NATHAN BARTLETT

Website: nathanbartlett.xyz
Phone: (301) 471-3944
nbb2@illinois.edu

1103 S. Prairie St.
Champaign, IL 61820

I am graduate student at the Center for Plasma-Material Interactions (CPMI) studying under Abel Bliss Professor of Engineering David N. Ruzic with my research focused on tin ion transport though hydrogen in the context of extreme ultraviolet (EUV) lithography sources. I have worked to cultivate both computational skills and lab skills which are vital to be a successful researcher and engineer. My professional aim is to make meaningful contributions to the semiconductor processing industry in order to develop ever more power computers which allow us to explore new frontiers.

EDUCATION

MS/PhD Program
University of Illinois at Urbana-Champaign — Expected Graduation: May 2026
Nuclear, Plasma, and Radiological Engineering
Advisor: David N. Ruzic

BS University of Illinois at Urbana-Champaign, Engineering Physics — 2020
Technical concentration in plasma science and engineering

RESEARCH EXPERIENCE

Center for Plasma Material Interactions, Champaign, IL — 2017 to Present
Graduate Research Assistant,

- My main project is studying tin-ion beam attenuation as it travels though hydrogen.
- This has been a combination of theoretical, computational, and experimental work.
- Developed a python code for working with interatomic potentials and calculating elastic scattering cross sections.
- Designed and built a beam scattering experiment in the style of Amdur and Jordan in order to measure the stopping ability of hydrogen.
- Managing three undergraduate research assistants.
- I also assist on three other projects where I have made meaningful contributions:
    - **Study of diffusion coefficients of tin in hydrogen:**
        - Here I helped mostly helped in training the graduate student running this project.
        - I have also helped in experimental design and fabrication of elements of the experiment using a manual mill.
        - I have also used my code to predict the diffusion coefficients using Chapmon-Enskog kinetic formulation.
    - **Improvement of CO_2 recombination catalyst:**

        - Aided in experimental design as well as fabricated several components of the experiment including the support frame and modified housing of an RF supply and a again using a manual mill and lathe.
    - **Measurement of Stannane (SnH_4) vapor pressure.**
        - Here I helped the post-doc running this project in building a small vacuum chamber for conducting vapor pressure measurements.
        - I also located and helped translate papers from Frits Paneth, one of the first to synthesis and study Stannane.

Undergraduate Research Assistant,

- I first began at the Center for Plasma-Material Interactions as a freshman undergraduate.
- My first project I helped on was trying to use HiPIMS magnetron sputtering to improve multilayer mirror coating for EUV optics.
- The second project I helped on was using HiPIMS sputtering to make diamond-like-carbon thin films.
- The third project I helped on was measuring the field lines of the HIDRA stellarator located at the Center for Plasma-Material Interactions.
- The final project io worked on was designing an electro-mechanical diagnostic for measuring the level of liquid lithium held in a reservoir for fusion engineering applications.

ITER Organization, Saint-Paul-Lez-Durance, France June 2019 – December 2019
Class B Intern Studying Ammonia Formation at the Divertor Region

- Reviewed the AMMONX database and check the validity of the reaction at high and low temperatures and densities
- Surveyed the SOLPS-ITER Eirene Monte-Carlo surface chemistry capabilities
- Modified the SOLPS-ITER Eirene Monte-Carlo code to accommodate more complex ammonia producing reactions

TEACHING EXPERIENCE

Teaching Assistant, NPRE 423 2022
Plasma Laboratory

- This is the flagship course offered by the NPRE department for undergraduate plasma engineers.
- Teaching assistants play a large role in the class as they set up and run labs each weak as well as provide office hours and do all grading.
- Labs include DC plasmas, vacuum tech, RF plasmas, spectroscopy, Langmuir probe, atmospheric plasma, physical vapor deposition and plasma etching.

PUBLICATIONS

First Author in Progress

Pyinteraction: An open-source python code for working with atomic and molecular interaction potentials and calculating scattering events. Nathan Bartlett, Tamar Dallal, Andrew Herschberg, Jameson Crouse, Raquel Garza, and David Ruzic (2023).

Elastic scattering cross sections of tin ions with molecular hydrogen using quantum chemistry software and classical scattering theory. Nathan Bartlett, Jack Stahl, Andrew Herschberg, Jameson Crouse, Tamar Dallal, Jake Nuttall, Steven Marcinko, Raj Ganesan, Raquel Garza, and David Ruzic. (2023).

Elastic scattering cross sections from experimental measurements of tin ion beam attenuation in molecular hydrogen. Nathan Bartlett, Andrew Herschberg, Jamison Crouse, Jack Stahl, Tamar Dallal, Jake Nuttall, Linus Ringstad, Raquel Garza, Raj Ganeson, and David Ruzic. (2023).

Co-Authored Accepted Publications

***HIDRA-MAT liquid metal droplet injector for liquid metal applications in HIDRA*.** A. Shone, Z. Koyn, B. Kamiyama, E. Perez, L. Barrus, N. Bartlett, J.P. Allain, D. Andruczyk., Fusion Engineering and Design. (2022) https://doi.org/10.1016/j.fusengdes.2022.113193
***Mapping of the HIDRA Magnetic Flux Surfaces*.** Rabel Rizkallah Matthew Parsons, Nathan Bartlett, Andrew Shone, Davide Curreli, and Daniel Andruczyk**.** Physics of Plasmas 26, 092503 (2019); https://doi.org/10.1063/1.5100744
Ring Catalog: A resource for designing self-assembling RNA nanostructures. Parlea, L., Bindewald, E., Sharan, R., Bartlett, N., Moriarty, D., Oliver, J., . . . Shapiro, B. A. (2016)**..** Methods, 103, 128-137. doi:10.1016/j.ymeth.2016.04.016

First Authored Posters

Scattering Cross Sections of Tin Ions With Molecular Hydrogen Nathan Bartlett, Andrew Herschberg, Jameson Crouse, Raquel Garza, Raj Ganeson, Tamar A. Dallal, Jake Nuttall, Linus Ringstad, and David N. Ruzic. SPIE Advanced Lithography. (2023).

***Characterization of Diamond-like-carbon Thin Film Depositions in Conjunction with High Power Impulse Magnetron Sputtering and Kick-pulse*.** Nathan Bartlett, Alp Aktuna, Lyle Regenwetter, Ian Haehnlein, David N. Ruzic. (2019).

***Functionalized RNA nanoparticles for targeted delivery* .** Nathan Bartlett, Daniel Moriarty, Lorena Parlea, Mathias Viard, Kirill Afonin, Bruce Shapiro. (2016).

Co-Authored Posters

Stopping a Tin Ion Beam with a Background Gas and Plasma. Jack Stahl, Nathan Bartlett, Andrew Herschberg, Tamar A. Dallal, Reese Peterson, and David N. Ruzic, (2022)

***Expected performance of the ITER core x-ray crystal spectrometer (XRCS-Core) diagnostic including sensitivity to alignment and tolerancing*.** Collin Dunn, Novimir Pablant, Robin Barnsley, Zhifeng Cheng, Maarten De Bock, Nathan Bartlett, Jovany Gallardy, Y Yakusevitch (2021).

X-ray raytracing of Bragg reflections from Highly Oriented Pyrolytic Graphite (HOPG) in support of the ITER XRCS-Core diagnostic. Jovany Gallardy, Novimir Pablant, Yevgeniy Yakusevich, Robin Barnsley, Nathan Bartlett, Zhifeng Cheng, Maarten DeBock, Collin Dunn, Sapna Mishra(2021) .

Characterization of plasma temperatures and heat fluxes during HIDRA operation. Matthew Parsons, Rabel Rizkallah, Andrew Shone, Nathan Bartlett, Daniel Andruczyk. (2018). Conference Papers.

CONFERENCES

SPIE 2022 Advanced Lithography and Patterning San Jose, Ca 2022

Poster presentation.

SPIE 2023 Advanced Lithography and Patterning San Jose, Ca 2023

Poster presentation.

CORE SKILLS

Vacuum Technology

- Worked on several chambers all using rough mechanical pumps and turbomolecular pumps.
- Designed and modified chambers as well as worked with many types of feed through and attachments (electrical, gas, mechanical, etc.).
- Trouble-shooted, repaired, and performed maintenance on chambers and pumps.

Plasma Sources

- Worked with several plasma sources such as DC capacitive discharges, RF inductive discharges, helicon sources, magnetron sources, and DC sputter gun sources.
- Performed several diagnostic methods with these sources such as spectroscopy and Langmuir probe.
- I know the basic models to calculate a-priori temperatures and densities of plasma sources.

Ion Scattering Physics

- My primary research consists of classical binary elastic scattering theory as formulated by the German school studying this.
- Written my own binary collision approximation software in python and used it to calculate scattering cross sections.
- Worked with a calutron ion beam source with electrostatic lens and magnetic ExB filter to run scattering experiments.

Python Programming

- I have programmed in several languages including Fortran and Rust, but I am most competent in writing in python.

Metal Working

- I have machine shop training on manual lathe and mill, band saw, grinder and several other common tools.
- I have gas and stick welding training from Parkland Community College.
- I have used these to fabricate several pieces for my own research as well as for other graduate students in my group.

COMMUNITY SERVICE

I aid in keeping the landscape upkept at St. Patrick's Catholic Church in Urbana, Illinois.

LANGUAGES

English: Native Language

Spanish: Conversational

ORGANIZATIONS

Society of Photo-Optical Instrumentation Engineers 2022-present
Student member.

I have attended the Advanced Lithography and Patterning conference twice. Both times I presented a poster on my current research.

Thomistic Institute 2021-present
Student member.

Participated in small group studies of Thomas Aquinas' Summa Theologica focused on the metaphysics of angels as well as the study of acedia.

BRAZILIAN JUI JITSU

I have been practicing Brazilian Jui Jitsu for approximately six months.

I competed in the Compnet Illinois Winter Championship 2023.

WEBSITE

nathanbartlett.xyz

I maintain a website where I publish several side projects and short essays.

MISCELLANEOUS TRAININGS

How To Become A Peer Reviewer? Basic And Advanced Training- SPIE 2023

Training on the basics of being a peer reviewer. Training done by **Researcher.Life**.