RISHABH DATTA

Email: rdatta@mit.edu • Website: ridatta.com • Linkedin: rishabh-datta

EDUCATION

Massachusetts Institute of Technology **2022-Present**
Ph.D. in Mechanical Engineering; Major in Plasma Physics, Minor in Photonics *Cambridge, MA*
Thesis: "*Radiatively-cooled magnetic reconnection on the Z pulsed-power machine*" *GPA: 5.0/5.0*

Massachusetts Institute of Technology **2019-2022**
S.M. in Mechanical Engineering *Cambridge, MA*
Thesis: *"High-Energy-Density Shocks in Magnetized Hypersonic Plasma Flows"* *GPA: 5.0/5.0*

Georgia Institute of Technology **2015-2019**
B.S. in Mechanical Engineering (Highest Honors) *GPA: 3.97/4.0*

RESEARCH EXPERIENCE

Research Assistant, Plasma Science & Fusion Center, MIT **2020-Present**
Research Supervisor: Dr Jack D Hare
- Demonstrated first evidence of radiative collapse in a novel magnetic reconnection experiment
- Led the multi-institute MARZ collaboration (MIT, Sandia National Labs, Princeton, UMich, and others)
- Computational modeling (MHD, radiation transport, etc. in Python, Fortran) of high energy density plasmas
- Novel diagnostic development (machine learning with spectroscopy, tomography, shock-based imaging, etc.)
- Developed analysis and synthetic modeling software (visible/X-ray spectroscopy, interferometry, imaging, etc.)

Research Intern, Technical University Munich **2018**
Research Supervisor: Dr Stefan Adami
- Developed Riemann solver(s) in C++ for compressible multiphase flow modeling

Research Assistant, Solar Fuels & Technologies Lab, Georgia Tech **2017-2018**
Research Supervisor: Dr Peter Loutzenhiser
- Thermodynamic characterization of novel fuels for thermochemical concentrated solar reactors

AWARDS, GRANTS, AND HONORS

- Igor Alexeff Outstanding Student in Plasma Science Award (1 selected, international) **2024**
- ZNetUS Program Grant *($50,000 to study compression in magnetized oblique shocks)* **2024**
- Wunsch Foundation Silent Hoist and Crane Outstanding Student Award (2 selected, department) **2023**
- MIT College of Engineering Exponent Fellowship (1 selected, institution) **2023**
- Finalist, Best Student Paper, IEEE Plasma Science Conference (5 selected, international) **2023**
- Best Poster, MIT Machine Learning for Engineering Design Poster Expo. **2022**
- MIT MathWorks Fellowship **2022**
- Keck Award in Thermal Sciences, MIT (1 selected, department) **2021**
- GSC Conference Grant, MIT (1 selected, institute) **2021**
- Honorable Mention, MIT Mechanical Engineering Research Exhibition **2021**
- President's Undergraduate Research Award, Georgia Tech **2018**
- Diversity, Equity and Inclusion Fellow, Georgia Tech **2018**
- Practical Research Experience Program Scholarship **2018**
- Dean's List **2018**

• Faculty Honors **2015, 2016, 2017, 2018**

PUBLICATIONS

[8] **Datta, R**., Crilly, A., Hansen, S., et al. (2024). Radiatively-cooled magnetic reconnection driven by pulsed power. Invited Paper. Phys. Plasmas. (In Review).

[7] **Datta, R**., Crilly, A., Hansen, S., et al. (2024). Plasmoid formation and strong radiative cooling in a driven magnetic reconnection experiment. Phys. Rev. Lett. (In Review).

[6] **Datta, R**., Crilly, A., Chittenden, J., et al. (2024). Simulations of radiatively cooled magnetic reconnection driven by pulsed-power. Journal Plasma Phys. (In Review).

[5] **Datta, R**., Faez, A., Hare, J.D. (2023). Machine learning assisted analysis of visible spectroscopy in pulsed-power-driven plasmas. IEEE Transactions on Plasma Science (Accepted).

[4] **Datta, R**., Angel, J., Greenly, J.B. , et al. (2023). Plasma flows during the ablation stage of an over-massed pulsed-power-driven planar wire array. Phys. Plasmas 30, 092104.

[3] **Datta, R.,** Russell, D. R., Tang, I., Clayson, T., et al. (2022). The structure of 3-D collisional magnetized bow shocks in pulsed-power-driven plasma flows. Journal Plasma Phys., 88(6), 905880604.

[2] **Datta, R**., et al. (2022) Time-resolved velocity and ion sound speed measurements from simultaneous bow shock imaging and inductive probe measurements. Rev. Sci. Instrum., 93(10), 103530.

[1] Bush, H. E., **Datta, R**., & Loutzenhiser, P. G. (2019). Aluminum-doped strontium ferrites for a two-step solar thermochemical air separation cycle: Thermodynamic characterization and cycle analysis. Solar Energy, 188, 775-786.

SELECTED TALKS AND PRESENTATIONS

• APS Division of Plasma Physics Meeting, Denver, CO. *Invited talk.* **2023**
• Z Fundamental Science Workshop (Virtual). *Invited plenary.* **2023**
• Dense Z Pinch Conference, Ann Arbor, MI. Contributed talk. **2023**
• International Magnetic Reconnection Workshop, Japan. Contributed talk. **2023**
• International Conference on Plasma Science, Santa Fe, NM. Contributed talk. **2023**
• MIT PSFC-NSF Meeting, Cambridge, MA. *Invited talk.* **2023**
• MIT Machine Learning for Engineering Design Expo, Cambridge, MA. Contributed Poster. **2022**
• APS Division of Plasma Physics Meeting, Spokane, WA. Contributed talk. **2022**
• High Temp. Plasma Diagnostics, Rochester, NY. Contributed poster. **2022**
• APS Division of Plasma Physics Meeting, Pittsburgh, PA. Contributed poster. **2023**
• MIT-Imperial College Meeting. *Invited Talk.* **2021**
• MIT Graduate Association of Mechanical Engineers Lunch Seminar. **2021**

TEACHING AND MENTORSHIP

• Teaching Assistant, 2.005 Thermofluids Engineering, MIT **2024**
Prepared teaching materials and lectures for 75 junior/senior undergraduate students

• Teaching Assistant, MechE Advanced Fluid Mechanics Qualifying Exam, MIT **2022**

• The Professor's Toolkit Teaching Course, MIT, Cambridge, MA **2024**
• Teaching Days Course, MIT, Cambridge, MA **2024**

• Undergraduate researcher (UROP) Advisor **2022-Present**
Closely mentored 6 undergraduate students on research projects I proposed as part of my research.
1. Emily Neill (Spring 2023-Present): Measuring the adiabatic index in high energy density plasmas
2. Osahon Odiase (Spring – Summer 2023): Construction and testing of a 1kA pulsed-power device
3. Dylan Robinson (Spring 2023): Mach-Zehnder interferometry measurements in planar wire arrays
4. Jane Atkinson (January 2023): Construction and testing of a 1kA pulsed-power device
5. Jose Arevalo (Spring – Fall 2023): Design and modeling of a 1kA pulsed-power device
6. Emily Wong (Fall 2022): Three-dimensional MHD modeling of planar wire arrays

LEADERSHIP & ACTIVITIES

• MIT GSC Sustainability, Committee Chair **2020-2022**
• MIT Sustainability Fund, Chair **2020-2022**
• Peer Mentor | MIT Graduate Association of Mechanical Engineers **2022-2023**
• Housing and Community Affairs, MIT Graduate Student Council **2020-2022**
• Graduate Student Coach, MIT **2021**
• Diversity and Inclusion Fellow, Georgia Tech **2018**
• Executive Board Member, Georgia Tech Mental Health Student Coalition **2017**
• Chair, Council of Grad Life, Georgia Tech **2017-2019**
• Diversity & Inclusion Chair, Student Center Programs Council, Georgia Tech **2016-2017**
• Committee Chair, Georgia Tech Student Government Association **2015-2017**

OTHER PROJECTS & PROFESSIONAL EXPERIENCE

Optics and Photonics

• Tomographic reconstruction using Mach-Zehnder interferometry measurements **2023**
Developed simultaneous algebraic reconstruction tomography software in Python.

• Surface Plasmon Polaritons on Anisotropic Interfaces **2023**
Analytical and FDTD computational modeling in Lumerical of SPP generation.

• Photonic band gaps in periodic double-negative multilayer structures **2023**
Modeled (FEM, COMSOL) photonic band gaps in multilayer crystals with negative index materials.

• Optical Modeling of Tunable Optical Plasma Metamaterials **2022**
Designed tunable plasma metamaterials using geometric ray tracing and Fourier optics.

Optimization and Machine Learning

• Optimization of pulsed-power-driven loads **2024**
Optimizing load geometry (using gradient-free optimization) based on electrostatic simulations.

• Multi-objective optimization of linkage mechanisms **2022**
Designed linkage mechanisms using genetic optimization algorithms (NSGA-II, SMS-EMOA, etc.)

• Using Deep Generative models for topological design of truss structures **2023**
Developed generative adversarial networks (GANs) and Variational Auto-Encoders (VAEs) in TensorFlow for generating novel diverse topologies of truss structures.

Computational Modeling and Design

• Engineering Intern, Emrgy Distributed Hydropower Solutions **2019**
Performed CFD simulations, numerical finite-difference modeling, and electrical systems modeling of hydrokinetic devices using Simscale, MATLAB, Python, and VBA.

• Design of a 10 kA micro-second pulsed power device **2023**
Designed (in Simulink) and manufactured a table-top pulsed power device.

• A finite-element Biot-Savart solver for electrostatic modeling of loads **2022**
Developed a numerical tool in MATLAB & Python to model the electrostatic magnetic field distribution in pulsed-power-driven loads.

• Thermochemical energy storage for concentrated solar power plants **2018-2019**
Thermodynamic modeling for a 1.5 MW solar plant with a primary air cycle and a secondary Rankine cycle, and storage modeling using a MnO_2/Mn_2O_3 continuous flow systems.