

# EMILY A. SPRAGUE-KLEIN

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## ACADEMIC APPOINTMENTS

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<b>Brown University</b>	July 2022
<b>Department of Chemistry</b>	
<i>Assistant Professor, Physical Chemistry</i>	
<i>Affiliate Faculty, Initiative For Sustainable Energy (ISE)</i>	Feb. 2023
<i>Affiliate Faculty, Initiative For Native American and Indigenous Studies (NAISI)</i>	Feb. 2023
<i>Honors/Awards: Nanoscale Emerging Investigator Award</i>	
<b>Northwestern University/Argonne National Laboratory</b>	2019 - 2022
<i>Division of Chemical Sciences &amp; Engineering</i>	
<i>Postdoctoral Appointee, Solar Energy Conversion Group</i>	
<i>Advisors: Prof. Lin X. Chen and Dr. David M. Tiede</i>	
<i>Honors/Awards: Department of Energy LDRD award in Emerging Materials</i>	

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## EDUCATION

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<b>Northwestern University, Ph.D. Applied Physics</b>	2018
<i>Advisors: Prof. Richard Van Duyne, Prof. George C. Schatz</i>	
<i>Dissertation topic: Single Particle Surface-enhanced Pump-Probe Raman Spectroscopy for the Direct Observation of Plasmon-Driven Chemistry</i>	
<i>Honors/Awards: National Science Foundation Graduate Research Fellowship, National Defense Science &amp; Engineering Graduate Fellowship, Ryan Fellowship</i>	
<b>Kellogg School of Management, Northwestern University</b>	2016
<i>Management for Scientists and Engineers, Graduate Certificate</i>	
<b>University of Illinois at Urbana-Champaign, B.S. Engineering Physics</b>	2012
<i>Advisors: Prof. Alexey Bezryadin and Prof. Aaron Lindenberg</i>	
<i>Honors/Awards: James Scholar, Dean's List, Laura B. Eisenstein Award, Excellence in Physics Award, Department of Energy Science &amp; Energy Research Challenge National Finalist, National Merit Scholar, Washington University in St. Louis High School Enrichment Program</i>	

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## PEER-REVIEWED ARTICLES

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N. Guo, C. Shi\*, N. Warren, **E. A. Sprague-Klein**, B. W. Sheldon, M. Chen\*, "Challenges and Opportunities for Passive Thermoregulation," *Advanced Functional Materials* [IF = 29.7], 2024, 2401776.

N. Warren, U. Yunusa, A. Singhal, **E. Sprague-Klein\***, "Facilitating Excited-State Plasmonics and Photochemical Reaction Dynamics," *Chemical Physics Reviews* [IF = 4.40], 2024, 5, 011307.

- *Editorial Board Featured Article*

U. Yunusa, N. Warren, D. Schauer, P. Srivastava, **E. Sprague-Klein\***, "Plasmon resonance dynamics and enhancement effects in Tris(bipyridine)ruthenium(II) gold nanosphere oligomers," *Nanoscale* [IF = 8.31], 2024, 16, 5601-5612.

- *Emerging Investigators Edition*

A. M. Potocny, B. T. Phelan, **E. A. Sprague-Klein**, M. W. Mara, D. M. Tiede, Lin X. Chen, K. L. Mulfort\*. "Harnessing Intermolecular Interactions to Promote Long-Lived Photoinduced Charge Separation from Copper Phenanthroline Chromophores," *Inorganic Chemistry* [IF = 5.44], 2022, 61, 48, 19119-19133.

R. B. Weerasooriya, M. C. Drummer, B. T. Phelan, J. L. Gesiorski, **E. A. Sprague-Klein**, L. X. Chen, K. D. Glusac\*. "Towards Metal-free Photocatalysis: Photochemical Regeneration of Organic Hydride Donors Using Phenazine-based Photosensitizers," *Journal of Physical Chemistry C* [IF = 3.70], 2022, 126, 42, 17816-17825.

**E. A. Sprague-Klein\***, X. He, M. W. Mara, B. J. Reinhart, S. Lee, L. M. Utschig, K. L. Mulfort, L. X. Chen\*, D. M. Tiede\*. "Photo-Electrochemical Effect in the Water Oxidation Catalyst Cobalt-Phosphate (CoPi)," *ACS Energy Letters* [IF = 22.0], 2022, 7, 9, 3129-3138.

L. Gimeno, B. Phelan, **E.A. Sprague-Klein**, T. Roisnel, E. Blart, C. Gourlaouen\*, L.X. Chen\*, Y. Pellegrin\*. "A very bulky and stable copper(I)-phenanthroline complex: impact of steric strain and symmetry on the excited state properties," *Inorganic Chemistry* [IF = 5.44], 2022, 61, 19, 7296-7307.

**E. A. Sprague-Klein**, R. Ho-Wu, D. Nguyen, S. C. Coste, Y. Wu, T. Seideman, G. C. Schatz\*, R. P. Van Duyne, "Modulating the Electron Affinity of Polypyridine Molecules on Single Gold Nanoparticles for Plasmon-Driven Electron Transfer," *Journal of Physical Chemistry C* [IF = 3.70], 2021, 125, 40, 22142-22153.

- *Featured in the Marie-Paule Pileni Festschrift Special Edition*

B. V. Kramer, B. T. Phelan, **E. A. Sprague-Klein**, B. T. Diroll, S. Lee, K. Otake, R. Palmer, M. W. Mara, O. K. Farha, J. T. Hupp\*, L. X. Chen\*, "Single-Atom Metal Oxide Sites as Traps for Charge Separation in nano Zr-MOF NDC-NU-1000," *ACS Energy & Fuels* [IF = 4.65], 2021, 35, 23, 19081-19095.

A. R. Bielinski, **E. A. Sprague-Klein**, B. T. Phelan, A. B. F. Martinson\*, "Pyroelectric Heat Detection for Calibrated Measurement of Atomic Layer Deposition Reaction Heat," *Chemistry of Materials* [IF = 10.5], 2021, 33, 6176-6185.

M. S. Eberhart, B. T. Phelan, J. Niklas, **E. A. Sprague-Klein**, D. M. Kaphan, D. J. Gosztola, L. X. Chen, D. M. Tiede, O. G. Poluektov, K. L. Mulfort\*, "Surface immobilized copper(I)diimine photosensitizers as molecular probes for elucidating the effects of confinement at interfaces for solar energy conversion," *Chemical Communications* [IF = 4.9], 2020, 56, 12130-12133.

- *Featured as the journal's back cover article*

**E. A. Sprague-Klein**, B. Negru, L. R. Madison, S. C. Coste, B. K. Rugg, A. M. Felts, M. O. McAnally, M. Banik, V. A. Apkarian, M. R. Wasielewski, M. A. Ratner, T. Seideman, G. C. Schatz, R. P. Van Duyne\*, "Photoinduced Plasmon-Driven Chemistry in trans-1,2-Bis(4-pyridyl)ethylene Gold Nanosphere Oligomers," *Journal of the American Chemical Society* [IF = 15.0], 2018, 140, 10583-10592.

B. Negru, M. O. McAnally, H. E. Mayhew, T. W. Ueltschi, L. Peng, **E. A. Sprague-Klein**, G. C. Schatz, and R. P. Van Duyne\*, "Fabrication of Gold Nanosphere Oligomers for Surface-Enhanced Femtosecond Stimulated Raman Spectroscopy," *Journal of Physical Chemistry C* [IF = 3.70] 2017, 121, 27004-27008.

**E. A. Sprague-Klein**, M. O. McAnally, D. V. Zhdanov, A. B. Zrimsek, V. A. Apkarian, T. Seideman, G. C. Schatz, and R. P. Van Duyne\*, "Observation of Single Molecule Plasmon-Driven Electron Transfer in

Isotopically Edited 4,4'-Bipyridine Gold Nanosphere Oligomers," *Journal of the American Chemical Society* [IF = 15.0], 2017, 139, 15212-15221.

- Highlighted in ACS Nano "Present and future of surface-enhanced Raman scattering"
- Highlighted in ACS Energy Letters "Plasmons for Energy Conversion"

## ARTICLES IN PREPARATION (DATA COLLECTED, MANUSCRIPT WRITTEN)

C. Shi, S.-H. Kim, N. Warren, N. Guo, X. Zhang, Y. Wang, A. Willemsen, C. López-Pernía, Y. Liu, A. Kingon, H. Yan, Y. Zheng, M. Chen\*, **E. Sprague-Klein\***, B. Sheldon\*, "A Hierarchically Micro- and Nano-structured Polymer via Crystallinity Alteration for Sustainable Environmental Cooling," *In press, just accepted in Langmuir* [IF = 3.9], 2024

D.G. Schauer, U. Yunusa, J. Bredelhoeft, A. Pattammattel, H.J. Wörner, **E. A. Sprague-Klein\***, "Targeted synthesis and characterization of tailored surface properties of gold nanorods using optical and X-ray spectroscopy," *Physical Chemistry Chemical Physics* [IF = 3.3], 2024, *Under Revision*.

P. Srivastava, N. Warren, A. Willemsen, A. Pattammattel, **E. Sprague-Klein\***, "Binding interactions and phonon dissipation in Tris(bipyridine)ruthenium(II) gold nanosphere oligomers," *To be submitted JPCC*, 2024.

N. Warren, E. Donahue, U. Yunusa, D. Schauer, A. Pattammattel, B. Ma, **E. Sprague-Klein\***, "Temperature Dependent Characterization of Nanoscale Copper-Carbon Interface," *To be submitted to the Journal of Chemical Physics*, 2024.

**E. A. Sprague-Klein**, B. Phelan, M. Mara, J. Yu, J. Niklas, M. Drummer, K. Glusac, S. Lee, X. Zhang, D. M. Tiede, L.X. Chen\*. "Ultrafast Electronic and Structural Dynamics in CoPi and CoBi Photocatalysts," *To be submitted JACS*, 2024.

**E. A. Sprague-Klein**, M. F. Cardinal, Z. Mansley, Y. Guo, Y. Shin, L. Peng, H. Mayhew, N. Chiang, M. Mattei, L.D. Marks, M. Hersam\*, G.C. Schatz\*, R.P. Van Duyne, "Polarization-Resolved and Pump Energy Dependence of Plasmon-Driven Electron Transfer in 4,4'-Bipyridine Single Particle Surface-Enhanced Raman Spectroscopy," *In preparation*, 2024.

## PRESENTATIONS

- The University of Rhode Island, Department of Chemical Engineering, *Amgen-sponsored Seminar Series*, Kingston, RI, November 2024, Invited Talk.
- The University of Rhode Island, *Department of Chemistry Seminar*, "Observing Molecule-Plasmon Dynamics for Reactive Chemistry at the Nanoscale," Kingston, RI, October 2024, Invited Talk.
- The XXVIII International Conference on Raman Spectroscopy (ICORS), *SERS, TERS, and Plasmonics: Mechanistic*, "Plasmonics for Photochemistry of Ions and Molecules," Rome, Italy, August 2024, Invited Talk.
- Electrochemical Society National Meeting, *Light Induced Redox*, "Light-Induced Redox Dynamics in Plasmonic Nanostructures and Photosensitizer Transition Metal Compounds," San Francisco, CA, May 2024, Contributed Talk.

- DARPA Proposers Day, *Expeditionary Carbon Utilization for Energy Resilience and Stabilization (ExCURSion)*, “Energy-storing fuel sources for CO<sub>2</sub> capture,” Arlington, VA, March 2024, Contributed Talk.
- Brown University, *The Tony & Pat Houghton Condensed Matter Seminar Series*, “Plasmon-driven electron transfer in single gold nanoparticles functionalized with adsorbed pyridine derivatives,” Providence, RI, December 2023, Invited Talk.
- Brown University Sustainable Energy Workshop, *Electrochemical Redox Catalysis for Energy Conversion and Usage*, “Photoelectrochemical spectroscopy for understanding oxygen evolving reactions in water-splitting catalysis,” Providence, RI, October 2023, Invited Talk.
- American Chemical Society National Meeting, *Catalysis Dynamics of Active Sites, Catalyst Structure, and Reaction Environment*, “Light-induced chemical structure dynamics in photosensitizer transition metal compounds and metal-oxide catalysts,” San Francisco, CA, August 2023, Invited Talk.
- Brown University, *Department of Chemistry Colloquium*, “Light-Induced Chemical Structure Dynamics in Plasmonic Nanostructures and Photosensitizer Transition Metal Compounds,” Providence, RI, October 2022, Invited Talk.
- Vistas in Catalysis, National Academies of Science, *Engineering and Medicine Workshop*, Washington D.C., October 2022, Contributed Talk.
- American Chemical Society National Meeting, *Photochemistry Spotlight: Answering the Big Questions in Photochemistry*, Chicago, IL, August 2022, Contributed Talk.
- Brown University, *Department of Chemistry*, “Light-Harvesting Photonic Materials for Electron Transfer and Water-Splitting Catalysis,” February 2022<sup>†</sup>, Invited Talk.
- Dartmouth, *Department of Chemistry*, “Light-Harvesting Photonic Materials for Enhanced Electron Transfer and Water-Splitting Catalysis Probed by Optical Spectroscopy,” January 2022<sup>†</sup>, Invited Talk.
- Baylor University, *Department of Chemistry*, “Time-resolved Dynamics of Photonic Materials Probed by Optical and X-ray Spectroscopy,” Waco, TX, January 2022, Invited Talk.
- Miami University, *Department of Chemistry*, “Solar Materials Probed by Time-Resolved Optical and X-ray Spectroscopy,” January 2022<sup>†</sup>, Invited Talk.
- Utah State University, *Department of Chemistry*, “Electronic and Structural Dynamics in Solar Materials Probed by Time-Resolved Optical and X-ray Spectroscopy,” Logan (main campus), Blanding (Diné/Navajo Nation)<sup>†</sup>, Uintah Basin (Ute Indian Tribe Education Partnership)<sup>†</sup>, Aggie Broadcast, December 2021, Invited Talk.
- SACNAS National Diversity in STEM Digital Conference, *Winner of the Indigenous Greeting, Native American Welcome*<sup>†</sup>, October 2021, Invited Talk.
- American Chemical Society Postdoc Symposium, *CATL/ENFL/PHYS/NUCL Divisions*, “Structural Changes and Charge Transport in Heterogenous and Molecular Cobalt Catalysts for Water Splitting Reactions,” November 2021<sup>†</sup>, Contributed Talk.

- Department of Energy, *Office of Intelligence and Counterintelligence*, “Native American Heritage Month,” Diversity, Equity + Inclusion Advisory Council Newsletter, B. Gaynor, M. R. Banon, and E. A. Sprague-Klein. United States: DY22 November 2021, Edition 13, Invited Talk.
- American Chemical Society National Meeting, *Division of Colloids & Surface Chemistry*, “Understanding surface plasmon-driven electron transfer by modulating the electronic affinity of polypyridine molecules adsorbed on single gold nanoparticles,” Atlanta, GA, August 2021, Contributed Talk.
- American Chemical Society National Meeting, *Spectroscopy for Understanding Catalysis*, “Structural Changes and Charge Transport in Heterogenous and Molecular Cobalt Catalysts for Water Splitting Reactions,” August 2020<sup>†</sup>, Contributed Talk.
- American Chemical Society National Meeting, *Chemistry in Real Space and Time Symposium*, “Nanoscale plasmon-driven electron transfer for solar energy applications,” San Diego, CA, August 2019, Invited Talk.
- Electrochemical Society, *Meeting Abstracts*, “Tracking Structures in Solar Fuels Catalysis: In-Situ X-Ray Structure Characterization of Interfacial Water-Splitting Molecular and Thin-Film Catalysts,” D.M. Tiede, T.W. Kim, E. Sprague-Klein, G. Kwon, A.B.F. Martinson, and K.L. Mulfort. 2019 Vol. MA2019-02 Issue 41 1955, Invited Talk.
- University of Chicago, *Institute for Molecular Engineering Seminar*, “Plasmon-Driven Electron Transfer in Single Gold Nanoparticles Functionalized with Adsorbed Pyridine Derivatives,” Chicago, IL, December 2018, Invited Talk.
- University of Chicago, *James Franck Institute Special Seminar*, “Hot Electrons & Transient Molecular Dynamics in Plasmonic Nanomaterials,” Chicago, IL, November 2018, Invited Talk.
- Northwestern University, *Spectroscopy & Theory Seminar*, “Direct Observation of Plasmon-Driven Electron Transfer in Gold Nanosphere Oligomers,” Evanston, IL, March 2018, Invited Talk.
- American Chemical Society National Meeting, *Energy & Charge Transfer at Nanoscale Interfaces*, “Observation of Single Molecule Plasmon-Driven Electron Transfer in Isotopically Edited 4,4'-Bipyridine Gold Nanosphere Oligomers,” New Orleans, LA, March 2018, Contributed Talk.
- American Chemical Society National Meeting, *Undergraduate Research Session*, “Plasmon-Driven Chemistry in Gold Nanosphere Assemblies,” Washington D.C., August 2017<sup>#</sup>, Contributed Talk.
- University of Nebraska-Lincoln, *National Conference for Undergraduate Women in Physics*, “3D Superconducting Resonator for use in Graphene and Qubit Studies,” E.A. Sprague and A. Bezryadin, October 2011, Contributed Talk.
- University of Illinois, *Women Chemists Committee (WCC) Regional Undergraduate Research Symposium*, “Dissipation due to Graphene within a High-Q Superconducting Fabry-Perot Resonator,” E.A. Sprague and A. Bezryadin, April 2011, Contributed Talk.
- University of Illinois, *Campus-wide Undergraduate Research Symposium*, “Dissipation due to Graphene within a High-Q Superconducting Fabry-Perot Resonator,” E.A. Sprague and A.

Bezryadin, April 2011, Contributed Talk.

- University of Illinois, *Physics Departmental Undergraduate Research Symposium*, “Femtosecond Timescale Bi-Plasma Interactions Probed by Visible Light Fluorescence,” E.A. Sprague, D. Daranciang, and A. Lindenberg, January 2011, Contributed Talk.
- Department of Energy, *Office of Scientific and Technical Information*, “Bi-Plasma Interactions on femtosecond Time-Scales,” E. Sprague and A. Lindenberg, SLAC-TN-11-015, United States: N.p., 2011. doi:10.2172/1017214, Contributed Talk.

‡ denotes a virtual talk due to the COVID-19 pandemic

# denotes a student presentation and mentorship of an undergraduate REU student

## TEACHING

**Brown University**, Providence, RI

September – December 2023

Department of Chemistry

- *Chem 2770* – Quantum Mechanics, a graduate level physical and theoretical chemistry course using rigorous mathematical treatment and Dirac notation of one- and three-dimensional problems of relevance to low dimensional materials, spin systems, and excited-state molecular dynamics.

**Brown University**, Providence, RI

January – May 2023

Department of Chemistry

January – May 2024

- *Chem 2020* – Advanced Statistical Mechanics, a graduate level physical chemistry course with emphasis on applications to computational challenges in catalysis, spectroscopy, and electrochemistry.

**Northwestern University**, Evanston, IL

January – March 2014

Department of Chemistry

- *Chem 329/445* – an advanced undergraduate & graduate course in plasmonics and vibrational spectroscopy averaging 50 students per quarter. Assisted in course planning and organization, lecturing, and grading.

**University of Illinois**, Urbana-Champaign, IL

January – May 2012

Department of Physics

- *Phys 211* – a calculus based introductory physics class for engineering, mathematics, physics, and chemistry majors averaging 300 students per semester. Supervised two discussion sections and lectured over problem solving technique and concepts, graded weekly quizzes, held weekly office hours, and proctored exams.

## RESEARCH ADVISING

### Ph.D. THESIS COMMITTEES:

Lisa Huang (4<sup>th</sup> year, Chemistry, Peter Weber)

David Romano (3<sup>rd</sup> year, Chemistry, Peter Weber)

Ahsan Zohaib (3<sup>rd</sup> year, Chemistry, Shouheng Sun)

Updated September 3<sup>rd</sup> 2024

Vaibhav Wani (3<sup>rd</sup> year, Chemistry, Lai-Sheng Wang)  
 Abeera Hassan (2<sup>nd</sup> year, Chemistry, Ou Chen)  
 Alex Jodko (2<sup>nd</sup> year, Chemistry, Peter Weber)  
 Deniz Kahraman (2<sup>nd</sup> year, Chemistry, Lai-Sheng Wang)  
 Yitian Liu (2<sup>nd</sup> year, Chemistry, Brenda Rubenstein)  
 Shuchen Tian (2<sup>nd</sup> year, Chemistry, Lai-Sheng Wang)

#### **UNDERGRADUATE THESES/CAPSTONE PROJECTS ADVISED:**

Ariana Clark, Computer Science & Critical NAIS Concentrator (CNC), class of 2024  
 Benjamín Córdova Herrera, Chemical Engineering & East Asian Studies (CNC), class of 2026

#### **STUDENTS & STAFF:**

##### **Postdoctoral**

Prasenjit Srivastava, PhD Physical Chemistry (October 2023 – present)

##### **Graduate Students**

Natalie Warren, 3<sup>rd</sup> year, Physical Chemistry (December 2022 – present)  
 Umar Yunusa, 3<sup>rd</sup> year, Physical Chemistry (December 2022 – present)  
 Elizabeth Donahue, 2<sup>nd</sup> year, Physical Chemistry (December 2023 – present)  
 Andes Willemsen, 2<sup>nd</sup> year, Physical Chemistry (December 2023 – present)  
 Yuanqing Yun, 2<sup>nd</sup> year, Physical Chemistry (December 2023 – present)

##### **Undergraduates**

Arnav Singhal, Chemical Physics (January 2023 – June 2023), class of 2026  
 Zhanxian George Gong, Chemical Physics (September 2023 – present), class of 2026  
 Yilin Xie (May 2023 – present), Chemical Physics, class of 2026

##### **Summer High School Honors Thesis**

Genevieve Geiser, Barrington High School, class of 2024  
 Troy Tian, Barrington High School, class of 2025  
 Alan Weng, Barrington High School, class of 2025

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#### **SERVICE AND OUTREACH**

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##### **To the department/university:**

- Member of Brown's *Institute for Molecular and Nanoscale Innovation (IMNI)*, 2022 – present
- Member of *Admissions Committee of the Chemistry Department*, 2022 – present
- Faculty organizer of *Chemistry Departmental Colloquium*, 2022 – present
- Faculty mentor of *Chemistry Departmental Undergraduate Group (ChemDUG)*, 2022 – present
- Faculty tour guide for the Chemistry Department's *STEM-Day* to attract underrepresented high school students. Providence, RI 2023 – present.
- Speaker for *Women and Non-Binary Faculty Panel Discussion*, March 2023
- Faculty facilitator and advisor for community partnership activities at the intersection of Science

*Updated September 3<sup>rd</sup> 2024*

- and Native American identities, *NAISI @ Brown*, 2023 – present
- Udall Foundation, *Faculty Review Committee*, 2024
- National Lab Day @ Brown, *Faculty Host Committee*, 2024
- Undergraduate curriculum development, *Faculty Committee*, 2023 – present

### **To the profession:**

- Peer reviewer for *Journal of the American Chemical Society*, *Chemical Reviews*, *Chemical Science*, *ACS Omega*, *ACS Applied Energy Materials*, *Journal of Applied Physics*
- Reviewer for *Department of Energy (DOE)* grant funding
- Discussion Leader, *Gordon Conference in Vibrational Spectroscopy*, 2024
- Session Presider, *ACS Division of Colloids and Surface Chemistry*, 2021
- Session Co-Chair, *ECS Division of Physical and Analytical Electrochemistry: General Session, Light Induced Redox*, 2024
- Member of the *American Chemical Society (ACS)*, since 2016
- Member of the *Electrochemical Society (ECS)*, since 2019
- Member of *Materials Research Society (MRS)*, since 2019
- Member of *Society of Women Engineers (SWE)*, since 2008
- Member of the *Association of Women in Science (AWIS)*, since 2019
- Member of *Asian Scientists and Engineers (SASE)*, since 2019
- Member of *American Indian Science and Engineering Society (AISES)*, since 2019
- Member of the *Society for the Advancement of Chicanos and Native Americans in Science (SACNAS)*, since 2010
- Mentor & Science Panelist for Chicago's *NAACP Afro-Academic, Cultural, Technological and Scientific Olympics*, 2020 -2021
- STEM Career Counselor for Resume Preparation, *QuantumHispano*, 2020 -2021
- Founding Board Member of Northwestern University's *Mentorship Opportunities for Research Engagement (MORE)*, 2013 – 2017
- President of the University of Illinois at Urbana-Champaign's *Society for Women in Physics (SWIP)*, 2011 – 2012

### **To the community:**

- Science Fair Judge for the Illinois Junior Academy of Science, 2013 – 2017
- Science Fair Judge for the Rhode Island Science and Engineering Fair, 2023 - present