Avik Mondal
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RESEARCH STATEMENT

I want to leverage my training in theoretical and computational physics to study the coupled climate system. I have a particular interest in understanding climate variability driven by interactions between the ocean and the atmosphere. I am currently looking for a position as a postdoctoral researcher.

EDUCATION

University of Michigan, Ann Arbor **Ann Arbor, MI**
College of Literature, Science, and the Arts (LSA) *August 2018–*
Program: Physics Ph.D.
Expected Graduation Date: June 2025

University of California Santa Barbara **Santa Barbara, CA**
College of Creative Studies (CCS) *September 2014 – June 2018*
Major: CCS Physics
Degree: Bachelor of Science (June 2018)

RESEARCH EXPERIENCE

Arbic Lab (Computational Physical Oceanography) **Ann Arbor, MI**
Graduate Student Research Assistant *May 2021 – Present*
- Developing numerical and theoretical tools to analyze air-sea interactions in high-resolution, global climate models

Lubensky Lab (Statistical Physics of Developmental Biology) **Ann Arbor, MI**
Graduate Student Research Assistant *May 2019-Present*
- Studied morphogenesis using theory and simulations, with a particular focus on pattern formation in fruit fly wings
- Developed simulations of growing tissues that incorporated mitosis, apoptosis, and periodic boundary conditions with heterogeneous cell properties

Carlson Lab (Complex Systems) **Santa Barbara, CA**
Undergraduate Researcher, Worster Fellow *March 2017-August 2019*
- Developed computationally efficient methods of human bone aimed at studying the structure and mechanics of trabecular bone

PAPER INVOLVEMENTS

In Development:

- D. Blanco-Obregon, **Avik Mondal,** David K. Lubensky, Pierre Leopold, Daniel McCusker. Manuscript on imaging *Drosophila* wing hairs and consequent pattern analysis. *Manuscript In Development.*
- **Avik Mondal**, David K. Lubensky, and Jakob Sheridan. "Compression Induced Fluidization in Vertex Models of Epithelial Tissue." *Manuscript In Development.*

Under Review

- **Avik Mondal*,** Andrew J. Morten*, Brian K. Arbic, Glenn R. Flierl, and Robert B. Scott. "Spatio-temporal spectral transfers in fluid dynamics." *Manuscript Under Review.* (arXiv:2405.02259v2)

Accepted

- **Avik Mondal**, Chantal Nguyen, Xiao Ma, Ahmed E. Elbanna, and Jean M. Carlson. "Network models for characterization of trabecular bone." *Phys. Rev. E* **99**, 042406 (2019)

* co-first authors

TECHNICAL SKILLS

(Current) C++, MATLAB, Python (including experience with Xarray, DASK, Pandas, GeoPandas), Mathematica, LaTeX, FIJI, MS Office, (**Previous)** JAVA, Arduino, Abaqus,

CODEBASES

FlyAnalysis (Python, Jupyter Notebook) (*private repository, contact for access*)

- Allows user to estimate shape and size of cells on fly wings from fly wing hair data.
- Contains tools to do statistical analysis of wings of different genotypes and vertex model output designed to simulate fly wings

Lubensky-Lab-Vertex-Models (C++, MATLAB, Python, Jupyter Notebook) *(private repository, contact for access)*

- Implements the vertex model of morphogenesis, a molecular dynamics-like model of cells and tissues that models cell dynamics in epithelial tissues
- Allows for simulations of ~10^5 cells, mitosis (cell division and proliferation), apoptosis, tissue growth, and cells with spatially varying properties

CoupledOceAtmo (Python, Jupyter Notebook)

- Contains code to estimate temperature variance budgets in the oceanic and atmospheric mixed layer in NASA's MITgcm/GEOS5 coupled simulation
- Designed for large calculations in Pleiades cluster

Skel-Analysis (MATLAB)

- Contains tools to analyze 3D reconstructions of trabecular bone. Allows users to convert trabecular bone VOI's into network and FEM models. These models can be analyzed for structural and mechanical properties.

TALKS/PRESENTATIONS

APS March Meeting 2024 (in-person talk)	March 2024
AGU Ocean Sciences Meeting 2024 (in-person talk)	February 2024
AGU23 (in-person poster presentation)	December 2023
APS March Meeting 2023 (in-person talk)	March 2023
APS March Meeting 2023(in-person presentation)	March 2023
APS March Meeting 2022 (virtual presentation)	March 2022
AGU Ocean Sciences Meeting 2022 (virtual presentation)	February-March 2022
APS March Meeting 2018 (in-person presentation)	March 2018

UNDERGRADUATE MENTORING

Dom Ross: *Machine Learning Models for Fly Wing Hair Segmentation*	June-August 2023
Hitanshu Patel: *Fly Wing Registration by Schwarz-Christoffel Transforms*	May-August 2023
Reid Tang, Yulin Zhang: *Time Dependent Tension on Vertex Model Edges*	January-June 2025

TEACHING EXPERIENCE

Physics 121, Physics of Architecture **Ann Arbor, MI**
Graduate Student Instructor *January 2023 – April 2023*

- Instructed undergraduate students in the architecture program in introductory physics concepts using laboratory demonstrations

Physics 411, Computational Physics **Ann Arbor, MI**
Graduate Student Instructor *August 2022 – December 2022*

- Grader for student assignment
- Held office hours to help students debug and fix Python code, used for numerical methods relevant to Physics

Earth 222/223, Intro to Oceanography/ Lab **Ann Arbor, MI**
Graduate Student Instructor *January 2021 – April 2021*

- Grader for student lab assignments
- Facilitated student discussion in main lecture class

Earth 421, Physical Oceanography **Ann Arbor, MI**
Graduate Student Instructor *August – December 2020, 2022, 2023*

- Grader for homework and midterm
- Provided students with support for Python homework exercises and preparation for midterm and final
- Organized class field trip to NOAA field station (2022, 2023)
- Substitute lecturer on several occasions

PSTAT 412, Introduction to Upper-Level Statistics **Ann Arbor, MI**
Graduate Student Instructor, grader August 2019 – May 2020, September 2020-December 2020

- Grader for midterms, homework, and final
- Held office hours

Physics 406, Statistical Mechanics and Thermodynamics **Ann Arbor, MI**
Graduate Student Instructor *January 2019 – May 2019*

- Taught statistical mechanics, thermodynamics, and the prerequisite mathematical and physical concepts to third and fourth-year physics majors.
- Coordinated with head instructor to create curriculum for sections
- Held office hours and ran weekly sections
- Substituted as lecturer when needed

Physics 141, Intro Mechanics Labs **Ann Arbor, MI**
Graduate Student Instructor *August 2018-December 2018*

- Taught fundamental concepts of classical mechanics to first year undergraduate engineering students using laboratory demonstrations and Python simulations

Physics 119B, Statistical Mechanics **Santa Barbara, CA**
Undergraduate Learning Assistant *January 2018 – April 2018*

- Helped students work through statistical mechanics problems during recitation