Nathan B. Bartlett – Curriculum Vitae

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Professional Summary

Nathan B. Bartlett is a doctoral student in Nuclear, Plasma, and Radiological Engineering at the University of Illinois at Urbana-Champaign with extensive experience in plasma-material interactions, high-vacuum systems, and computational modeling. His research focuses on plasma-assisted processes relevant to extreme ultraviolet (EUV) lithography, including ion scattering, chemical etching, and thin film deposition. Nathan has contributed to multiple experimental and theoretical projects in collaboration with leading institutions such as ASML and the ITER Organization. He has co-authored peer-reviewed publications and presented his work at major international conferences. Proficient in Python, MATLAB, Fortran, and several scientific simulation platforms, he combines strong technical and analytical skills with hands-on expertise in laboratory diagnostics and system design. Nathan brings a collaborative, research-driven mindset to advancing plasma science and engineering.

Education

- **Ph.D. in Nuclear, Plasma, and Radiological Engineering**
  University of Illinois at Urbana-Champaign, Expected 2026
  GPA: 3.89/4.00
- **M.S. in Nuclear, Plasma, and Radiological Engineering**
  University of Illinois at Urbana-Champaign, 2024
  GPA: 3.89/4.00
- **B.S. in Engineering Physics**
  Technical Concentration in Plasma Science
  University of Illinois at Urbana-Champaign, 2020
  GPA: 3.78/4.00

Research and Employment Experience

Graduate Research Assistant
Center for Plasma-Material Interactions, UIUC   (2021 – Present)

- Studying plasma-neutral interactions in extreme ultraviolet (EUV) sources.
- Measured scattering cross sections of Sn ions with hydrogen.
- Constructed experiment for deposition and etching of amorphous tin thin films.

- Developed code to extract transport properties from intermolecular potentials.
- Maintained and operated vacuum diagnostics including turbo pumps, RGAs, and high vacuum systems.

External Contractor (Remote)
Source Engineering Services, San Diego, CA (2024 – Present)

- Following my internship at ASML in San Diego, I was able to continue working remotely on my projects for ASML as an external contractor hired through Source Engineering Services.
- I have continued to improve our etching chemistry models by incorporating more chemical reaction data from literature as well as developing simpler (but faster) etching models.

Science Tutor (Remote)
HOLA HP, Dallas, TX (2024 – Present)

- I provide one-on-one remote tutoring in math, physics, statistics, computer science, and biology from eight grade to AP level classes.
- I am skilled in working remotely with students and breaking down complex ideas into simpler concepts usable by the students.
- I pride myself on being flexible with students and parents to get them the help they need as soon as possible.

Plasma Etch Scientist Intern
ASML, San Diego, CA (May – August 2023 and May – August 2024)

- Developed models for plasma-gas interactions.
- I reviewed ten years of internal documentation and summarize into a cohesive report.
- Designed measurements for plasma species in EUV systems.
- Aided in the installation of quartz crystal microbalances to an EUV test source to measure tin deposition.

Class B Intern – Ammonia Formation Studies
ITER Organization, Saint-Paul-Lez-Durance, France (June – December 2019)

- Assessed ammonia reaction networks in edge plasma.
- Modified SOLPS-ITER Eirene Monte-Carlo code for complex chemical reactions.

First Author Publications

- Bartlett, N., et al. (2024). ***Elastic scattering cross sections and transport of tin ions in EUV lithography sources.*** *Physica Scripta*.

Contributing Author Publications

- Jack Granat, Nathan Bartlett, David Ruzic, RGTfun: *An Open-Source MATLAB App for Rarefied Gas Transport Coefficient Calculations, JOSS*, In review
- Pablant, N. A., Bartlett, N., et al. (2024). *Synthetic model of the ITER XRCS-Core diagnostic*. *Rev. Sci. Instrum.*, 95, 083517.
- Shone, A., Bartlett, N., et al. (2022). *Liquid metal droplet injector in HIDRA*. *Fusion Eng. Des.* https://doi.org/10.1016/j.fusengdes.2022.113193
- Rizkallah, R., Bartlett, N., et al. (2019). *Mapping HIDRA Magnetic Flux Surfaces*. *Phys. Plasmas*, 26, 092503.
- Parlea, L., Bartlett, N., et al. (2016). *Ring Catalog for RNA nanostructures*. *Methods*, 103, 128–137.

Conference Speaker Presentations

- NWO Physics 2025 – **The *Plasma in EUV Sources that does NOT Emit EUV Light*** – Presentation, Eindhoven, Netherlands, presented on behalf of Professor David N. Ruzic
- SPIE 2025 Optical and EUV Nanolithography XXXVIII – *High energy and thermal transport of tin ions in an extreme ultraviolet lithography source* – Oral & Poster, San Jose, CA

Conference Poster Presentations

- American Vacuum Society 2025 – *Simultaneous Deposition and Removal of Tin in a Hydrogen Plasma Environment – Poster* Presentation, Charlotte, NC
- SPIE 2024 Optical and EUV Nanolithography XXXVII – *Elastic and inelastic cross section of tin ions in an extreme ultraviolet lithography source* – Poster, San Jose, CA
- SPIE 2023 Optical and EUV Nanolithography XXXVI –*Scattering cross sections of tin ions with molecular hydrogen* – Poster, San Jose, CA

Conference Poster Presentation Contributions

- Greene, N Bartlett, D Qerimi, D Ruzic , Optical and EUV Nanolithography XXXVIII - *Investigation of stannane (SnH4) decomposition and sticking coefficient on varied metal surfaces in EUV lithography environments* -
- Emily Greene, Nathan Barlett, Jameson Crouse, Eric Mushrush, Alex Shapiro, Niels Braaksma, David Ruzic *Stannane **Decomposition and Sticking Coefficient in Extreme Ultraviolet Lithography Environments**,* American Vacuum Society 2025
- Andrew C Herschberg, Nathan Bartlett, Jameson Crouse, Jaime Robertson, Emily Greene, David N Ruzic*, **Monitoring Net CO2 Dissociation Rates in the Effluent of Common Plasma Discharges with Optical Emission Spectroscopy***, American Vacuum Society 2025
- Jameson Crouse, Nathan Bartlett, Emily Greene, Shiva Rajavalu, Andrew Herschberg, University of Illinois at Urbana-Champaign; Sergio Ferraris, Niels Braaksma, David

Ruzic, University of Illinois at Urbana-Champaign, *Measurement and Modelling of Sn-H2 Vapor Diffusion Coefficients in the Transition Flow Regime*, American Vacuum Society 2025

- Gordon Jameson Crouse, Andrew Herschberg, Nathan Bartlett, Niels Braaksma, David Ruzic, *Measurement of tin diffusion coefficients through molecular hydrogen*, SPIE 2024 Optical and EUV Nanolithography XXXVII
- Andrew C Herschberg, Nathan Bartlett, Jameson Crouse, David N Ruzic, Plasma enhanced CO2 recombination in EUV drive lasers, SPIE 2023 Optical and EUV Nanolithography XXXVI
- Jack Stahl, Nathan Bartlett, David Ruzic, *Stopping a tin ion beam with a background gas and plasma*, SPIE 2022 Optical and EUV Nanolithography XXXV

- Collin Dunn, Novimir Pablant, Robin Barnsley, Zhifeng Cheng, Maarten De Bock, Nathan Bartlett, Jovany Gallardy, Y Yakusevitch, *Expected performance of the ITER core x-ray crystal spectrometer (XRCS-Core) diagnostic including sensitivity to alignment and tolerancing*, APS 2021 Division of Plasma Physics Meeting Abstracts
- Rabel Rizkallah, Matthew Parsons, Nathan Bartlett, Andrew Shone, Zachary Jeckell, Steven Marcinko, Davide Curreli, Daniel Andruczyk, *Mapping of the HIDRA Magnetic Flux Surfaces Through Experimental Measurements and Computational Codes*, APS 2018 Division of Plasma Physics Meeting Abstracts
- Daniel Andruczyk, Rabel Rizkallah, Matthew Parsons, Andrew Shone, Matthew Szott, Steven Stemmley, Nathan Bartlett, Brandon Holybee, Zak Koyn, Aveek Kapat, Steven Marcinko, David Ruzic, Jean Paul Allain, Davide Curreli, Rajesh Maingi, Jiansheng Hu, Guizhong Zuo, Zhen Sun*, Overview of the latest results from HIDRA*, APS 2018 Division of Plasma Physics Meeting Abstracts
- Matthew Parsons, Rabel Rizkallah, Andrew Shone, Nathan Bartlett, Daniel Andruczyk, *Characterization of plasma temperatures and heat fluxes during HIDRA operation*, APS 2018 Division of Plasma Physics Meeting Abstracts

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Programming and Simulation Knowledge

Python

- My most proficient programming language is python. I have been writing software in python since 2017. I have contributed to codes such as XICSRT (a ray tracing software). I have written a Monte-Carlo transport code as well as software to calculate classical transport properties of atoms and ions.
- I am familiar with many scientific programming concepts such as interpolation, extrapolation, model fitting, numerical integrations, solving differential equations, and plotting.

MATLAB

- I lead a project (in collaboration with my undergraduate research assistant Jack Granat) to write a MATLAB code with GUI to calculate scattering and transport properties of arbitrary intermolecular potentials (RGTfun, https://github.com/nbb2/rgtfun).

Fortan

- I am not particularly skilled but am actively learning to program in Fortran. I found a great deal of legacy codes are written in Fortran and it is a straightforward language to do simpler scientific computation efferently.
- I have started a YouTube series explaining at scientific programming and am using Fortran. This is mostly a learning exercise for myself.

Binary Collision Approximation Codes

- I have a great deal of familiarity with binary collision approximation codes which seek to model ion implantation and surface sputtering.
- I have used SRIM/TRIM for many simulations and have also used and modified a more modern BCA code RustBCA.
- I have written my own BCA code in python to model my own experiments.

Vacuum, Plasma, and Surface Metrology Experience

Chamber Design

- I have designed constructed a vacuum chamber for thin film deposition and etching from individual components.
- I have a working proficiently with Inventor Pro CAD software as well as simulation software such as OpenFOAM and COMSOL.

Gauges

- Pheiffer full rage gauge.
- Pirani (Convectron) gauge
- Capacitance manometer (Baritron)
- Ion Gauge

Pumps

- Welch Duo Seal oil rough pump

- Ebara and Pheiffer turbomolecular pumps
- Limited experience with a cryopump and compressor

Flow Controllers

- Alicat mass flow controllers

Residual Gas Analyzers

- SKS RGA 100 series

Electronics Equipment

- Multimeter
- Oscilliscope

Plasma Sources

- DC (for small ion source, magnetron sputtering, educational lab)
- RF (13.56 MHz) (Used in various settings for research and lab class)
- Variable Microwave power source (variable frequency around 100 MHz) (most familiar with this source, was used as main plasma source in my PhD)
- Atmospheric microwave torch (used during an educational lab)
- Atmospheric dielectric barrier discharge (kHz frequency) (used during an educational lab)

Thin Film Coaters

- Kurt J Lesker magnetron sputter gun with DC and HIPIMS power supplies
- High temperature molecular beam epitaxy source.

Power Supplies

- 100 W Starfire microwave power supply
- 300 W RF power supply with matching network
- 2 kW RF power supply
- High current low voltage supply for thermionic emission
- Variac for running heating tape to bake out chamber
- DC supplies of various voltages, worked with up to 10 kV supply (for ion fun) down to simple DC supplies for running stepper-motors.

RF Matching Networks

- Stub tuner for a microwave supply
- Homemade L network
- Industry built automatic matching network for a helicon plasma source

Diagnostics

- Langmuir probe with a source measurement unit
- Type K and C thermocouples for temperature measurements
- Coated thermocouples to measure radical probes.
- Faraday cup.

Scanning electron microscope

- I have extensive experience with a Hitachi S-4800 high resolution scanning electron microscope.
- I have analyzed thin film samples in order to determine experimental effects on surface growth morphology of tin on silicon, gold, and aluminum.

Optical Microscope

- I am familiar with the Keyence VK-X1000 3D Laser Scanning Confocal Microscope. I use it regularly to image samples, measure film height, and measure film roughness.

Miscellaneous Topics of Interest

- Analog Computing
    - I have for some time been very interested in analog computing. I own an Anabrid analog computer as well as an Okika field programmable analog array (FPAA).
    - This has helped me better understand different ways of solving differential equations as well as imporove my general knowledge about circuits.
- Blog
    - I maintain a blog (https://nathanbartlett.substack.com/) where I write about topics that interest me (mostly history, archaeology, science, and technology)

Language Proficiency

I am conversationally proficient in Spanish.

International Experience

- I lived and worked in Aix-en-Provence France for six months. I worked with an international team from all seven member countries of the ITER project.
- I traveled to the Netherlands to give an invited talk in place of my advisor who was unable to go on short notice. I also met with research collaborators at ASML while on the trip.
- I regularly visit El Salvador to visit my in-laws and have studied the history, language, and culture of the country.