

Curriculum Vitae for Conner Dykstra

Dykstra.41@osu.edu

(763) 377-3772

Education

University of Illinois, Department of Chemistry (Champaign-Urbana, IL)

Ph.D. in Chemistry, August 2017- August 2023

Thesis: *Ultrafast Charge Injection Dynamics in Quantum Dot Sensitized Metal Oxides*

Advisor: Professor Renske van der Veen, Professor Josh Vura-Weis

Northwestern University, Department of Chemistry (Evanston, IL)

B.A. in Chemistry, August 2010 – June 2014

Senior Thesis: Platinum Dot Functionalized Few-Layer MoS₂ Transistors for Applications in Gas Sensing

Advisor: Professor Vinayak Dravid

Work and Research Experience

Research Scientist – Ultrafast Spectroscopy

NSF NeXUS Research Facility

January 2025 to Present

Ohio State University (Columbus, OH)

- Steward for Ultrafast X-ray spectroscopy beamline, which includes multiple end-stations capable of supporting solid, and gas phase samples. Routine tasks include maintaining ultrahigh vacuum equipment, aligning X-ray and laser optics. Characterizing the X-ray beam for flux, spot size and divergence, and spectral coverage and important parameters for the operating condition of the beamline, which requires proper phase matching during X-ray generation.
- Evaluate and facilitate user-proposed experiments by giving input on the feasibility of proposed experiments. User experiments require close collaboration on sample format, installation, and experimental parameters like measurement geometry and prioritization.
- Design and implement new capabilities for the NeXUS facility, such as X-ray Magnetic Circular Dichroism (XMCD) and liquid phase samples.
- Maintain and improve the Laser-Induced Electron Diffraction (LIED) setup for gas phase samples. This instrument has two Time-of-Flight spectrometer which can be flexibly used for electron or ion detection, and potentially coincidence measurements.

Postdoctoral Researcher

Baker Lab

January 2024 to December 2024

Ohio State University (Columbus, OH)

- Set research priorities with principal investigator, Professor Robert Baker, and graduate students.
- Ensured smooth operation of High Harmonic Generation (HHG) X-ray spectroscopy setup. This is a complex instrument requiring ultrahigh vacuums and

high-power lasers. Routine laser maintenance was performed including cavity alignment, top-to-bottom beamline alignment, and spectral and temporal characterization *via* FROG.

- Applied transient and static X-ray spectroscopy to study nonequilibrium surface phenomena in BiVO₄, yttrium iron garnet, and Heusler alloys. Example phenomena include coherent phonon dynamics, formation of polaronic quasiparticle states, and carrier migration away from surface.
- Implemented X-ray magnetic circular dichroism to study spin ordering in strongly correlated materials, with eventual extension into nonequilibrium dynamics in chiral materials.
- Made fundamental improvements to beamline operation by implementing hardware and software improvements. Codebase improvements can be found on github and include migration from Matlab to Python, energy calibration by signal cross-correlation and baseline fitting with Principal Component Analysis.

Graduate Researcher

Renske van der Veen and Josh Vura – Weis Labs

October 2017 – August 2023

University of Illinois Urbana – Champaign (Champaign, IL)

Thesis: Ultrafast Charge Injection Dynamics in Quantum Dot Sensitized Metal Oxides

- Led research into the ultrafast dynamics in quantum dot charge transfer systems, including CdSe/PbSe quantum dots molecularly attached to TiO₂/ZnO nanostructures. Research revolved around the application of time – resolved X-ray and optical absorption spectroscopy (XTA and OTA respectively) to understand the influence of defects, quantum confinement, and surface chemistry on the timescale of charge separation.
- The feasibility of a transient X-ray absorption experiment on quantum dot sensitized metal oxides was determined by comparing signal amplitudes between XTA and OTA within similar classes of materials.
- XTA on bare ZnO nanorods revealed a novel effect in X-ray spectroscopy after photoexcitation, which applied a novel time resolved technique combining X-ray transient absorption and X-ray linear dichroism.
- A novel PbSe – TiO₂ nanostructure was synthesized, and fully characterized.

Research Scientist

October 2014 – April 2015

Ecolab Inc. (Minneapolis, MN)

- Synthesized new compounds for use as a green, biodegradable disinfectant. The formation and degradation kinetics of the active ingredient under various conditions was characterized using pH titration. New materials were evaluated with practical metrics for marketability, stability, and production.

Researcher

Jeffrey Brinker Lab

June – October 2014**University of New Mexico** (Albuquerque, New Mexico)

- Chemically exfoliated MoS₂ nanosheets were synthesized and explored for their utility as a photocatalyst by using a standard illumination/gas chromatography setup.
- Thin membranes were synthesized from the nanosheets doped with gold and characterized using Van der Pauw measurements. The membranes and nanosheets were explored for their utility as a conductive ink in printing applications.

Researcher**Vinayak Dravid Lab****March 2011 – June 2014****Northwestern University** (Evanston, IL)Senior Thesis: “Platinum Dot Functionalized Few-Layer MoS₂ Transistors for Applications in Gas Sensing”

- A gas sensing device based on few-layered molybdenum disulfide was constructed as a senior thesis project. The molybdenum disulfide was mechanically exfoliated, then plated with gold electrodes and platinum dots using electron beam lithography, and thermal evaporation.
- The device was characterized using atomic force microscopy. The electrical properties and adsorption/desorption kinetics, were investigated by recording the device’s electrical response when exposed to ammonia and nitrogen monoxide.
- Iron oxide magnetic nanostructures were synthesized with a polyethylene glycol coating to stabilize the nanostructures in aqueous solutions. Various polyethylene glycol-based ligands were synthesized to stabilize nanoparticles in aqueous solutions, reduce their cytotoxicity, and allow for functionalization. The goal was to create a nanostructure that could act as a drug delivery vehicle, a stable MRI contrast agent, or as a localized heat generator to induce cell death.
- A biodistribution study was performed by injecting mice with iron oxide magnetic nanostructures functionalized with various chemical coatings. ICP-MS was used to determine the iron content of the mice organs and compared with a control mouse.

Work Experience**Technical Support****June 2015 – June 2017****Epic Inc.** (Verona, WI)

- Worked closely with a few hospitals to solve integrated software issues within Epic’s Pharmacy Application, Willow. That support included building out software features, determining root cause of unwanted behavior, advocate for development of bug fixes or develop bug fixes personally, depending on client’s priorities.
- Key skills included proficiency in hands on debugging in clients’ system, followed by detailed write up and communication to developers. Of primary importance was working with clients to ensure the system reflected their needs.

- Developed a script with colleagues to convert key metrics of a customer's system to an actionable report.

Technical Expertise

Spectroscopic methods: Time-resolved X-ray absorption, ultraviolet-visible light absorption, fluorescence, Fourier transform infrared spectroscopy.

Analytical techniques: Inductively coupled atomic emission spectroscopy, mass spectrometry, nuclear magnetic resonance spectroscopy, X-ray diffraction/absorption/fluorescence.

Inorganic and organic synthesis methods: nanomaterial syntheses, sol-gel syntheses, Schlenk line, glove box, autoclave syntheses, silica gel and thin-layer chromatography, distillation.

Materials characterization: transmission electron microscopy, scanning electron microscopy, electron beam lithography, atomic force microscopy, FTIR, Raman, photoluminescence.

Software: Python, X-ray data processing software (Athena, Artemis, Larch), Igor Pro, Excel, JMP, Mumps.

GitHub: <https://github.com/BozarkV2>

Publications

Dykstra, C. P. Enright, M., Rossi, T. C., van der Veen, R., Vura-Weis, J. (2024) ZnO Surface States Dominate Interfacial Dynamics Post Charge Transfer in Quantum Dot Sensitized Solar Cells *In preparation*.

Dykstra, C. P. Enright, M., Rossi, T. C., van der Veen, R., Vura-Weis, J. (2024) Bimodal Interfacial Charge Transfer in Quantum Dot Heterostructures Revealed by Donor-/Acceptor-Specific Broadband Transient Absorption Spectroscopy. *Submitted*.

Burke, J. H., Bae, D. Y., Wallick, R. F., **Dykstra, C. P.**, Rossi, T. C., Smith, L. E., Leahy, C. A., Schaller, R. D., Mirica, L. M., Vura-Weis, J., & van der Veen, R. M. (2024). High-Spin State of a Ferrocene Electron Donor Revealed by Optical and X-ray Transient Absorption Spectroscopy. *Journal of the American Chemical Society*, 146(31), 21651–21663.

Wallick, R. F., Chakrabarti, S., Burke, J. H., Gnewkow, R., Chae, J. B., Rossi, T. C., Mantouvalou, I., Kanngießer, B., Fondell, M., Eckert, S., **Dykstra, C.**, Smith, L. E., Vura-Weis, J., Mirica, L. M., & van der Veen, R. M. (2024). Excited-State Identification of a Nickel-Bipyridine Photocatalyst by Time-Resolved X-ray Absorption Spectroscopy. *The Journal of Physical Chemistry Letters*, 15(18), 4976–4982.

Rossi, T. C., **Dykstra, C. P.**, et al. (2021). Charge Carrier Screening in Photoexcited Epitaxial Semiconductor Nanorods Revealed by Transient X-ray Absorption Linear Dichroism. *Nano Letters*, 21(22), 9534–9542.

Gentle, C. M., Wang, Y., Haddock T., **Dykstra, C. P.**, et al. (2020). Internal Atomic-Scale Structure Determination and Band Alignment of II–VI Quantum Dot Heterostructures. *The Journal of Physical Chemistry C*, 124(6), 3895–3904.

Chou, S. S., De, M., Kim, J., Byun, S., **Dykstra, C. P.**, et al. (2013). Ligand conjugation of chemically exfoliated MoS₂. *Journal of the American Chemical Society*, 135(12).

Chou, S. S., Huang, Y.-K., Kim, J., Kaehr, B., Foley, B. M., Lu, P., **Dykstra, C.**, et al. (2015). Controlling the metal to semiconductor transition of MoS₂ and WS₂ in solution. *Journal of the American Chemical Society*, 137(5)

Tan, H., Liu, T., Wu, Y., Thacker, J., et al. (2014). Evaluation of iron content in human cerebral cavernous malformation using quantitative susceptibility mapping. *Journal of Investigative Radiology*, 49(7).

Conferences

International Symposium on Molecular Spectroscopy, June 2023

Presentation: Interrogation Interfacial Effects in Quantum Dot Sensitized ZnO with Dual Probe Transient Absorption Spectroscopy. **C. Dykstra**, M. Enright, T. Rossi, R. van der Veen, J. Vura-Weis

American Chemical Society, Indiana March 2023

Poster presentation: ZnO Surface States Dominate Post-Charge Transfer Electron Dynamics in Quantum Dot Sensitized ZnO. **C. Dykstra**, M. Enright, T. Rossi, R. van der Veen, J. Vura-Weis

Inter-American Photochemical Society, Florida January 2023

Poster presentation: Revealing Interfacial Dynamics in Quantum Dot Sensitized Metal Oxides with Dual-Probe Transient Absorption Spectroscopy. **C. Dykstra**, M. Enright, T. Rossi, R. van der Veen, J. Vura-Weis

International Symposium on Molecular Spectroscopy, June 2022

Presentation: Ultrafast Carrier Dynamics in Quantum Dot Sensitized ZnO. **C. Dykstra**, M. Enright, T. Rossi, R. van der Veen, J. Vura-Weis

X-ray Absorption Fine Structure Conference, Illinois Institute of Technology July 2018

Leading scientists in the field of X-ray absorption spectroscopy gave lectures over the course of a week on X-ray methods, interpretation, and data analysis.

AMC Workshop at Materials Research Laboratory, University of Illinois June 2018

A series of seminars was given by staff scientists and vendors teaching and showcasing the instrumental capabilities at the Frederick Seitz Materials Research Laboratory.

Argonne Photon Source User Meeting, Argonne National Labs May 2018

Talks centered on the work done at the Argonne Photon source were presented, along with a special session on ultrafast spectroscopy.

Awards

Departmental Scholar in Chemistry; June 2014
Chemistry of Life Processes Summer Scholars Award; August 2013
MRSEC Undergraduate Research Internship Award; Academic Year Intern 2011-2012
Chemistry of Life Processes Intern Award; August 2011

References

Professor Robert Baker
Baker.2364@osu.edu
2110 Newman & Wolfrom Lab
Columbus, OH 43210

Professor Josh Vura Weis
Vuraweis@illinois.edu
University of Illinois Urbana-Champaign
Urbana, Illinois 61821

Professor Renske van der Veen
renske-vanderveen@helmholtz-berlin.de
HZB Berlin, Germany

Professor Li Junzhong
Junzhong.Li@ecolab.com
655 Lone Oak Dr
Eagan, MN 55121