

AKM Sadman Mahmud

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EDUCATION

Bucknell University August 2020 - May 2024	Lewisburg, PA
Bachelor of Science: Physics (Concentration: Astrophysics)	Expected May 2024
Minor: Mathematics	GPA 3.94/4.00
Academic Advisor: Dr. Katharina Vollmayr-Lee	

AWARDS AND SCHOLARSHIPS

Dean's Award , Bucknell University	<i>Fall 2020 - Spring 2023</i>
– Awarded to students who receive a term grade point average of 3.5 or higher while completing at least 3 course credits for a conventional letter grade and a minimum of 3 total course credits.	
Alpha Lambda Delta National Honor Society , Bucknell University	<i>August 2021</i>
– Awarded for excellence in academic performance throughout a student's first year of college. To be eligible for this award, recipients must rank in the top 20% of their class.	
Fremont Scholar , Bucknell University	<i>Fall 2020 - Present</i>
– Awarded four incoming international first-year students for their outstanding academic profiles.	

RESEARCH EXPERIENCE

Undergraduate Research Assistant , Department of Physics & Astronomy	Bucknell University
Advisor: Dr. Katharina Vollmayr-Lee	<i>June 2021 - Present</i>

- Wrote LAMMPS input scripts for molecular dynamics simulation in the NVE ensemble of a 2D (extensible to 3D) bidisperse system to study the effects of fixed pins on the jamming transition of the system under shear.
- Developed a modified version of Dissipative Particle Dynamics (DPD) that introduces a purely repulsive potential and a dissipative force among particles.
- Reduced a vast volume of simulation output data and created a plethora of plots with xmgrace to figure out the region of interest to analyze the jamming transition in the modified Liu & Nagel diagram.
- Analyzed heatmaps with Python and OVITO to visualize the evolution of the system.
- Created highly visual animations of velocity and shear stress profiles using Matplotlib and Seaborn.
- Developed master bash scripts to increase efficiency, automate creating input scripts, varying parameters, and submitting jobs to a supercomputer provided by NSF's Xtreme Science and Engineering Discovery Environment (XSEDE).
- Determined the timescale and the length-scale associated with the distribution of particles by performing basic time series analysis on the evolution of single particles in Python.
- Evaluate the power law of normalized force distribution with a Fortran script and compare the distribution of d_{\min}^2 , a quantity of non-affine motion, to the force distribution.

- Wrote Python and MATLAB scripts to explore the deep ocean data of pressure, temperature, and practical salinity, collected by Deep Argo Floats, deployed early 2023 in the eastern Pacific sector of the southern ocean, and historical data from shipboard surveys taken during the World Ocean Circulation Experiment (WOCE), CLIVAR, and more recently GO-SHIP.
- Reduced, sorted, and corrected the data read from netCDF4 files, and saved the straightened data in binary format for further use.
- Analyzed conservative temperature, absolute salinity, and potential density σ_4 , following the Thermodynamic Equation of Seawater-2010, along the trajectories of the Deep Argo Floats and shipboards.
- Assessed the geographic and temporal dimensions of the focus region, referencing the pertinent local eddy scales, to discern the degrees of freedom inherent in the data.
- Determined the warming and freshening trends of Antarctic Bottom Water, the longitudinal variation of the trends, and the reduction of its volume for the focus region in the last three decades.
- Participated in weekly talks, seminars and a hands-on, one-day ocean sampling cruise onboard the R/V Tioga focusing on data collection and sampling methods with advanced oceanographic instruments.

MANUSCRIPTS IN PREPARATION

Gregory Johnson, **AKM Sadman Mahmud**, Alison Macdonald, *Accelerating Antarctic Bottom Water Warming off West Antarctica*, Targeted for GRL (Geophysical Research Letters) submission.

Katharina Vollmayr-Lee, Amy Graves, **AKM Sadman Mahmud**, Michael Bolish, Xiang Li, Jean-Luc Ishimwe, Amin Danesh, Ella Carlender, *Non-affine Dynamics of a Sheared Athermal System with Pins*, Targeted for Physical Review E submission.

SCIENTIFIC TALKS

Bottom Water Warming in Eastern-Pacific Southern Ocean, **AKM Sadman Mahmud** [Presenter], Departmental Seminar, Bucknell University (September 2023)

Warming of Antarctic Bottom Water in Eastern Pacific region of Southern Ocean, **AKM Sadman Mahmud** [Presenter], Summer Student Fellows Presentation, Woods Hole Oceanographic Institution (July 2023)

Determining Critical Temperature in 2D Ising Model: Spin-spin Correlation, **AKM Sadman Mahmud** [Presenter], PHYS 310 Final Project, Bucknell University (May 2023)

S01.00006 : *Velocity and Shear Stress Profiles of a Sheared Athermal System with Pins*, **AKM Sadman Mahmud** [Presenter], Katharina Vollmayr-Lee, Michael J Bolish, Amin Danesh, Amy L Graves, Cacey S Bester, Brian Utter, APS March Meeting (March 2023)

Shearing of a Pinned 2D-Granular System, **AKM Sadman Mahmud** [Presenter], Departmental Seminar, Bucknell University (September 2022)

POSTER PRESENTATIONS

Variable Star Monitoring: Calculating Stellar Distance via Light Curve Analysis, **AKM Sadman Mahmud**, Tess Balsley, Minhaj Bhuiyan, ASTR 201 Final Project, Bucknell University (May 2023)

Analysis of a Sheared 2D Granular System with Pins, **AKM Sadman Mahmud** [Presenter], Summer 2023 Poster Session, Bucknell University (August 2022)

N00.00147 : *Influence of Pins on The Jamming Transition of a Sheared Athermal System*, **AKM Sadman Mahmud** [Presenter], Katharina Vollmayr-Lee, Michael J Bolish, Amy L Graves, Cacey S Bester, Brian Utter, APS March

Meeting (March 2022)

Influence of Pins on The Jamming Transition of a Sheared Athermal System, **AKM Sadman Mahmud** [Presenter],
Kalman Symposium, Bucknell University (April 2022)

RELEVANT COURSEWORK

Physics & Astronomy: Classical and Modern Physics I (PHYS 211), Classical and Modern Physics II (PHYS 212), Classical Mechanics (PHYS 221), Wave Mechanics and Quantum Physics (PHYS 222), Experimental Physics (PHYS 310), Thermodynamics/Statistical Mechanics (PHYS 317), Advanced Classical Mechanics (PHYS 331), Electromagnetic Theory I (PHYS 333), Electromagnetic Theory II (Independent Study) [Spring 2024], Introduction to Quantum Mechanics (PHYS 332), Advanced QM & Particle Physics (PHYS 337), Observational Astrophysics (ASTR 201), Astrophysics (ASTR 301) [Spring 2024].

Mathematics: Calculus II (MATH 202), Calculus III (MATH 211), Differential Equations (MATH 211), Linear Algebra (MATH 245), Logic, Sets, and Proofs (MATH 280), Topology (MATH 333).

Computer Science: Introduction to Computer Science (CSCI 203), Data Structures & Algorithms (CSCI 204), Software Engineering & Design (CSCI 205) [Spring 2024].

Geoscience: Physical/Environmental Geology (GEOL 203), Geophysics (GEOL 334).

EXTRACURRICULAR ACTIVITIES

Assistant Coach, *Bangladesh Junior Science Olympiad* **Bangladesh** *May 2018 - Present*

- Train & prepare the lesson plans for Bangladesh National Team for International Junior Science Olympiad.

President, *The Society of Physics Students* **Bucknell University** *August 2023 - Present*

- Organize social gatherings, movie nights, or any informal gatherings to build a strong community among physics enthusiasts, encouraging networking and fostering friendships.
- Organize study groups to facilitate collaborative learning in introductory physics courses.
- Reach out to on-campus students and actively encourage their participation in departmental talks.

Activist, *Global Student Council* **Bucknell University** *August 2022 - Present*

- Crowdfund, leveraging social media platforms and alumni networks to reach a wider audience, for any hardpressing issues. Efforts resulted in a substantial amount of funding being raised to support the victims of the 2023 earthquake in Turkey.
- Help arrange speaker forums in academic and social issues reagrding international student community.

Participant, *Leadership Seminar* **Open Discourse Coalition** *August 2023 - Present*

- Develop analytical, organizational, evidence-based thinking, and speaking skills in situations requiring leadership.
- Learn global thinking through successful leadership models from different periods of history and from different cultures across different disciplines.

August 2022 - Present

- August 2022 - Present

- August 2022

- May 2019 - August 2021

- Research Interests:** Stars & Exoplanets, Computational Modeling, Machine Learning, Planetary Science, Soft Matter, Non-linear Physics,

Languages: English(native), Bengali(native), German(A2)

Professional Memberships: American Physical Society (APS)

Co-curricular Interest: Film, Stand Up Art, Salsa Dance, Piano