

Md Mohsin, Ph.D.

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About Me

I am a computational biophysicist specializing in bioelectricity of cytoskeletal filaments, nonlinear PDE/ODE modeling, and high-performance scientific computing. My research develops multiscale transmission-line models that link molecular electrostatics with emergent ionic conduction and oscillatory signals in actin and microtubules. I build simulation pipelines in Python, Fortran, and Mathematica, integrating electrokinetics, nanopore transport, and electrodynamics to study cellular information processing.

Research Interests

- Bioelectricity of cytoskeletal filaments (microtubules & actin)
- Electrodynamics and ionic conduction in biological polymers
- Multiscale transmission-line modeling
- Nonlinear PDE/ODE solvers for biophysical systems
- Nanopore-mediated transport and voltage-dependent conductance

Education

Ph.D., Physics — University of Texas at San Antonio (UTSA), 2025

Dissertation: Polyelectrolyte Properties of Actin and Microtubule and Their Roles in Electrical Activities in Neurons

M.S., Physics — University of Texas at San Antonio, 2022

M.S., Physics — University of Chittagong, Bangladesh, 2008

B.Sc. (Hons.), Physics — University of Chittagong, Bangladesh, 2006

Publications

PUBLISHED ARTICLES

Mohsin, M., Cantiello, H. F., Cantero, M. D. R., & Marucho, M. (2025). Electrical oscillations in microtubules. *Scientific Reports*, 15(1), 41106. <https://doi.org/10.1038/s41598-025-24920-w>

Hunley, C., **Mohsin, M.**, & Marucho, M. (2022). Electrical impulse characterization along actin filaments in pathological conditions. *Computer Physics Communications*, 275, 108317. <https://doi.org/10.1016/j.cpc.2022.108317>

Rahman, A. K. M. R., Meaze, A. K. M. M. H., Chakraborty, S. R., & **Mohsin, M.** (2020). Evaluations of $n + {}^{27}Al$ reaction in the energy range 0.1–200 MeV. *Indian Journal of Physics*, 94(8), 1255–1262. <https://doi.org/10.1007/s12648-019-01555-y>

Ghose, P., Abdul Gafur, Md., Das, S. K., Chakraborty, S. R., **Mohsin, M.**, Deb, A. K., & Rakibul Qadir, Md. (2014). Effects of flux concentrations and sintering temperature on dental porcelain. *The European Physical Journal Applied Physics*, 65(2), 20701. <https://doi.org/10.1051/epjap/2014130378>

SUBMITTED

George, A., **Mohsin, M.**, Brancaleon, L., & Marucho, M. Hydrodynamic and Mechanical Properties of Microtubules in Dilute Solutions. Submitted to Macromolecules.

Selected Presentations

CONFERENCE

Mohsin, M., & Marucho, M. (2024, October 17–19). *Oscillating Electrical Signal Propagation along Microtubules* [Poster session]. The Fall 2024 Joint Meeting of the Texas Section of the APS, Texas Section of the AAPT & Zone 13 of the SPS, Southern Methodist University in Dallas, TX, United States.

Mohsin, M., & Marucho, M. (2024, August 16). *Biophysical Mechanisms Underlying Microtubule Electrical Oscillation and Amplification* [Rapid Fire Talk]. XII Texas Soft Matter Meeting, The University of Texas at San Antonio, San Antonio, TX, United States.

Mohsin, M., & Marucho, M. (2024, May 21–24). “Skin-like” Layer Formation around Cytoskeleton Filaments and their Exceptional Biophysical Properties [Poster session]. 9th annual Biophysical Society of Canada (BSC) Meeting, Université de Montréal in Montréal, Québec, Canada.

Research Experience

Doctoral Researcher — University of Texas at San Antonio (2021–2025)

- Developed electrodynamic and nonlinear electrokinetic models for ionic signal transport.
- Built multiscale transmission-line solvers (Python/Fortran/Mathematica).
- Modeled nanopore-mediated voltage-dependent conductance.
- Integrated theoretical predictions with experimental observations.

Graduate Researcher (Master's Thesis) — University of Chittagong (2006–2007)

- Modeled Lorentz and CPT symmetry violations in neutrino oscillations.

Teaching & Mentoring Experience

Graduate Teaching Assistant, University of Texas at San Antonio (2020–2025)

Undergraduate physics labs: mechanics, electricity, magnetism — strong student evaluations.

Assistant Professor, University of Chittagong (2012–2020)

Taught Modern Physics, Quantum Mechanics, Statistical Mechanics; supervised M.S. research.

Adjunct Lecturer, Chittagong Independent University (2013–2017)

Physics for engineering students.

Honors & Awards

- APS Texas Section Travel Grants (2022, 2024)
- UTSA Graduate School Travel Awards (2022, 2024)
- UTSA Writing Scholarship, College of Sciences (2023, 2024)
- Alvarez Scholarship, UTSA (2021)

Skills & Certifications

- Modeling & Computation:** Electrodynamics, nonlinear PDEs/ODEs, transmission-line modeling
- Programming:** Python, Fortran, Mathematica, COMSOL, HPC/parallel computing, Git
- Scientific Software:** Mathematica, COMSOL Multiphysics
- Certifications:** IBM Data Science (2025), PCAP Python (2024), Mathematica (2021)