Brian S. Rolczynski, Ph.D.

US Naval Research Laboratory
Building 208, Room 158
4555 Overlook Ave SW
Washington, DC 20375

Email: brian.rolczynski@gmail.com
Mobile: (312) 515-0821
Office: (202) 404-6294
Website: rolczynski.com

EDUCATION

Northwestern University, Evanston, IL **2007 – 2013**

Ph.D., Physical Chemistry
Dissertation: "Charge-Transfer Oligomers and Polymers for Organic Photovoltaics: Structure, dynamics, and their implications for solar devices"

University of Washington, Seattle, WA **2002 – 2007**

BS, Chemistry and BA, English (with honors)

RESEARCH EXPERIENCE

US Naval Research Laboratory, Washington, DC **2018 - present**

ASEE fellow, Electronics Science and Technology Division

- Using DNA nanotechnology to produce chromophore networks with well-defined orientations and positions, to understand and design coherent quantum mechanical properties using 2D electronic spectroscopy (currently under construction).
- Using machine-learning methods to develop quantitative models that predict energy transfer efficiencies, positions, and orientations of chromophores in DNA-origami scaffolds.
- Modeling energy transfer in cascading, DNA-scaffolded multi-chromophore relays.
- Single-molecule FRET fluorescence microscopy to understand polydispersity in DNA sample ensembles.

The University of Chicago, Chicago, IL **2013 - 2018**

Postdoctoral fellow, Department of Chemistry and The James Franck Institute
PI: Greg S. Engel

- Developed a time-ordered, time-domain vibrational technique based on 2D electronic spectroscopy, and used it to observe interexcitonic vibrational correlations in a photosynthetic pigment-protein complex. These correlations can extend coherence lifetimes.
- Developed a method to obtain highly resolved 2D electronic spectra, revealing the overlapping peak positions of feature-rich spectra.
- Developed a combined 2D spectroscopy and machine-learning approach to calculate Hamiltonians in the site basis for biological systems.
- Built an experiment to measure the transient material response to Laguerre-Gaussian "twisted light," and used it to measure how the response in semiconductors depends on the light's orbital angular momentum. These dynamics can be understood and optimized to create solid-state detectors for this quantum number in light.

Northwestern University, Evanston, IL **2007 – 2013**
and concurrently at **Argonne National Laboratory, Lemont, IL** **2010 – 2013**
Graduate researcher, Department of Chemistry and ANSER Center
PI: Lin X. Chen

- Studied intramolecular and intermolecular exciton dissociation in alternating copolymers, identifying trends between intramolecular polymer processes and corresponding bulk heterojunction device efficiencies. These studies explained high power conversion efficiencies in organic photovoltaic devices employing alternating copolymers.
- Examined aggregate morphologies in neat and bulk heterojunction alternating copolymer films using grazing incidence wide/small angle X-ray scattering, demonstrating correlations between π-π stacking distances and bulk heterojunction device fill factor.
- Studied spontaneous self-assembly behavior in spin-coated photovoltaic oligomer systems depending on monomer length, using grazing incidence wide/small angle X-ray scattering and atomic force microscopy.
- Characterized anisotropic absorption behavior of organic donor-acceptor co-crystals as a function of modular chromophore species.

FELLOWSHIPS

ASEE Fellowship (2018-present)
Argonne Graduate Fellowship (2010-2012)

TALKS

14. **Rolczynski, B. S**. "Correlated Protein Environments Prolong Quantum Coherence." Invited talk, NIST, Gaithersburg, MD. 5/14/19.

13. **Rolczynski, B. S.**; Klein, W.; Diaz, S.; Zadegan, R.; Ancona, M.; Kuang, W.; Medintz, I.; Melinger, J. "Understanding energy transport relays using machine-learning tools." FNano conference, Snowbird, UT. 4/16/19.

12. **Rolczynski, B. S.**, and Engel, G. S. "Correlated Protein Environments Prolong Quantum Coherence." Carnegie Mellon University, Pittsburgh, PA. 1/21/19.

11. **Rolczynski, B. S.** and Engel, G. S. "Correlated Protein Environments Prolong Quantum Coherence." US Naval Research Laboratory, Washington, DC. 5/3/18.

10. **Rolczynski, B. S.** and Engel, G. S. "Correlated Protein Environments Drive Prolonged Quantum Coherence." Washington University in St. Louis, St. Louis, MO. 11/30/17.

9. **Rolczynski, B. S.** and Engel, G. S. "Correlated Motion for Prolonged Quantum Coherences in a Photosynthetic Protein." Invited talk, Loyola University, Chicago, IL. 4/20/17.

8. **Rolczynski, B. S.**; Navotnaya, P.; Engel, G. S. "Driving delocalized dynamics using the orbital angular momentum of light." ACS Meeting, San Francisco, CA. 4/5/17.

7. **Rolczynski, B. S.**; Yeh, S.; Navotnaya, P.; Ashraf, K.; Gardiner, A.; Cogdell, R.; Engel, G. S. "Resolving the detailed 2D spectral structure of the Fenna-Matthews-Olson complex." ACS Meeting, San Francisco, CA. 4/5/17.

6. **Rolczynski, B. S.**; Zheng, H.; Singh, V.; Navotnaya, P.; Caram, J.; Ashraf, K.; Gardiner, A.; Cogdell, R.; Engel, G. S. "Correlated vibrational motion in the Fenna-Matthews-Olson complex." ACS Meeting, San Francisco, CA. 4/2/17.

5. **Rolczynski, B. S.** and Engel, G. S. "Correlated exciton environments in the Fenna-Matthews-Olson complex." Photosynthesis conference, Marshall, IN. 11/5/16.

4. **Rolczynski, B. S.** and Engel, G. S. "Transcribing light's orbital angular momentum to materials." Spinos VI, Chicago, IL. 10/17/16.

3. **Rolczynski, B. S.** and Engel, G. S. "Long-lived coherences through correlated environments." ACS Meeting, Philadelphia, PA. 8/22/16.

2. **Rolczynski, B. S.** and Engel, G. S. "How Long Does a CdSe Quantum Dot Remember Its Excitation Energy?" Nanotalk Symposium, Chicago, IL. 2/25/14.

1. **Rolczynski, B. S.** and Chen, L. X. "The role of tuning push-pull interactions in small optical gap copolymers." Gordon Research Seminar, Easton, MA. 7/10/11.

PUBLICATIONS

Google Scholar link

27. **Rolczynski, B. S.**; Yeh, S.-H.; Navotnaya, P.; Lloyd, L. T.; Ginzburg, A. R.; Zheng, H.; Allodi, M. A.; Otto, J. P.; Ashraf, K.; Gardiner, A. T.; Cogdell, R. J.; Kais, S.; Engel, G. S. Time-domain Line-shape Analysis from 2D Spectroscopy to Precisely Determine Hamiltonian Parameters for a Photosynthetic Complex. J. Phys. Chem. B 2021. DOI: 10.1021/acs.jpcb.0c08012.

26. Mathur, D.; Kim, Y. C.; Diaz, S. A.; Cunningham, P. D.; **Rolczynski, B. S.**; Ancona, M. G.; Medintz, I. L.; Melinger, J. S. Can a DNA Origami Structure Constrain the Position and Orientation of an Attached Dye Molecule? J. Phys. Chem. C 2020, 125, 1509-1522.

25. Klein, W. P.; **Rolczynski, B. S.**; Oliver, S. M.; Zadegan, R.; Buckhout-White, S.; Ancona, M. G.; Cunningham, P. D.; Melinger, J. S.; Vora, P. M.; Kuang, W.; Medintz, I. L.; Díaz, S. A. DNA Origami Chromophore Scaffold Exploiting HomoFRET Energy Transport to Create Molecular Photonic Wires. ACS Appl. Nano Mater. 2020, 3, 4, 3323-3336.

24. Allodi, M. A.; Otto, J. P.; Sohail, S. H.; Saer, R. G.; Wood, R. E.; **Rolczynski, B. S.**; Massey, S. C.; Ting, P.-C.; Blankenship, R. E.; Engel, G. S. Redox Conditions Affect Ultrafast Exciton Transport in Photosynthetic Pigment–Protein Complexes. J. Phys. Chem. Lett. 2018, 9, 89-95.

23. **Rolczynski, B. S.**; Zheng, H.; Singh, V. P.; Navotnaya, P.; Ginzburg, A. R.; Caram, J. R.; Ashraf, K.; Gardiner, A. T.; Yeh, S.-H.; Kais, S.; Cogdell, R. J.; Engel, G. S. Correlated Protein Environments Drive Quantum Coherence Lifetimes in Photosynthetic Pigment-Protein Complexes. Chem 2018, 4, 138-149.

*Highlighted in a Preview. (Maiuri, M.; Scholes, G. 2D Spectroscopy Helps Visualize the Influence of Spectral Motion on Chromophore Response. Chem 2018, 4, 20-21.)

*Selected as an editor's top article of 2018

22. Flanagan, M. L.; Long, P. D.; Dahlberg, P. D.; **Rolczynski, B. S.**; Massey, S. C.; Engel, G. S. Mutations to R. sphaeroides Reaction Center Perturb Energy Levels and Vibronic Coupling but Not Observed Energy Transfer Rates. J. Phys. Chem. A. 2016. 120(9), 1479.

21. Cho, S.; **Rolczynski, B. S.**; Xu, T.; Yu, L.; Chen, L. X. Solution Phase Exciton Diffusion Dynamics of a Charge-Transfer Copolymer PTB7 and Homopolymer P3HT. J. Phys. Chem. B. 2015, 119(24), 7447.

20. Blackburn, A. K.; Sue, A. C.-H.; Shveyd, A. K.; Cao, D.; Tayi, A.; Narayanan, A.; **Rolczynski, B. S.**; Sarko, J. M.; Bozdemir, O. A.; Wakabayashi, R.; Lehrman, J. A.; Chen, L. X.; Nassar, M. S.; Stupp, S. I.; Stoddart, J. F. Lock–arm supramolecular ordering: A molecular construction set for cocrystallizing organic charge transfer complexes. J. Am. Chem. Soc. 2014, 136, 17224.

19. **Rolczynski, B. S.**; Szarko, J. M.; Son, H. J.; Yu, L.; Chen, L. X. Effects of Exciton Polarity in Charge Transfer Polymer/PCBM Bulk Heterojunction Films. J. Phys. Chem. Lett. 2014, 5(11), 1856.

18. Szarko, J. M.; **Rolczynski, B. S.**; Lou, S. J.; Xu, T.; Strzalka, J.; Marks, T. J.; Yu, L.; Chen,

L. X. Photovoltaic Function and Exciton/Charge Transfer Dynamics in a Highly Efficient Semiconducting Copolymer. Adv. Funct. Mater. 2014, 24(1), 10.

*Over 100 citations.

17. Zheng, H.; Caram, J. R.; Dahlberg, P. D.; **Rolczynski, B. S.**; Viswanathan, S.; Dolzhnikov, D. S.; Khadivi, A.; Talapin, D. V.; Engel, G. S. Dispersion-free continuum two-dimensional electronic spectrometer. Applied Optics 2014, 53(9), 1909.

16. Caram, J. R.; Zheng, H.; Dahlberg, P. D.; **Rolczynski, B. S.**; Griffin, G. B.; Dolzhnikov, D. S.; Talapin, D. V.; Engel, G. S. Exploring size and state dynamics in CdSe quantum dots using two-dimensional electronic spectroscopy. J. Chem. Phys. 2014, 140(8), 084701.

15. Griffin, G. B.; Lundin, P. M.; **Rolczynski, B. S.**; Linkin, A.; McGillicuddy, R. D.; Bao, Z.; Engel, G. S. Ultrafast energy transfer from rigid, branched side-chains into a conjugated, alternating copolymer. J. Chem. Phys. 2014, 140(3), 034903.

14. Caram, J. R.; Zheng, H.; Dahlberg, P. D.; **Rolczynski, B. S.**; Griffin, G. B.; Fidler, A. F.; Dolzhnikov, D. S.; Talapin, D. V.; Engel, G. S. Persistent Interexcitonic Quantum Coherence in CdSe Quantum Dots. J. Phys. Chem. Lett. 2014, 5(1), 196.

13. Singh, V. P.; Fidler, A. F.; **Rolczynski, B. S.**; Engel, G. S. Independent phasing of rephasing and non-rephasing electronic spectra. J. Chem. Phys. 2013, 139(8), 084201.

12. Tayi, A. S.; Shveyd, A. K.; Sue, C.-H.; Szarko, J. M.; **Rolczynski, B. S.**; Sarjeant, A. A.; Stern, C. L.; Cao, D.; Paxton, W. F.; Wu, W.; Dey, S. K.; Fahrenbach, A. C.; Guest, J.; Mohseni, H.; Chen, L. X.; Wang, K. L.; Stoddart, J. F.; Stupp, S. I. Room Temperature Ferroelectricity in Supramolecular Networks of Charge Transfer Complexes. Nature 2012, 488, 485.

*Over 350 citations.

11. **Rolczynski, B. S.**; Szarko, J. M.; Son, H. J.; Liang, Y.; Yu, L.; Chen, L. X. Ultrafast Intramolecular Exciton Splitting Dynamics in Isolated Low-Band-Gap Polymers and Their Implications on Photovoltaic Materials Design. J. Am. Chem. Soc. 2012, 134, 9, 4142.

*Over 150 citations.

10. Gothard, N. A.; Mara, M. W.; Huang, J.; Szarko, J. M.; **Rolczynski, B. S.**; Lockard, J. V.; Chen, L. X. Strong Steric Hindrance Effect on Excited State Structural Dynamics of Cu(I) Diimine Complexes. J. Phys. Chem. A 2012, 116, 9, 1984.

9. Carsten, B.; Szarko, J. M.; Son, H. J.; Wang, W.; Lu, L.; He, F.; **Rolczynski, B. S.**; Lou, S. J.; Chen, L. X.; Yu, L. Examining the Effect of the Dipole Moment on Charge Separation in Donor-Acceptor Polymers for Organic Photovoltaic Applications. J. Am. Chem. Soc. 2011, 133, 50, 20468.

*Over 350 citations.

8. Murray, I. P.; Lou, S. J.; Cote, L. J.; Loser, S.; Kadleck, C. J.; Xu, T.; Szarko, J. M.; **Rolczynski, B. S.**; Johns, J. E.; Huang, J.; Yu, L.; Chen, L. X.; Marks, T. J.; Hersam, M. C. Graphene Oxide Interlayers for Robust, High-Efficiency Organic Photovoltaics. J. Phys. Chem. Lett. 2011, 2, 3006.

*Over 150 citations.

7. Szarko, J. M.; Guo, J.; **Rolczynski, B. S.**; Chen, L. X. Nanoscale structure, dynamics and power conversion efficiency correlations in small molecule and oligomer-based photovoltaic devices. Nano Rev. 2011, 2, 7249.

6. Szarko, J. M.; Guo, J.; **Rolczynski, B. S.**; Chen, L. X. Current trends in the optimization of low band gap polymers in bulk heterojunction photovoltaic devices. J. Mater. Chem. 2011, 21, 22, 7849.

5. **Rolczynski, B. S.**; Szarko, J. M.; Lee, B.; Strzalka, J.; Guo, J.; Liang, Y.; Yu, L.; Chen, L. X. Length-dependent self-assembly of oligothiophene derivatives in thin films. J. Mater. Res. 2011, 26, 296.

4. Szarko, J. M.; **Rolczynski, B. S.**; Guo, J.; Liang, Y.; He, F.; Mara, M. W.; Yu, L.; Chen, L. X. Electronic Processes in Conjugated Diblock Oligomers Mimicking Low Band-Gap Polymers: Experimental and Theoretical Spectral Analysis. J. Phys. Chem. B 2010, 114, 14505.

3. Szarko, J. M.; Guo, J.; Liang, Y.; Lee, B.; **Rolczynski, B. S.**; Strzalka, J.; Xu, T.; Loser, S.; Marks, T. J.; Yu, L.; Chen, L. X. When Function Follows Form: Effects of Donor Copolymer Side Chains on Film Morphology and BHJ Solar Cell Performance. Adv. Mater. 2010, 22, 48, 5468.

*Over 350 citations.

2. Guo, J.; Liang, Y.; Szarko, J.; Lee, B.; Son, H. J.; **Rolczynski, B. S.**; Yu, L.; Chen, L. X. Structure, Dynamics, and Power Conversion Efficiency Correlations in a New Low Bandgap Polymer:PCBM Solar Cell. J. Phys. Chem. B 2010, 114, 2, 742.

*Over 150 citations.

1. Szarko, J.; Guo, J.; Liang, Y.; **Rolczynski, B.**; Yu, L.; Chen, L. X. The electron and energy transfer between oligothiophenes and thieno[3,4-b]thiophene units. Proc. of SPIE 2008, 7034, 703403.

PUBLICATIONS (NOT PEER-REVIEWED)

Rolczynski, B. S.; Navotnaya, P.; Sussman, H. R.; Engel, G. S. Cysteine-mediated mechanism

disrupts energy transfer to prevent photooxidation. Proc. Nat. Acad. Sci. 2016. 113(31), 8562.

SERVICE

1. Member, Committee on Minority Affairs, Chemical Society of Washington 2020-present
2. Instructor, Gateway Science Workshop, Northwestern University 2008-2009

TEACHING

The University of Chicago, Chicago, IL

Laboratory research mentor
5 graduate students, 4 undegraduates

Guest lecture
Wave Mechanics and Spectroscopy Fall 2015

Northwestern University, Evanston, IL

Laboratory research mentor
1 graduate student, 1 undergraduate

Super TA, General Physical Chemistry Spring 2008, Spring 2009
delivered lectures and review sessions, co-wrote and proctored exams and quizzes, wrote homework solutions, and more

Instructor, Gateway Science Workshop Spring 2008, Spring 2009
instructed a co-curricular honors Chemistry program for undergraduates

TA, Advanced Undergraduate Laboratory Summer 2009
TA, General Inorganic Chemistry Winter 2008
TA, General Chemistry Fall 2007