Emil N. Gillett

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EDUCATION

University of Illinois at Urbana-Champaign (UIUC), Champaign, IL **Jan. 2024 - Present**
- PhD in Physical Chemistry, Expected May 2026

Rice University, Houston, TX **Jul. 2020 - Jan. 2024**
- MA in Chemistry

Trinity University, San Antonio, TX **Aug. 2019 - May 2021**
- Bachelor of Science in Chemistry, magna cum laude
- GPA: 3.8

Lone Star College System, Houston, TX **Jan. 2017 - May 2019**
- Associate of Science in Biology
- GPA: 4.0

RESEARCH EXPERIENCE

University of Illinois at Urbana-Champaign, Champaign, IL **Jan. 2024 - Present**
PhD student in the Landes Research Group
- Aligned an optical microscope for the simultaneous tracking of the orientation of anionic dyes in polyethylene oxide films to advance battery technology.
- Performed optical simulations using vectorial diffraction theory with realistic experimental parameters to train a novel deep learning network for the 6D tracking of dipole emitter positions and orientations in low signal-to-noise conditions.
- Simulated realistic movies of single emitters undergoing 3D Brownian, directed, anomalous, and confined transport dynamics from the perspective of a fluorescent microscope with phase engineering.
- Recovered simulated dynamics with ground truth using an unbiased tracking algorithm for testing a novel deep learning classification algorithm.
- Developed a custom 6D optical microscope using phase engineering and a liquid crystal spatial light modulator (SLM) to extract 3D positions and 3D orientations of single molecules
- Built full instrument workflows from hardware alignment to vectorial diffraction theory simulations in MATLAB and trained a deep learning model on simulated microscopy data to estimate molecular orientations in low SNR conditions
- Co-developed D-blur, a deep learning method to analyze motion-blurred PSFs and a machine learning algorithm to classify single-molecule trajectories with an accuracy of 80%
- Applied fluorescence microscopy to study ion transport in polymer electrolytes and pH-responsive polymer brushes
- Mentored undergraduate and graduate students on recording and analyzing data on a new microscope
- Wrote the orientational tracking portion of a DOE proposal for future work involving probing the mechanisms behind fouling in ion-exchange membranes.
- Reviewed and provided technical feedback to improve scientific communication in scientific articles submitted to: *Analytical Chemistry*, *Environmental Science & Technology, Nano Letters*, *Biophysical Journal, Journal of Physical Chemistry,* and *Journal of Chemical Physics.*

Rice University, Houston, TX **Jul. 2021 - 2023**
PhD student in the Landes Research Group

- Developed an optical microscope for the simultaneous tracking of orientation and 3D spatial dynamics of single molecules at polymer interfaces
- Mentored a high school student while designing a high school lab for a student photospectrometer kit during the summer of 2022
- Collaborated with Trimontana Teaching Solutions to calibrate and test a modular UV-Vis spectrometer kit
- Developed and led a high school lab module teaching spectroscopy, reaction kinetics, and Python analysis

Trinity University, San Antonio, TX **Feb. 2020**
Undergraduate Research Assistant with Prof. Adam Urbach

- Full-time in Summer 2020 and part-time in the academic year
- Designed, synthesized, and analyzed a peptide library for the characterization of structure-activity relationships in the binding of a synthetic receptor
- Investigated the effects of salt on the measurement of competitive equilibria involving host-guest systems

The Pennsylvania State University, State College, PA **Summer 2019**
Undergraduate Researcher Assistant with Prof. Ozgur Cakmak

- Developed cost-efficient light absorbers utilizing the novel properties of gold nanoparticles
- Employed electron beam evaporation, thermal evaporation, sputtering, atomic layer deposition, nanoparticle synthesis, UV-vis spectral analysis, field emission scanning electron microscopy, and atomic force microscopy

SKILLS & TOOLS

- Programming & Simulation: MATLAB, Python
- Microscopy & Optics: 4f system alignment, SLM calibration, PSF engineering, interferometry
- Data Analysis & ML: Deep learning, trajectory analysis, noise modeling
- Instrumentation: EMCCD and sCMOS cameras, laser alignment, spectrometer design
- Software & Collaboration: Github, Jupyter, Spyder, Google Colab, MS Office, ImageJ

PRESENTATIONS

- ISMS 2025 – "Super resolution optical microscopy enables 6D tracking of dipole emitters in crowded environments." Oral presentation, 78th International Symposium on Molecular Spectroscopy, UIUC, June 2025.
- GRC 2024 – "Tracking Spatial and Orientational Antibody Dynamics in 3D." Poster presentation, Single Molecule Approaches to Biology conference, Jordan Hotel at Sunday River, July 2024.
- ISMS 2024 – "3D Tracking of Spatial and Orientational Antibody Dynamics." Oral presentation, 77th International Symposium on Molecular Spectroscopy, UIUC, June 2024.
- "Tracking Spatial and Orientational Antibody Dynamics in 3D." Poster presentation, Chemical Imaging conference, Stonehill College, July 2023.
- "Developing Tools for the Accurate Analysis of Competitive Equilibria." Oral presentation, Summer Undergraduate Research Symposium, Trinity University, July 2020.
- "Roadmap to an Absorber with Nanoparticles – Colloidal Nanoparticles." Oral presentation, Summer Research Opportunities Program Symposium, Penn State University, July 2019.

PUBLICATIONS

- *In Final Preparation:* **Gillett, E.**; Chatterjee, J.; Chatterjee, S., Kovalenko, N.; Xu, C.; Fan, D.; Chen, Y; Qiu, Y.; Miao, J.; Nelavoy, V.; Lew, M.; Backlund, M.; Landes, C. Fused deep-learning enables 6D single-molecule localization in polarization-resolved microscopy
- *Published:* Chatterjee, S.; Oh, H.; **Gillett, E.;** Bruncz, A.; Ferguson, J.; Dupas, J.; Moses, M; Lee-Paul, S.; Tauzin, L.; Daniels, C.; Link, S.; Landes, C. A Spectrometer Instrument Assembly and Python-Based Data Science Lab for Studying Reduction Kinetics of Methylene Blue for Secondary Education
- *Published:* Chatterjee, J.; Chatterjee, S.; **Gillett, E**.; Kovalenko, N.; Fan, D.; Landes, C. Feature Selection and Hyperparameter Optimization for Machine Learned Classification of 3D Single-Particle Tracking, Chemical & Biomedical Imaging, 2025
- *Published:* Fan, D.; Kovalenko, N.; Chatterjee, J.; Chatterjee, S.; Xu, C.; **Gillett, E.;** Landes, C. D-Blur: A Deep Learning-Enhanced Approach for Resolving Fast Diffusion Dynamics in Single Molecule Microscopy with Motion Blur
- *Published:* Fan, D.; Ramezani Bajgiran; S., Safi Samghabadi, F.; Dutta, C.; **Gillett, E.,** Rossky, P. J., Conrad, J. C.; Marciel, A. B., Landes, C. F. Imaging Heterogeneous 3D Dynamics of Individual Solutes in a Polyelectrolyte Brush, Langmuir, 2023

EXTRACURRICULAR ACTIVITIES

Laser Safety Officer- Rice University / UIUC **June 2023 – Present**
- Oriented 7 lab members on laser safety related to fluorescence microscopes with no lab accidents.

Teaching Assistant – Rice University *CHEM 123, 124* **Fall 2021 – Spring 2023**
- Led general and chemistry lab sessions, guided experiments, enabled problem-solving skills and assessed final reports

LSC-UP Ambassadors, Houston, TX **Aug. 2017 - May 2019**
Student Leader
- Led volunteer event setups and breakdowns for registered student organizations and faculty events
- Judged high school students at the Klein ISD Regional Academic Decathlon 2019

PROFESSIONAL EXPERIENCE

iEducate, Houston, TX **Feb. - May 2019**
College Readiness Mentor
- Streamlined the learning process at Hoyland Elementary by reading and completing classwork with groups of 4th-grade students

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Habitat for Humanity NWHC, Houston, TX **Oct. - Dec. 2018**
Off-Campus Work-Study Intern
- Developed an effective contact system for donors of home construction projects

- Compiled and requested donations from local businesses for ToolBox Bash, the organization's signature fundraising event

NASA Community College Aerospace Scholars, Houston, TX **Sep. 2017**
Intern
- Won first place in a Mars rover Lego EV3 robotics team challenge

HONORS & AWARDS

Rice University Houston Livestock Show & Rodeo Fellowship **January 2022**
- Support for graduate students who demonstrated outstanding potential for the completion of a graduate degree program in biology or a related biological science.

Rice University J. Evans Attwell-Welch Graduate Fellowship **August 2021**
- Recruiting award for superior chemistry students joining Rice University

Trinity University Dean's List **Aug. 2019 – May 2021**
- GPA: 3.8

ACS Scholars Program **May 2020**
- Competitive scholarship program offered to high-achieving, underrepresented students majoring in chemistry-related disciplines

James Augustus McCloskey Endowed Scholarship **Mar. 2020**
- Merit-based scholarship administered through Trinity University's Department of Chemistry

Lone Star College President's List **Dec. 2017 - May 2019**
- Graduated with a 4.0 GPA

Lone Star College Ambassador Go-Getter Award **Mar. 2018**
- Received recognition for stellar student service as a Student Ambassador of Lone Star College