

NATHANAEL PARKER KAZMIERCZAK

ASSISTANT PROFESSOR OF CHEMISTRY

HOPE COLLEGE, HOLLAND, MI

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Professional Appointments

2025-present **Assistant Professor of Chemistry**
Hope College, Holland, MI

Education

2020-2025 **Ph.D. in Chemistry**
California Institute of Technology
Advisor: Prof. Ryan G. Hadt
Thesis Title: "Illuminating Molecular Spin Relaxation Mechanisms through Ligand Field Theory and Physical Inorganic Spectroscopy."
GPA: 4.3

2015-2020 **B.S. in Chemistry *summa cum laude* (with honors)**
B.A. in Music *summa cum laude*
Calvin University
Advisor: Prof. Douglas A. Vander Griend
GPA: 4.0

Publications

863 citations, h-index = 13 (Google Scholar)
(* denotes equal contribution)

Graduate Research:

25. Espinosa, M. R.*; Guerrero, F.*; **Kazmierczak, N. P.***; Oyala, P. H.; Hong, A.; Hadt, R. G.; Agapie, T. Slow Electron Spin Relaxation at Ambient Temperature with Copper Coordinated by a Rigid Macrocyclic Ligand. *J. Am. Chem. Soc.* **2025**, 147, 14036-14042.
24. **Kazmierczak, N. P.***; Xia, K. T.*; Sutcliffe, E.; Aalto, J. P.; Hadt, R. G. A Spectrochemical Series for Electron Spin Relaxation. *J. Am. Chem. Soc.* **2025**, 147, 2849-2859.
23. Nelson, K.; **Kazmierczak, N. P.**; Cagan, D. A.; Follmer, A. H.; Scott, T. R.; Raj, S. L.; Garratt, D.; Powers-Riggs, N.; Gaffney, K. J.; Hadt, R. G.; Cordones, A. A. Multiconfigurational Electronic Structure of Nickel Cross-Coupling Catalysts Revealed by X-ray Absorption Spectroscopy. *J. Phys. Chem. Lett.* **2025**, 16, 87-94.
22. **Kazmierczak, N. P.**; Oyala, P. H.; Hadt, R. G. Spectroscopic Signatures of Phonon Character in Molecular Electron Spin Relaxation. *ACS Cent. Sci.* **2024**, 10, 2353-2362.
21. Sutcliffe, E.; **Kazmierczak, N. P.**; Hadt, R. G. Ultrafast All-Optical Coherence of Molecular Electron Spins in Room-Temperature Water Solution. *Science* **2024**, 386, 888-892.
20. Lohaus, S. H.; **Kazmierczak, N. P.**; Luedecke, K. M.; Marx, B.; Nemykin, V. N.; Hadt, R. G. Quantifying the effects of peripheral substituents on the spin-lattice relaxation of a vanadyl molecular quantum bit. *J. Porphyr. Phthalocyanines* **2024**, 28, 383-389.

19. Cagan, D. A.; Bím, D.; **Kazmierczak, N. P.**; Hadt, R. G. Mechanisms of Photoredox Catalysis Featuring Nickel-Bipyridine Complexes. *ACS Catal.* **2024**, 14, 9055–9076.
18. Poh, Y. R.; Morozov, D.; **Kazmierczak, N. P.**; Hadt, R. G.; Groenhof, G.; Yuen-Zhou, J. Alternant Hydrocarbon Diradicals as Optically Addressable Molecular Qubits. *J. Am. Chem. Soc.* **2024**, 146, 15549–15561.
17. **Kazmierczak, N. P.**; Lopez, N. E.; Luedecke, K. M.; Hadt, R. G. Determining the Key Vibrations for Spin Relaxation in Ruffled Cu(II) Porphyrins via Resonance Raman Spectroscopy. *Chem. Sci.* **2024**, 15, 2380–2390.
16. **Kazmierczak, N. P.***; Luedecke, K.*; Gallmeier, E.; Hadt, R. G. T_1 Anisotropy Elucidates Spin Relaxation Mechanisms in an $S = 1$ Cr(IV) Optically Addressable Molecular Qubit. *J. Phys. Chem. Lett.* **2023**, 14, 7658–7664.
15. McNicholas, B.; Tong, Z. J.; Bím, D.; Turro, R.; **Kazmierczak, N. P.**; Chalupský, J.; Reisman, S.; Hadt, R. Electronic Structures of Nickel(II)-Bis(Indanyloxazoline)-Dihalide Catalysts: Understanding Ligand Field Contributions That Promote C(sp²)-C(sp³) Cross-Coupling. *Inorg. Chem.* 62, 14010–14027, **2023**.
14. Cagan, D. A.; Bím, D.; McNicholas, B. J.; **Kazmierczak, N. P.**; Oyala, P. H.; Hadt, R. G. Photogenerated Ni(I)-Bipyridine Halide Complexes: Structure–Function Relationships for Competitive C(sp²)-Cl Oxidative Addition and Dimerization Reactivity Pathways. *Inorg. Chem.* **2023**, 62, 9538–9551.
13. **Kazmierczak, N. P.**; Hadt, R. G. Illuminating Ligand Field Contributions to Molecular Qubit Spin Relaxation via T_1 Anisotropy. *J. Am. Chem. Soc.* **2022**, 144, 20804–20814.
12. Cagan, D. A.; Bím, D.; Silva, B.; **Kazmierczak, N. P.**; McNicholas, B. J.; Hadt, R. G. Elucidating the Mechanism of Excited-State Bond Homolysis in Nickel–Bipyridine Photoredox Catalysts. *J. Am. Chem. Soc.* **2022**, 144, 6516–6531.
11. **Kazmierczak, N. P.**; Mirzoyan, R.; Hadt, R. G. The Impact of Ligand Field Symmetry on Molecular Qubit Coherence. *J. Am. Chem. Soc.* **2021**, 143, 17305–17315.
10. Mirzoyan, R.; **Kazmierczak, N. P.**; Hadt, R. G. Deconvolving Contributions to Decoherence in Molecular Electron Spin Qubits: A Dynamic Ligand Field Approach. *Chem. – Eur. J.* **2021**, 27, 9482–9494.

Undergraduate Research:

9. Van Winkle, M.; Craig, I. M.; **Kazmierczak, N. P.**; Carr, S.; Dandu, M.; Ophus, C.; Bustillo, K. C.; Ciston, J.; Brown, H. G.; Raja, A.; Griffin, S. M.; Bediako, D. K. Interferometric 4D-STEM Imaging of Rotational and Dilational Reconstruction in Moiré Superlattices. *Microsc. Microanal.* **2023**, 29, 268–269.
8. Van Winkle, M.; **Kazmierczak, N. P.**; Ophus, C.; Bustillo, K. C.; Carr, S.; Brown, H. G.; Ciston, J.; Kwabena Bediako, D. Direct Measurement of Atomic Reconstruction, Strain, and Disorder in Moiré Materials Using 4D-STEM. *Microsc. Microanal.* **2022**, 28, 1764–1766.
7. **Kazmierczak, N. P.**; Chew, J. A.; Vander Griend, D. A. Bootstrap Methods for Quantifying the Uncertainty of Binding Constants in the Hard Modeling of Spectrophotometric Titration Data. *Anal. Chim. Acta* **2022**, 1227, 339834.
6. **Kazmierczak, N. P.**; Chew, J. A.; Vander Griend, D. A. A Reliable Algorithm for Calculating Stoichiometry Parameters in the Hard Modeling of Spectrophotometric Titration Data. *J. Chemometrics* **2022**, 36, e3409.

5. Husremović, S.; Groschner, C. K.; Inzani, K.; Craig, I. M.; Bustillo, K. C.; Ercius, P.; **Kazmierczak, N. P.**; Syndikus, J.; Van Winkle, M.; Aloni, S.; Taniguchi, T.; Watanabe, K.; Griffin, S. M.; Bediako, D. K. Hard Ferromagnetism Down to the Thinnest Limit of Iron-Intercalated Tantalum Disulfide. *J. Am. Chem. Soc.* **2022**, *144*, 12167–12176.
4. **Kazmierczak, N. P.***; Van Winkle, M.*; Ophus, C.; Bustillo, K. C.; Carr, S.; Brown, H. G.; Ciston, J.; Taniguchi, T.; Watanabe, K.; Bediako, D. K. Strain Fields in Twisted Bilayer Graphene. *Nat. Mater.* **2021**, *20*, 956–963.
3. **Kazmierczak, N. P.**; Vander Griend, D. A. Properly Handling Negative Values in the Calculation of Binding Constants by Physicochemical Modeling of Spectroscopic Titration Data. *J. Chemometrics* **2019**, *33*, e3183.
2. **Kazmierczak, N. P.**; Chew, J. A.; Michmerhuizen, A. R.; Kim, S. E.; Drees, Z. D.; Rylaarsdam, A.; Thong, T.; Van Laar, L.; Vander Griend, D. A. Sensitivity Limits for Determining 1:1 Binding Constants from Spectrophotometric Titrations via Global Analysis. *J. Chemometrics* **2019**, *33*, e3119.
1. **Kazmierczak, N. P.**; Vander Griend, D. A. Improving Student Results in the Crystal Violet Chemical Kinetics Experiment. *J. Chem. Educ.* **2017**, *94*, 61–66.

Presentations

Talks:

18. **Kazmierczak, N. P.** “New Spectroscopic Approaches for Probing Spin Relaxation Mechanisms.” Herbert Newby McCoy Award Symposium, Caltech, Pasadena, CA, **2025**
17. **Kazmierczak, N. P.**; Lopez, N. E.; Luedecke, K. M.; Hadt, R. G. “Determining the Key Vibrations for Spin Relaxation in Ruffled Cu(II) Porphyrins via Resonance Raman Spectroscopy.” American Chemical Society Spring National Meeting, San Diego, CA, **2025**
16. **Kazmierczak, N. P.**; Xia, K. T.; Sutcliffe, E.; Aalto, J. P.; Hadt, R. G. “A Spectrochemical Series for Electron Spin Relaxation.” American Chemical Society Spring National Meeting, San Diego, CA, **2025**
15. **Kazmierczak, N. P.**; Xia, K. T.; Sutcliffe, E.; Aalto, J. P.; Hadt, R. G. “A Spectrochemical Series for Electron Spin Relaxation.” Molecular Magnetism in North America (MAGNA), Tallahassee, FL, **2025**
14. **Kazmierczak, N. P.** “Building Molecular Quantum Sensors: How Vibrational Modes Impact the Movement of Electron Spins.” Calvin University, Grand Rapids, MI, **2024**
13. **Kazmierczak, N. P.** “Building Molecular Quantum Sensors: How Vibrational Modes Impact the Movement of Electron Spins.” Hope College, Holland, MI, **2024**
12. **Kazmierczak, N. P.** “Spectroscopic Signatures of Vibrational Character in Electron Spin Relaxation.” California Institute of Technology, Division of Chemistry & Chemical Engineering (CCE) Seminar Day, Pasadena, CA, **2024**
11. **Kazmierczak, N. P.**; Luedecke, K. M.; Alexander, K. H.; Hadt, R. G. “Probing Spin Relaxation Mechanisms through T_1 Anisotropy.” American Chemical Society Spring Meeting, New Orleans, LA, **2024**
10. **Kazmierczak, N. P.**; Hadt, R. G. “Developing New Spectroscopic Observables to Probe Spin Relaxation Mechanisms.” California Institute of Technology, Inorganic-Organometallics Seminar Series, Pasadena, CA, **2024**

9. **Kazmierczak, N. P.**; Hadt, R. G. “Probing Spin Relaxation Mechanisms through T_1 Anisotropy.” Molecular Magnetism in North America (MAGNA), Lake Tahoe, CA, **2023**
8. **Kazmierczak, N. P.**; Hadt, R. G. “Illuminating Ligand Field Contributions to Molecular Qubit Spin Relaxation *via* T_1 Anisotropy.” American Chemical Society Spring Meeting, Indianapolis, IN, **2023**
7. **Kazmierczak, N. P.** “The Impact of Ligand Field Symmetry on Molecular Qubit Coherence.” California Institute of Technology, Inorganic-Organometallics Seminar Series, Pasadena, CA **2022**
6. **Kazmierczak, N. P.**; Vander Griend, D. A. “Estimating Binding Stoichiometry from Titrations: Combining Chemical, Mathematical, and Computational Techniques.” Calvin University Chemistry Seminar Series, Grand Rapids, MI, **2018**
5. **Kazmierczak, N. P.**; Vander Griend, D. A. “Calculating Great Binding Constants from Spectrophotometric Titration Data through Global Analysis.” Gulf Coast Undergraduate Research Symposium, Rice University, Houston, TX, **2018**
4. **Kazmierczak, N. P.**; Vander Griend, D. A. “Four New Research Projects in the Methodology of Determining Binding Constants.” Indiana University, Bloomington, IN, **2017**
3. **Kazmierczak, N. P.**; Vander Griend, D. A. “Optimization of Dangerous Parameters in Global Analysis of Spectrophotometric Titration Data: Information Beyond the Binding Constant.” 254th American Chemical Society National Meeting and Exposition, Washington D.C., **2017**
2. **Kazmierczak, N. P.**; Vander Griend, D. A. “Studying Self-Assembly with Global Analysis: Turning Thousands of Data Points into One Great Binding Constant.” Arnold and Mabel Beckman Foundation Annual Symposium, Irvine, CA, **2017**
1. **Kazmierczak, N. P.**; Vander Griend, D. A. “Studying Self-Assembling Structures with UV-Vis Spectroscopy: Experimental Challenges and Data Analysis Solutions.” Aquinas College, Grand Rapids, MI, **2016**

Posters:

8. **Kazmierczak, N. P.**; Xia, K. T.; Sutcliffe, E.; Aalto, J. P.; Hadt, R. G. “A Spectrochemical Series for Electron Spin Relaxation.” Telluride School for Theoretical Chemistry, Telluride, CO, **2025**
7. **Kazmierczak, N. P.**; Xia, K. T.; Sutcliffe, E.; Aalto, J. P.; Hadt, R. G. “A Spectrochemical Series for Electron Spin Relaxation.” American Chemical Society Spring National Meeting, San Diego, CA, **2025**
6. **Kazmierczak, N. P.**; Xia, K. T.; Sutcliffe, E.; Oyala, P. H.; Hadt, R. G. “New Spectroscopic Approaches for Probing Spin Relaxation in Molecular Qubit Candidates.” Inorganic Chemistry Gordon Research Conference, Newport, RI, **2024**.
5. **Kazmierczak, N. P.**, Mirzoyan, R., Hadt, R. G. “Understanding Molecular Qubit Coherence Through Ligand Field Spin Dynamics.” American Chemical Society Spring Meeting, San Diego, CA, **2022**.
4. **Kazmierczak, N. P.**; Chew, J. A.; Vander Griend, D. A. “The Tie That Binds: Optimal Design of Equilibrium Spectrophotometric Titrations.” West Michigan Regional Undergraduate Science Research Conference, Grand Rapids, MI, **2018**.

3. **Kazmierczak, N. P.;** Vander Griend, D. A. "Uncertainty Estimation in Global Analysis of UV-Vis Titrations." 254th American Chemical Society National Meeting and Exposition, Washington D.C., **2017**
2. **Kazmierczak, N. P.;** Vander Griend, D. A. "Optimal Spectrophotometric Analysis of Binding Equilibria." Arnold and Mabel Beckman Foundation Annual Symposium, Irvine, CA, **2017**
1. **Kazmierczak, N. P.;** Vander Griend, D. A. "Modeling Error in Equilibrium-Restricted Factor Analysis." 252nd American Chemical Society National Meeting and Exposition, Philadelphia, PA, **2016**

Honors and Awards

2025	Herbert Newby McCoy Award, Caltech (thesis prize)
2025	Arnold O. Beckman Postdoctoral Fellow in the Chemical Sciences (declined)
2025	Schmidt Science Fellows Finalist
2021-2025	Hertz Fellowship
2020-2023	National Science Foundation Graduate Research Fellowship
2020	National Defense Science and Engineering Graduate Fellowship (NDSEG), U.S. Department of Defense (declined)
2019-2020	Karen Muyskens Outstanding Senior Award in Chemistry, Calvin University
2019-2020	Undergraduate Physical Chemistry Award, Calvin University
2018	Outstanding Presentation in Spectroscopy Award, Gulf Coast Undergraduate Research Symposium
2017-2019	Goldwater Scholar
2017-2018	ACS Division of Analytical Chemistry: Undergraduate Award in Analytical Chemistry, Calvin University
2016-2018	NSF Scientific Computing Scholarship, Calvin University
2016-2017	Beckman Scholar
2016	Scholarship for Scientific Excellence, American Chemical Society (ACS): Division of Chemical Information (CINF)
2015-2020	Dean's List, Calvin University
2015-2020	National Merit Scholarship
2015-2018	Howard Hughes Medical Institute Scholarship, Calvin University
2015-2016	Undergraduate Award in Inorganic Chemistry, Calvin University
2015	Louisiana House of Representatives, 2015 Regular Session, House Resolution No. 207. "Commends Nathanael P. Kazmierczak on his academic achievements."

Teaching

2025	Certificate of Practice (CoP) Teaching Certification, Center for Teaching, Learning, and Outreach (CTLO), California Institute of Technology
2024	Computational Chemistry Bootcamp Co-Leader, Rising Tide Summer Program, California Institute of Technology
2024-2025	Undergraduate Computational Chemistry Curriculum Developer (Ch 1a & Ch 102), California Institute of Technology
2023-2025	Curriculum Developer, Physical Inorganic Spectroscopy Open Educational Resource (Hadt Lab; Cottrell Scholars Grant)
2023-2025	Graduate Advanced Ligand Field Theory Teaching Assistant (Ch 213a&b), California Institute of Technology (Prof. Harry B. Gray)
2023	Graduate Inorganic Spectroscopy Teaching Assistant (Ch 153b), California Institute of Technology (Prof. Ryan G. Hadt)
2022, 2025	Graduate Inorganic Spectroscopy Teaching Assistant (Ch 153c), California Institute of Technology (Prof. Ryan G. Hadt)
2019-2020	Undergraduate Physical Chemistry Laboratory Teaching Assistant, Calvin University (two semesters, Profs. Herbert Fynewever and Mark Muyskens)
2018-2020	Undergraduate Organic Chemistry Laboratory Teaching Assistant, Calvin University (four semesters, Profs. Chad Tatko, Michael R. Barbachyn, Carolyn E. Anderson, and Karl Seper)

Outreach

2021-2023	Student Group Leader, San Marino High School STEM class
2022	Hertz Fellowship Student Resource, Fellowships Advising and Study Abroad (FASA), California Institute of Technology
2018-2020	Content Coordinator, Science and Religion Forum, Calvin University

Funded Grant Support

2023-2025	Discover allocation, NSF ACCESS, “CHE230085: Phonon effects on spin relaxation in molecular quantum bits.” Co-PIs: Nathanael P. Kazmierczak, Prof. Ryan G. Hadt. 750,000 ACCESS credits on NSF supercomputer systems. Monetary valuation: \$10,959.14.
2020-2021	Startup allocation, NSF XSEDE, “CHE200080: Spectroscopy of Transition Metal Complexes”. PI: Nathanael P. Kazmierczak. 50,000 compute hours on NSF supercomputer systems. Monetary valuation: \$1,114.00.

Mentorship

Graduate students (* denotes co-author, current position listed in parentheses):

- Jonathan P. Aalto (Caltech)
- Juliette Whiteside (Caltech)

Undergraduate students (* denotes co-author, current position listed in parentheses):

- *Elisabeth T. Gallmeier (Research scientist at Ecoelectro, Inc.)
- *Nathan E. Lopez (Ph.D. student at University of Chicago)
- Matthew J. Cox (Ph.D. student at Massachusetts Institute of Technology)
- John Cao (undergraduate at UCLA)
- Kevin H. Alexander (undergraduate at UMass Amherst, 2024 Goldwater Scholar)
- Aadarsh Balaji (undergraduate at Caltech)

High school students:

- Aidan Graham