2009 - 2011
Undergraduate Researcher   Lewiston ME

→ *Investigating Plasmons with Total Internal Reflection Microscopy* [PDF]
→ Designed and constructed a combined total internal reflection / atomic force microscope.
→ Coordinated work with my advisor and other staff and faculty.

Michael Dailey Group - neuroscience   2008
Undergraduate Researcher   Iowa City IA

→ Dissected and prepared mouse brain samples for in-vivo microglial imaging studies.
→ Trained to utilize confocal microscopy setup.

Peter L. Nagy Group - epigenetics   2007
High School Researcher   Iowa City IA

→ Designed and created plasmid, taught myself techniques from from reference materials.
→ Inserted plasmid into yeast.

PUBLICATIONS

10. *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.*

9. *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.*

8. *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.*

7. Kohler, D. D., **Thompson, B. J.** & Wright, J. C. (2018) Resonant Third-Order Susceptibility of PbSe Quantum Dots Determined by Standard Dilution and Transient Grating Spectroscopy. *The Journal of Physical Chemistry C*, 122 (31), 18086–18093. doi:10.1021/acs.jpcc.8b04462
    → *Used standard dilution method to extract nonlinear optical constants quantitatively.*
    → *Compared measurements with prior quantitative work.*
    → *Raw data and code freely available at osf.io/3vprb.*

6. Sunden, K. F., **Thompson, B. J.** & Wright, J. C. (2018) WrightSim: Using PyCUDA to Simulate Multidimensional Spectra
    Proceedings of the 17th Python in Science Conference doi:10.25080/Majora-4af1f417-00c

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* doi: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.*

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
    → *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*

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$_2$ Using State-Selective Coherent Multidimensional Spectroscopy. *ACS Nano*, 9(12), 12146–12157. doi:10.1021/acsnano.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
    → *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](doi:10.1021/ja509142w)
$\rightarrow$ *Performed transient reflectance spectroscopy.*

PROJECTS (see my github at github.com/untzag)

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-syncronus 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, flexable 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

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.** Spectroscpic Investigation of Plasmonic Nanoparticles. (2011) *Bates College Mount David Summit.* Lewiston, ME USA

AWARDS & HONORS

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

Analytical Techniques

→ Spectroscopy: Raman / IR / UV-VIS / NMR
→ Ultrafast Spectroscopy: Pump Probe / CMDS
→ General purpose analytical techinques: 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

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 ACTIVITES & COMMUNITY INVOLVEMENT

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.