

CURRICULUM VITAE

ERIK M. GRUMSTRUP

Assistant Professor
Montana Collaborative Materials Science Program
Department of Chemistry and Biochemistry
Montana State University

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PROFESSIONAL APPOINTMENTS

Assistant Professor, Montana State University 2014 – present
Montana Collaborative Materials Science Program
Department of Chemistry and Biochemistry

EDUCATION

Post-doctoral: National Research Council Research Associate 2013 – 2014
Army Research Office, Research Triangle Park
Department of Chemistry, University of North Carolina
Research Advisors: Dr. James K. Parker, Prof. John M. Papanikolas
Ultrafast Pump-Probe Microscopy of Semiconductor Nanostructures

Post-doctoral: Energy Frontier Research Center Postdoctoral Research Fellow 2011 – 2013
Department of Chemistry, University of North Carolina
Research Advisor: Prof. John. M. Papanikolas
Ultrafast Vibrational Spectroscopy of Light Harvesting Polymers

Ph.D. University of Colorado at Boulder, Chemical Physics 2006 – 2011
Dissertation: “*Elucidation of Ultrafast Photophysics with Optical Pulse Shaping*”
Research Advisor: Prof. Niels H. Damrauer

B. S. University of Minnesota Twin Cities, M: Chemistry m: Mathematics 2001 – 2006
Research Advisors: Prof. Ken R. Leopold and Prof. Christopher J. Cramer

PUBLICATIONS (with MSU affiliation)

29. Hill, A. H.; Kennedy, C. L.; Massaro, E. S.; **Grumstrup, E. M.**, Perovskite Carrier Transport: Disentangling the Impacts of Effective Mass and Scattering Time Through Microscopic Optical Detection. *The Journal of Physical Chemistry Letters* **2018**, Accepted. [10.1021/acs.jpcllett.8b00652](https://doi.org/10.1021/acs.jpcllett.8b00652)
28. Cating, E. E. M.; Pinion, C. W.; Christesen, J. D.; Christie, C. A.; **Grumstrup, E. M.**; Cahoon, J. F.; Papanikolas, J. M., Probing Intrawire, Interwire, and Diameter-Dependent Variations in Silicon Nanowire Surface Trap Density with Pump-Probe Microscopy. *Nano Letters* **2017**, 17 (10), 5956-5961. [10.1021/acs.nanolett.7b01876](https://doi.org/10.1021/acs.nanolett.7b01876)
27. Kennedy, C. L.; Hill, A. H.; Massaro, E. S.; **Grumstrup, E. M.**, Ultrafast Excited State Transport and Decay Dynamics in Cesium Lead Mixed-Halide Perovskites. *ACS Energy Letters* **2017**, 2, 1501-1506. [10.1021/acsenergylett.7b00257](https://doi.org/10.1021/acsenergylett.7b00257)

26. Hill, A. H.; Smyser, K. E.; Kennedy, C. L.; Massaro, E. S.; **Grumstrup, E. M.**, Transient absorption imaging of carrier dynamics in disordered semiconductors. *Proc. SPIE-Int. Soc. Opt. Eng.* **2017**, *10193* (Ultrafast Bandgap Photonics II), 101930W. [10.1117/12.2262664](https://doi.org/10.1117/12.2262664)
25. Massaro, E.; **Grumstrup, E. M.**, Label-Free Saturated Structured Excitation Microscopy [Invited Article]. *Photonics* **2017**, *4* (2), 36. [10.3390/photonics4020036](https://doi.org/10.3390/photonics4020036)
24. Hill, A. H.; Smyser, K. E.; Kennedy, C. L.; Massaro, E. S.; **Grumstrup, E. M.**, Screened Charge Carrier Transport in Methylammonium Lead Iodide Perovskite Thin Films. *Journal of Physical Chemistry Letters* **2017**, *8* (5), 948-953. [10.1021/acs.jpcllett.7b00046](https://doi.org/10.1021/acs.jpcllett.7b00046)
23. Massaro, E. S.; Hill, A. H.; Kennedy, C. L.; **Grumstrup, E. M.**, Imaging Theory of Structured Pump-Probe Microscopy. *Optics Express* **2016**, *245* (18), 20868. [10.1364/oe.24.020868](https://doi.org/10.1364/oe.24.020868)
22. Massaro, E. S.; Hill, A. H.; **Grumstrup, E. M.**, Super-Resolution Structured Pump-Probe Microscopy. *ACS Photonics* **2016**, *3* (4), 501-506. [10.1021/acsphotonics.6b00140](https://doi.org/10.1021/acsphotonics.6b00140)
21. **Grumstrup, E. M.**; Gabriel, M. M.; Cating, E. E. M.; Van Goethem, E. M.; Papanikolas, J. M., Pump-probe microscopy: Visualization and spectroscopy of ultrafast dynamics at the nanoscale [Invited Perspective]. *Chemical Physics* **2015**, *458*, 30-40. [10.1016/j.chemphys.2015.07.006](https://doi.org/10.1016/j.chemphys.2015.07.006)

PUBLICATIONS (prior to MSU)

20. Zigler, D. F.; Morseth, Z. A.; Wang, L.; Ashford, D. L.; Brennaman, M. K.; **Grumstrup, E. M.**; Brigham, E. C.; Gish, M. K.; Dillon, R. J.; Alibabaei, L.; Meyer, G. J.; Meyer, T. J.; Papanikolas, J. M., Disentangling the Physical Processes Responsible for the Kinetic Complexity in Interfacial Electron Transfer of Excited Ru(II) Polypyridyl Dyes on TiO₂. *Journal of the American Chemical Society* **2016**, *138* (13), 4426-38. [10.1021/jacs.5b12996](https://doi.org/10.1021/jacs.5b12996)
19. Brennaman, M. K.; Norris, M. R.; Gish, M. K.; **Grumstrup, E. M.**; Alibabaei, L.; Ashford, D. L.; Lapides, A. M.; Papanikolas, J. M.; Templeton, J. L.; Meyer, T. J., Ultrafast, Light-Induced Electron Transfer in a Perylene Diimide Chromophore-Donor Assembly on TiO₂. *Journal of Physical Chemistry Letters* **2015**, *6* (23), 4736-4742. [10.1021/acs.jpcllett.5b02194](https://doi.org/10.1021/acs.jpcllett.5b02194)
18. **Grumstrup, E.M.**; Gabriel, M.M.; Pinion, C.W.; Parker J.K.; Cahoon, J.F.; Papanikolas, J.M.; Reversible strain-induced electron-hole recombination in silicon nanowires observed with femtosecond pump-probe microscopy. *Nano Letters*, **2014**, *14*, 6287-6292. [10.1021/nl5026166](https://doi.org/10.1021/nl5026166)
17. Gabriel, M.M.; **Grumstrup, E.M.**; Kirschbrown J.R.; Christesen, J.D.; Pinion, C.W.; Cahoon, J.F.; Papanikolas J.M.; Imaging carrier motion in nanowire p-i-n junctions using ultrafast microscopy. *Nano Letters*, **2014**, *14*, 3079-3087. [10.1021/nl5012118](https://doi.org/10.1021/nl5012118)
16. **Grumstrup, E.M.**; Gabriel, M.M.; Kirschbrown J.R.; Cating E.M.; Christesen, J.D.; Pinion, C.W.; Vallorz, E. L. III; Cahoon, J.F.; Parker, J.K.; Papanikolas J.M.; Ultrafast carrier dynamics in individual silicon nanowires: Characterization of diameter-dependent carrier lifetime and surface recombination with pump-probe microscopy. *Journal of Physical Chemistry C*, **2014**, *118*, 8634-8640. [10.1021/Jp502737e](https://doi.org/10.1021/Jp502737e)
15. **Grumstrup, E.M.**; Cating E.M.; Gabrielle M.M.; Kirschbrown J.R.; Vallorz, E. L. III; Christesen, J.D.; Pinion, C.W.; Cahoon, J.F.; Parker, J.K.; Papanikolas J.M.; Ultrafast carrier dynamics of silicon nanowire ensembles: The impact of geometrical heterogeneity on charge carrier lifetime. *Journal of Physical Chemistry C*, **2014**, *118*, 8626-8633. [10.1021/jp501079b](https://doi.org/10.1021/jp501079b)
14. Chen*, Z.; **Grumstrup*, E.M.**; Gilligan, A; Schanze, K.S.; Papanikolas, J.M. Ultrafast energy transfer in polystyrene linked donor acceptor co-polymers. *Journal of Physical Chemistry B*, **2014**, *118*, 372-378. [10.1021/jp411565p](https://doi.org/10.1021/jp411565p)

13. Christesen, J.D.; Pinion, C.W.; **Grumstrup, E.M.**; Papanikolas J.M.; Cahoon, J.F.; Synthetically encoding 10 nm morphology in silicon nanowires. *Nano Letters*, **2013**, *13*, 6281-6286. [10.1021/nl403909r](https://doi.org/10.1021/nl403909r)
12. **Grumstrup, E.M.**; Chen, Z.; Vary, R.P.; Moran, A.M.; Schanze, K.S.; Papanikolas, J.M. Frequency modulated femtosecond stimulated Raman spectroscopy (FM-FSRS) of ultrafast energy transfer in a donor-acceptor co-polymer. *Journal of Physical Chemistry B*, **2013**, *117*, 8245-8255. [10.1021/jp404498u](https://doi.org/10.1021/jp404498u)
11. Wang, L.; Puodziukynaite, E.; **Grumstrup, E.M.**; Schanze, K.S.; Reynolds, J.R.; Papanikolas, J.M. Charge separation in Ru-loaded poly(3-hexylthiophene) light-harvesting polymer. *Journal of Physical Chemistry Letters*, **2013**, *4*, 2269-2273. [10.1021/jz401089v](https://doi.org/10.1021/jz401089v)
10. Gabriel, M. M.; Kirschbrown, J. R.; Christesen, J. D.; Pinion, C. W.; Zigler, D. F.; **Grumstrup, E. M.**; Mehl, B. P.; Cating, E. E. M.; Cahoon, J. F.; Papanikolas, J. M. Direct imaging of free carrier and trap carrier motion in silicon nanowires by spatially-separated femtosecond pump-probe microscopy. *Nano Letters* **2013**, *13*, 1336–1340. [10.1021/nl400265b](https://doi.org/10.1021/nl400265b)
9. **Grumstrup, E.M.**; Damrauer, N. H. Modeling and correction of distorted two-dimensional Fourier transform spectra from pixelated pulse shaping devices. *Optics Express* **2012**, *20*, 20908–20919. [10.1364/oe.20.020908](https://doi.org/10.1364/oe.20.020908)
8. Wang, L.; Puodziukynaite, E.; Vary, R. P.; **Grumstrup, E. M.**; Walczak, R. M.; Zolotarskaya, O. Y.; Schanze, K. S.; Reynolds, J. R.; Papanikolas, J. M. Competition between ultrafast energy flow and electron transfer in a Ru(II)-loaded polyfluorene light-harvesting polymer. *Journal of Physical Chemistry Letters*. **2012**, *3*, 2453–2457. [10.1021/jz300979j](https://doi.org/10.1021/jz300979j)
7. **Grumstrup, E.M.**; Johnson, J. C.; Damrauer, N. H. Enhanced triplet formation in polycrystalline tetracene films by femtosecond optical-pulse shaping. *Physical Review Letters* **2010**, *105*, 257403. [10.1103/PhysRevLett.105.257403](https://doi.org/10.1103/PhysRevLett.105.257403)
6. **Grumstrup*, E. M.**; Montgomery*, M.A.; Damrauer, N. H. Fourier transform spectroscopies derived from amplitude or phase shaping of broadband laser pulses with applications to adaptive control. *Journal of the Optical Society of America B* **2010**, *27*, 2518–2533. [10.1364/JOSAB.27.002518](https://doi.org/10.1364/JOSAB.27.002518)
5. Brauer, C. S.; Sedo, G.; Dahlke, E.; Wu, S.; **Grumstrup, E. M.**; Leopold, K. R.; Marshall, M. D.; Leung, H. O.; Truhlar, D. G. Effects of ¹⁸O isotopic substitution on the rotational spectra and potential splitting in the OH-OH₂ complex: improved measurements for ¹⁶OH-¹⁶OH₂ and ¹⁸OH-¹⁸OH₂, new measurements for the mixed isotopic forms, and ab initio calculations of the ²A'-²A'' energy separation. *The Journal of Chemical Physics* **2008**, *129*, 104304. [10.1063/1.2973638](https://doi.org/10.1063/1.2973638)
4. **Grumstrup*, E.M.**; Shim*, S-H.; Montgomery, M. A.; Damrauer, N. H.; Zanni, M. T. Facile collection of two-dimensional electronic spectra using femtosecond pulse-shaping technology. *Optics Express* **2007**, *15*, 16681–16689. [10.1364/oe.15.016681](https://doi.org/10.1364/oe.15.016681)
3. Wu, S.; Sedo, G.; **Grumstrup, E. M.**; Leopold, K. R. Microwave spectra of O(2)-HF and O(2)-DF: hyperfine interactions and global fitting with infrared data. *The Journal of Chemical Physics* **2007**, *127*, 204315. [10.1063/1.2804770](https://doi.org/10.1063/1.2804770)
2. Brauer, C. S.; Craddock, M. B.; Kilian, J.; **Grumstrup, E. M.**; Orilall, M. C.; Mo, Y.; Gao, J.; Leopold, K. R. Amine-hydrogen halide complexes: experimental electric dipole moments and a theoretical decomposition of dipole moments and binding energies. *Journal of Physical Chemistry A* **2006**, *110*, 10025–10034. [10.1021/jp062101a](https://doi.org/10.1021/jp062101a)

1. Brauer, C.S.; Sedo, G; **Grumstrup, E.M.**; Leopold, K.; Marshall, M.; Leung, H.; Effects of partially quenched orbital angular momentum on the microwave spectrum and magnetic hyperfine splitting in the OH-water complex. *Chemical Physics Letters* **2005**, 401, 420-425. [10.1063/1.2973638](https://doi.org/10.1063/1.2973638)

*Authors contributed equally

INVITED CONFERENCE PRESENTATIONS

1. “Chemically and Structurally Correlated Charge Carrier Transport in Nanoscale Materials”; ACS Spring Meeting; New Orleans, LA; 03/18/18
2. “Superresolution optical strategies for revealing ultrafast carrier-phonon dynamics in nanoscale materials”; Arnold and Mabel Beckman Foundation Research Symposium; Irvine, CA; 07/03/2017
3. “Structurally-correlated charge carrier dynamics in disordered semiconductors”; DOE Solar Photochemistry PI Meeting; Gaithersburg, MD; 06/07/2017
4. “Transient Absorption Imaging of Carrier Dynamics in Disordered Semiconductors”; SPIE Defense + Security – Ultrafast Bandgap Photonics II; Anaheim, CA; 04/12/17
5. “Ultrafast Dynamics of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Perovskites: Spatial and Temporal Insight through Pump-Probe Microscopy”; Telluride Science Series - Perovskites: Theory meets Experiment; Telluride, CO; 07/13/16
6. “Ultrafast Dynamics of $\text{CH}_3\text{NH}_3\text{PbI}_3$ Perovskites: Spatial and Temporal Insight through Pump-Probe Microscopy”; Southwest Ultrafast Conference; Austin, TX; 06/16/16
7. “Ultrafast microscopy of methylammonium lead iodide perovskite thin-films: heterogeneity of excited state spatial and temporal evolution”; DOE Solar Photochemistry PI meeting; Gaithersburg, MD; 06/08/16
8. “Ultrafast Imaging: Correlating Structure and Function in Silicon Nanomaterials”; Fluorofest Durham, NC; 11/02/14
9. “Strain-Enhanced Carrier Recombination in Silicon Nanowires”; Excited State Phenomena Symposium; Santa Fe, NM; 06/07/14.
10. “Photoinduced Charge Transfer Dynamics at the Chromophore- and Assembly- Semiconductor Interface”; Energy Frontier Research Center Principle Investigators Meeting; Washington, DC; 07/18/13.

INVITED DEPARTMENTAL SEMINARS

1. “Chemically and Structurally Correlated Charge Carrier Transport in Nanoscale Materials”; University of Colorado, Boulder, Co; 04/13/17
2. “Watching Electrons Move and Shake at the Nanoscale”; Chemistry Department Seminar; Cal Poly San Luis Obispo, San Luis Obispo, CA; 04/07/17
3. “Optoelectronics at the Nanoscale: Ultrafast Electron Dynamics of Complex Materials”; Chemistry Department Seminar; BYU Idaho; Rexburg, ID; 03/10/16
4. “Optoelectronics at the Nanoscale: Ultrafast Electron Dynamics of Complex Materials”; Physics Department Seminar; Montana State University; Bozeman, MT; 03/09/16
5. “Ultrafast Imaging: Watching Electrons Move at the Nanoscale”; Chemistry Department Seminar; Carroll College; Helena, MT; 11/20/14

6. *“Time-Resolved Pump Probe Microscopy of Ultrafast Carrier Dynamics in Silicon Nanowires”*; Chemistry Departmental Seminar; Montana State University; Bozeman, MT. 03/30/14
7. *“Time-Resolved Pump Probe Microscopy of Ultrafast Carrier Dynamics in Silicon Nanowires”*; Chemistry Departmental Seminar; Colorado School of Mines; Golden, CO. 03/10/14
8. *“Time-Resolved Pump Probe Microscopy of Ultrafast Carrier Dynamics in Silicon Nanowires”*; Nanoscience Departmental Seminar; South Dakota School of Mines; Rapid City, SD. 02/26/14

EXTERNAL GRANTS AND FUNDING (\$1.52M total costs awarded)

1. *Superresolution Optical Strategies for Revealing Ultrafast Carrier-Phonon Dynamics in Nanoscale Materials*
Source: Arnold and Mabel Beckman Foundation
Amount: \$750,000 over 4 years
Role: PI (no co-PIs)
Dates 09/17 -08/21
2. *Photoconversion in Disordered Semiconductors: Spatial, Spectral, and Temporal Insights through Nonlinear Microscopy*
Source: US Department of Energy Early Career Award
Amount: \$750,000 over 5 years
Role: PI (no co-PIs)
Dates: 07/15/15 – 07/14/20
3. *Superresolution Stimulated Raman Imaging for label-free Biomedical Imaging*
Source: Toby Markowitz Biomedical Research Grant (through MSU Foundation)
Amount: \$22,000
Role: PI (no co-PIs)
Dates: 10/06/15 – 10/05/16

HONORS AND AWARDS

- Arnold and Mabel Beckman Foundation Young Investigator 2017
- Department of Energy Early Career Research Award 2015
- National Research Council Post-Doctoral Fellowship 2013

TEACHING

COURSES

- Fall 2014 CHMY 557 – Quantum Mechanics I
Section 1 (3 students) Composite Instructor Evaluation (CIE): CIE: 4.96/5.00
- Fall 2015 CHMY 141 – College Chemistry I
Section 3 (289 students) Composite Instructor Evaluation: CIE: 4.39/5.00
Section 58 (81 students) Composite Instructor Evaluation: CIE: 4.57/5.00
- Fall 2016 CHMY 557 – Quantum Mechanics I
Section 1 (8 students) CIE: 4.96/5.00
- Spring 2017 MTSI 552 – Adv. Materials Char. II
Section 1 (16 students, 8 at MSU, 8 at UM and MT Tech) CIE: 4.73/5.00

- Fall 2017 CHMY 141 – College Chemistry I CIE: 4.61/5.00
Section 1 (181 students)
- Spring 2018 MTSI 552 – Adv. Materials Char. II CIE: 4.61/5.00
Section 1 (16 students, 11 at MSU, 5 at MT Tech)

UNDERGRADUATE RESEARCH/INDEPENDENT STUDY

- Fall 2015 CHMY 490R 10 credit hours (4 students)
- Spring 2016 CHMY 490R 8 credit hours (3 students)
- Fall 2016 CHMY 490R 2 credit hours (1 students)
- Spring 2017 CHMY 490R 5 credit hours (2 students)
- Spring 2018 CHMY 490R 3 credit hours (1 students)

GRADUATE RESEARCH/THESIS

- Fall 2015 CHMY 690 6 credit hours (1 student)
- Spring 2016 CHMY 689 2 credit hours (1 student)
CHMY 690 9 credit hours (2 students)
- Fall 2016 CHMY 689 2 credit hours (1 student)
CHMY 690 6 credit hours (1 students)
- Spring 2017 CHMY 689 5 credit hours (2 students)
CHMY 690 10 credit hours (3 students)
- Fall 2017 CHMY 689 5 credit hours (2 students)
CHMY 690 11 credit hours (3 students)
- Spring 2018 CHMY 689 2 credit hours (1 student)
CHMY 690 19 credit hours (3 students)

ADVISINGPOST DOCTORAL ASSOCIATES

- Geoffrey Piland, Ph.D. UC Riverside, Chemistry 10/17 – Present

GRADUATE STUDENT GROUP MEMBERS

- Casey Kennedy Chemistry 11/15 – Present
- Alexander Hathaway Chemistry 11/17 – Present
- Andrew Hill Materials Science 11/14 – Present
- Eric Massaro Chemistry 11/14 – Present
- Saranyan Srinivasan Rangunath Materials Science 11/16 – 05/18

UNDERGRADUATE STUDENT GROUP MEMBERS

- Erin Dockins Chemistry/History 09/15 – Present
- Jenna Kuipers Chemistry 08/18 – 05/18
- Kori Smyser Chemistry – now Ph.D. student at CU Boulder 01/15 – 05/17
- Bill Vandenberg Industrial Engineering 08/16 – 05/17
- Claire Neumeier Chemistry 08/15 – 05/16
- Gunnar Hillborn Chemistry Summer Program (Carroll College) 06/15 – 08/15
- Tanner Nielsen Chemistry 08/15 – 12/15

GRADUATE COMMITTEES

- Currently serving on 15 graduate student (5 Materials Science; 10 Chemistry/Biochemistry) committees
- Completed serving on 8 graduate student committees (2 Mat. Sci.; 8 Chemistry/Biochemistry)

SERVICE AND SYNERGISTIC ACTIVITIES

PROFESSIONAL

- Proposal reviewer for NSF, ACS-PRF, Army Research Office, and U.S. Department of Energy
- Peer-review for manuscripts in ACS Applied Materials and Interfaces, Journal of Physical Chemistry C, Journal of Physical Chemistry Letters, Optics Letters, Laser and Photonics Reviews, Nano Letters, ACS Nano, Heat Transfer Engineering, ChemPhysChem, Nature Photonics, ACS Sustainable Chemistry and Engineering, JACS

UNIVERSITY/DEPARTMENTAL

- Chemistry and Biochemistry Seminar Series Co-organizer AY 14-15 – Present
- Undergraduate Scholars Program Proposal Reviewer AY 15-16 – Present
- Committee Member: Environmental Health and Safety AY 15-16 – Present
- Committee Member: Chem/Biochem Graduate Admissions AY 15-16 – Present
- Chair Pat Callis Symposium Organizing Committee AY 17-18
- Hiring Committee member (Asst. Prof. in AMO) – Physics AY 16-17
- Co-organizer proposal writing workshop for Graduate Student Summit AY 15-16
- Panel Member for Graduate Student CV/resume workshop AY 15-16
- Hiring Committee Member (Asst. Prof. in O. Chem.) – Chem/Biochem AY 15-16
- Committee Member: Chem/Biochem Graduate AY 15-16
- “MSU Friday” Lecturer AY 15-16

COMMUNITY

- Co-Founder of *Bozeman Tech on Tap*, a semi-monthly discussion group bringing together local optics industry representatives and optics-centric graduate students, postdocs, and faculty from MSU