

EMILY A. SPRAGUE-KLEIN

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EMPLOYMENT

Assistant Professor **Brown University** July 2022
Department of Chemistry, Physical Chemistry

Postdoctoral Associate **Northwestern University/Argonne National Laboratory** 2019 - 2022
Division of Chemical Sciences & Engineering
Solar Energy Conversion Group
Advisors: Prof. Lin X. Chen and Dr. David M. Tiede

Honors/Awards: Department of Energy LDRD award in Emerging Materials

EDUCATION

Ph.D. **Northwestern University**, Applied Physics 2018
Advisors: the late Prof. Richard Van Duyne, now Prof. George C. Schatz

Dissertation topic: Single Particle Surface-enhanced Pump-Probe Raman Spectroscopy for the Direct Observation of Plasmon-Driven Chemistry

Honors/Awards: National Science Foundation Graduate Research Fellowship, National Defense Science & Engineering Graduate Fellowship, Ryan Fellowship

Management for Scientists & Engineers Certificate 2016
Kellogg School of Management

B.S. **University of Illinois at Urbana-Champaign**, Engineering Physics 2012
Advisors: Prof. Aaron Lindenberg and Prof. Alexey Bezryadin

Honors/Awards: James Scholar, Dean's List, Laura B. Eisenstein Award, Excellence in Physics Award, Department of Energy Science & Energy Research Challenge National Finalist, National Merit Scholar, Washington University in St. Louis High School Enrichment Program

AFFILIATIONS & APPOINTMENTS

02/2023 – present Affiliate Faculty of the *Initiative for Sustainable Energy (ISE) at Brown*

02/2023 – present Affiliate Faculty of the *Initiative for Native American and Indigenous Studies at Brown*

2009 summer SULI Intern, *Lawrence-Berkeley National Laboratory, Berkeley, CA*

2010 summer SULI Intern, *Stanford Linear Accelerator Laboratory, Menlo Park, CA*

PEER-REVIEWED PUBLICATIONS

N. Warren, U. Yunusa, A. Singhal, **E. Sprague-Klein***, "Excited-state Chemistry in Confined Environments," *Chemical Physics Reviews*, 2024, 5, 011307. [IF = 4.40]

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*, 2024, DOI: 10.1039/D3NR06129A. [IF = 8.31]

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," *Journal of the American Chemical Society*, 2023 (To be submitted). [IF = 15.0]

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*, 2022, 61, 48, 19119-19133. [IF = 5.44]

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*, 2022, 126, 42, 17816-17825. [IF = 3.70]

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*, 2022, 7, 9, 3129-3138. [IF = 22.0]

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*, 2022, 61, 19, 7296-7307. [IF = 5.44]

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*, 2021, 125, 40, 22142-22153. [IF = 3.70] *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*, 2021, 35, 23, 19081-19095. [IF = 4.65]

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*, 2021, 33, 6176-6185. [IF = 10.5]

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*, 2020, 56, 12130-12133. [IF = 4.9] *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*, 2018, 140, 10583-10592. [IF = 15.0]

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*, 2017, 121, 27004-27008. [IF = 3.70]

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*, 2017, 139, 15212-15221. [IF = 15.0] *Highlighted in ACS Nano “Present and future of surface-enhanced Raman scattering”*; *Highlighted in ACS Energy Letters “Plasmons for Energy Conversion”*

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,” 2024 (In preparation).

TECHNICAL REPORTS, CONFERENCE PROCEEDINGS, & SCIENCE POLICY

B. Gaynor, M. R. Banon, **E. A. Sprague-Klein**. “Native American Heritage Month,” Diversity, Equity + Inclusion Advisory Council Newsletter, Department of Energy, *Office of Intelligence and Counterintelligence*, United States: DY22 November 2021, Edition 13.

D.M. Tiede, T.W. Kim, **E. Sprague-Klein**, G. Kwon, A.B.F. Martinson, K.L. Mulfort. “Tracking Structures in Solar Fuels Catalysis: In-Situ X-Ray Structure Characterization of Interfacial Water-Splitting Molecular and Thin-Film Catalysts,” *ECS Meeting Abstracts*, 2019 Vol. MA2019-02 Issue 41 1955.

E. Sprague, A. Lindenberg, “Bi-Plasma Interactions on femtosecond Time-Scales,” SLAC-TN-11-015, Department of Energy, *Office of Scientific and Technical Information*, United States: N.p., 2011. doi:10.2172/1017214.

SEMINAR TALKS AND CONFERENCE PRESENTATIONS

- Brown University Sustainable Energy Workshop, “Photoelectrochemical spectroscopy for understanding oxygen evolving reactions in water-splitting catalysis,” Electrochemical redox catalysis for energy conversion and usage, Providence, RI, October 2023. (Invited Talk)
- ACS National Meeting, “Light-induced chemical structure dynamics in photosensitizer transition metal compounds and metal-oxide catalysts,” Catalysis Dynamics of Active Sites, Catalyst Structure, and Reaction Environment, San Francisco, CA, August 2023. (Invited Talk)
- Brown University, Department of Chemistry Colloquium, October 2022.
- Vistas in Catalysis, National Academies of Science, Engineering and Medicine Workshop, Washington D.C., October 2022. (Contributed Talk)
- ACS National Meeting, Photochemistry Spotlight: Answering the Big Questions in Photochemistry, Chicago, IL, August 2022 (Contributed Talk).
- Brown University, Department of Chemistry, February 2022*.
- Dartmouth, Department of Chemistry, January 2022*.
- Baylor University, Department of Chemistry, Waco, TX, January 2022.
- Miami University, Department of Chemistry, January 2022*.
- Utah State University, Department of Chemistry, Logan (main campus) & Blanding (Diné/Navajo Nation)*, Aggie Broadcast, December 2021.
- SACNAS National Diversity in STEM Digital Conference, October 2021 (Winner of the Indigenous Greeting, Native American Welcome)*.
- ACS National Meeting, “Understanding surface plasmon-driven electron transfer by modulating the

electronic affinity of polypyridine molecules adsorbed on single gold nanoparticles,” Division of Colloids & Surface Chemistry, Atlanta, GA, August 2021. (Contributed Talk, Invited Presider)

- ACS Postdoc Symposium, “Structural Changes and Charge Transport in Heterogenous and Molecular Cobalt Catalysts for Water Splitting Reactions,” CATL/ENFL/PHYS/NUCL Divisions, November 2021*. (Contributed Talk)
- ACS National Meeting, “Structural Changes and Charge Transport in Heterogenous and Molecular Cobalt Catalysts for Water Splitting Reactions,” Spectroscopy for Understanding Catalysis, August 2020*. (Contributed Talk)
- ACS National Meeting, “Nanoscale plasmon-driven electron transfer for solar energy applications,” Chemistry in Real Space and Time Symposium, San Diego, CA, August 2019. (Invited Talk)
- University of Chicago, “Plasmon-Driven Electron Transfer in Single Gold Nanoparticles Functionalized with Adsorbed Pyridine Derivatives,” Institute for Molecular Engineering Seminar, 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)
- ACS 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)
- ACS National Meeting, Undergraduate Research Session, “Plasmon-Driven Chemistry in Gold Nanosphere Assemblies,” Washington D.C., August 2017#. (Contributed Talk)

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

denotes a student presentation and mentorship of an undergraduate REU student

POSTER PRESENTATIONS AND LIGHTNING TALKS

- Sprague-Klein, E.A., McAnally, M.O., Ulteschi, T.W., Cardinal, M.F., Apkarian, V.A., Schatz, G.C., Seideman, T., Van Duyne, R.P. Plasmon-Driven Electron Transfer in Gold Nanosphere Assemblies, University of Jyväskylä, Finland, 06/08/2017. (Poster)
- Sprague-Klein, E.A., McAnally, M.O., Zhdanov, D.V., Zrimsek, A.B., Apkarian, V.A., Schatz, G.C., Seideman, T., Van Duyne, R.P. Plasmon-Driven Hot Electron Transfer in Isotopically Edited 4,4'-Bipyridine Nanoantennas, Gordon Research Conference, University of New England in Biddeford, ME, United States, 07/21/2016. (Poster)
- Sprague-Klein, E.A., McAnally, M.O., Zhdanov, D.V., Zrimsek, A.B., Apkarian, V.A., Schatz, G.C., Seideman, T., Van Duyne, R.P. Plasmon-Driven Hot Electron Transfer in Isotopically Edited 4,4'-Bipyridine Nanoantennas, SciX Conference presented by FACSS, Minneapolis, MN United States, 09/22/2016. (Poster)
- Sprague-Klein, E.A., McAnally, M.O., Mayhew, H.E., Ulteschi, T.W., Apkarian, V.A., Schatz, G.C., Seideman, T., Van Duyne, R.P. Dynamic Optical Control of Plasmon-Driven Hot Electron Transfer in Gold Nanosphere Assemblies, To SERS with Love, University of Minnesota, Minneapolis, MN, USA, 9/18/2017. (Poster)
- Sprague-Klein, E.A., McAnally, M.O., Zhdanov, D.V., Zrimsek, A.B., Apkarian, V.A., Schatz, G.C., Seideman, T., Van Duyne, R.P. Plasmon-Driven Hot Electron Transfer in Isotopically Edited 4,4'-Bipyridine Nanoantennas, NUPF Symposium, Chicago, IL United States, 09/14/2016. (Poster)
- Sprague, E.A., Bezryadin, A. 3D Superconducting Resonator for use in Graphene and Qubit Studies, National Conference for Undergraduate Women in Physics, University of Nebraska-Lincoln, October 2011. (Oral Presentation)
- Sprague, E.A., Bezryadin, A. Dissipation due to Graphene within a High-Q Superconducting Fabry-Perot Resonator, Women Chemists Committee (WCC) Regional Undergraduate Research Symposium, University of Illinois, April 2011. (Oral Presentation)

- Sprague, E.A., Bezryadin, A. Dissipation due to Graphene within a High-Q Superconducting Fabry-Perot Resonator, Campus-wide Undergraduate Research Symposium, University of Illinois, April 2011. (Oral Presentation)
- Sprague, E.A., Daranciang, D., Lindenberg, L. Femtosecond Timescale Bi-Plasma Interactions Probed by Visible Light Fluorescence, Physics Departmental Undergraduate Research Symposium, University of Illinois, January 2011. (Oral Presentation & Poster)
- Sprague, E.A., Daranciang, D., Lindenberg, L. Femtosecond Timescale Bi-Plasma Interactions Probed by Visible Light Fluorescence, SERCh National Competition, Argonne National Laboratory, U.S. Department of Energy, Fall 2010. (Poster)
- Sprague, E.A., Garcia-Sciveres, M. Nanowire ‘Carpet’ Hybrid Pixel Detectors, SERCh National Competition, Oak Ridge National Laboratory, U.S. Department of Energy, Fall 2009. (Poster)

TEACHING EXPERIENCE

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 and spin systems.
- (Enrollment: 18)

Brown University, Providence, RI January – May 2023

Department of Chemistry

- CHEM 2020 – Advanced Statistical Mechanics, a graduate level physical chemistry course with emphasis on applications to computational challenges in catalysis, spectroscopy, and nanotechnology.
- (Enrollment: 10)

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.
- (Enrollment: 33)

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.
- (Enrollment: 19 & 24)

SERVICE AND OUTREACH

To the department/university:

- PhD thesis committee member for 5 Brown graduate students, since 2022
- 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
- Facilitate community partnership activities at the intersection of Science and Native American identities, *NAISI @ Brown*, 2023 – present
- Udall Foundation, *Faculty Review Committee*, 2024

To the profession:

- Peer reviewed for *Chemical Reviews*, *Chemical Science*, *ACS Omega*, and *ACS Applied Energy Materials*
- Reviewer for *Department of Energy (DOE)* grant funding
- 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
- Presider for the *ACS Division of Colloids and Surface Chemistry*, 2021
- Mentor & Science Panelist for Chicago's *NAACP Afro-Academic, Cultural, Technological and Scientific Olympics*, 2020 -2021
- STEM Career Counseling and Resume Preparation for *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