

# Brian S. Rolczynski

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## EDUCATION

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|--|---------------------|-----------------------|
| <b>The University of Chicago</b>   | <b>Chicago, IL</b>  | <b>2013 - present</b> |
| Postdoctoral fellow, Department of Chemistry and The James Franck Institute  |                     |                       |
| <b>Northwestern University</b>   | <b>Evanston, IL</b> | <b>2007 – 2012</b>    |
| Ph.D., Physical Chemistry<br>Dissertation: “Charge-Transfer Oligomers and Polymers for Organic Photovoltaics: Structure, dynamics, and their implications for solar devices” |                     |                       |
| <b>University of Washington</b>  | <b>Seattle, WA</b>  | <b>2002 – 2007</b>    |
| BS, Chemistry and BA, English (with honors)  |                     |                       |

## RESEARCH EXPERIENCE

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| <b>The University of Chicago</b>  | <b>Chicago, IL</b>  | <b>2013 - present</b> |
| Postdoctoral fellow, Department of Chemistry and The James Franck Institute<br>Advisor: Greg S. Engel   |                     |                       |
| <ul style="list-style-type: none"><li>• Built an experiment to measure the time-resolved material response to Laguerre-Gaussian light, discovering new excited state response in bulk GaAs. Helped conceive of, design, and obtain funding (\$3 million) for the experiment.</li><li>• Developed a time-domain vibrational technique based on 2D electronic spectroscopy, and used it to observe interexciton vibrational correlations directly in the Fenna-Matthews-Olson complex.</li><li>• Developed a method to obtain highly resolved diagonal and cross peaks in 2D electronic spectra, revealing the detailed spectral features in congested spectra.</li></ul> |                     |                       |
| <b>Argonne National Laboratory</b>  | <b>Lemont, IL</b>   | <b>2010 - 2012</b>    |
| Laboratory graduate research fellow, concurrent with Northwestern University  |                     |                       |
| <b>Northwestern University</b>  | <b>Evanston, IL</b> | <b>2007 – 2012</b>    |
| Graduate research assistant<br>Advisor: Lin X. Chen   |                     |                       |
| <ul style="list-style-type: none"><li>• Studied intramolecular and intermolecular exciton dissociation in alternating copolymers, identifying trends between intramolecular polymer processes and corresponding bulk</li></ul>  |                     |                       |

heterojunction device efficiencies.

- Examined aggregate morphologies in neat and bulk heterojunction alternating copolymer films using grazing incidence wide/small angle X-ray scattering, demonstrating correlations between  $\pi$ - $\pi$  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 cocrystals as a function of modular chromophore species.

## GRANTS

### 1. “Transcribing Quantum Information using Quantum Dynamics of Coherent Materials” (PI: Engel)

10/1/2014 - 9/30/2019

Agency: Department of Defense National Security Science and Engineering Faculty Fellowship

Total costs: \$3,000,000 (all to U. Chicago, PI: Engel)

### 2. “Coherent Energy Transfer in Novel Excitonic Materials for Solar Energy Applications” (PI: Engel)

1/31/2016 - 1/30/2019

Agency: Qatar National Research Foundation

Total costs: \$3,000,000 (20% to U. Chicago, PI: Engel; 80% to QEERI, PI: Sabre Kais)

## TALKS & PUBLICATIONS

### — Talks —

8. **Rolczynski, B. S.**; Navotnaya, P.; Engel, G. S. “Driving delocalized dynamics using the orbital angular momentum of light.” ACS Meeting, San Francisco, CA, 3/5/17.

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. 3/5/17.

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. 3/2/17.

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.” Spin 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.

— *Submitted manuscripts* —

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- **Rolczynski, B. S.**; Zheng, H.; Singh, V. P.; Navotnaya, P.; Ginzburg, A. R.; Caram, J. R.; Ashraf, K.; Gardiner, A. T.; Cogdell, R. J.; Engel, G. S. “Correlated Protein Motions Contribute to Quantum Coherence Lifetimes in Photosynthetic Pigment-Protein Complexes.” *Chem, submitted.*

— *Publications* —

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23. 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.* 2015. 120(9), 1479.
22. 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.
21. 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.
20. **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.

19. 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.
18. 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.
17. 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.
16. 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.
15. 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.
14. 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.
13. 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.
12. **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.
11. 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.
10. 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.

9. 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." *Phys. Chem. Lett.* 2011, 2, 3006.
8. 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.
7. 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.
6. **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.
5. 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.
4. 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.
3. 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.
2. 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.

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— *Commentaries* —

1. **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.

## TEACHING

### **Northwestern University**

**Evanston, IL**

TA, Advanced Undergraduate Laboratory

Summer 2009

Super TA, General Physical Chemistry

Spring 2008, Spring 2009

TA, General Inorganic Chemistry

Winter 2008

TA, General Chemistry

Fall 2007

### **Kannagara Jinja**

**Granite Falls, WA**

Martial arts (Aikido) instructor, children's class

2002-2007