Arman Duha

Stillwater, OK 74075

405-612-3562 • arman.duha@okstate.edu • armanduha8.github.io

arman-duha • Google Scholar

Professional Summary

Computational condensed matter and AMO physicist, specializing in quantum many-body dynamics, quantum simulation, and metrologically useful entanglement generation. Experienced in designing and simulating quantum systems such as Floquet-engineered spin models, to advance applications in quantum sensing and computing. Proficient in leveraging high-performance computing (HPC) clusters for scientific computing tools (Python, Mathematica).

Education

Ph.D. in Physics (GPA: 3.9), Oklahoma State University, Stillwater, OK — Expected June 2025

Master of Science in Physics, Oklahoma State University, Stillwater, OK — May 2022

Bachelor of Science in Physics, University of Dhaka, Dhaka, Bangladesh — September 2018

Relevant Experience

Graduate Research Assistant (Atomic, Molecular, and Optical Physics) — May 2023 – Present

Co-advisor: Dr. Thomas Bilitewski, Oklahoma State University

- Demonstrated novel dynamical phase transitions by identifying universal scaling of non-equilibrium squeezing dynamics with applications in quantum sensing and simulation **(arXiv preprint)**
- Numerically investigated non-equilibrium spin dynamics using discrete truncated Wigner approximation (dTWA) and achieved Heisenberg scaling of sensitivity by implementing a Floquet protocol in power-law interacting spin systems **(published in PRA)**

Graduate Research Assistant (Solid-State Physics) — June 2020 – Present

Co-advisor: Dr. Mario Borunda, Oklahoma State University

- Developed symbolic regression-based machine learning models to predict radiation damage, enhancing predictive accuracy in material behavior analysis **(arXiv preprint)**
- Utilized Mathematica in HPC clusters to analyze the impact of defects on electronic and thermal transport, identifying critical phase transitions in 2D materials crucial for semiconductor device reliability **(published in PRB)**
- Collaborated with external research teams to design a high-efficiency (31%) perovskite solar cell as part of a NASA-funded project on space energy applications by performing device simulations to analyze defect behavior and charge dynamics **(published in Optical Materials)**
- Performed DFT simulations to analyze catalytic surface energetics and defect dynamics, providing insights into material efficiency and stability relevant to semiconductor and energy applications **(manuscript)**

Graduate Teaching Assistant (College Physics 1) — August 2019 – May 2020

Oklahoma State University, Stillwater, OK

- Served as physics lab instructor and organized review sessions before exams, supervising groups of over 40 students.

Undergraduate Research (Quantum Mechanics) — June 2018 – June 2019

Advisor: Dr. S. Hasibul Hassan Chowdhury, University of Dhaka, Bangladesh

- Calculated gauge-invariant energy spectra of an electron in 2-dimensional noncommutative quantum mechanics **(published in Annals of Physics)**

Publications

- **Arman Duha**, Samuel Begg, and Thomas Bilitewski. "Nonequilibrium Universality of a Squeezing Phase Transition." arXiv:2503.11802
- Rosty B. Martinez Duque, **Arman Duha**, and Mario F. Borunda. "Machine Learning-Driven Analytical Models for Threshold Displacement Energy Prediction in Materials." arXiv:2502.01813
- **Arman Duha**, and Mario F. Borunda. "Effect of uncorrelated on-site scalar potential and mass disorder on transport of two-dimensional Dirac fermions." Physical Review B 110.9 (2024): 094205.
- **Arman Duha**, and Thomas Bilitewski. "Two-Mode Squeezing in Floquet-Engineered Power-Law Interacting Spin

Models." Physical Review A 109, no. 6 (June 26, 2024): L061304.
- **Arman Duha**, Borunda M. "Optimization of a Pb-free all-perovskite tandem solar cell with 30.85% efficiency." Optical Materials. 2022 Jan 1.
- Chowdhury SH, Chowdhury TA, **Arman Duha** "Gauge invariant energy spectra in 2-dimensional noncommutative quantum mechanics." Annals of Physics 430 (2021): 168505.

Presentations

- Universal scaling of two-mode squeezing in Floquet-engineered power-law interacting spin models, 2025 APS Global Physics Summit, Anaheim, CA.
- Two-mode squeezing and entanglement dynamics for power-law interactions in two-dimensional bi-layer spin system, 2024 APS DAMOP meeting, Fort Worth, TX.
- Two-mode squeezing and entanglement dynamics for power-law interactions in two-dimensional bi-layer spin system, 2024 APS March meeting, Minneapolis, MN.
- Investigating transport properties of Graphene on Boron Nitride, 2023 APS March meeting, Las Vegas, NV.
- Lead-free All-perovskite Tandem Solar Cell, Joint Fall 2022 Meeting of the Texas Section of APS, Houston, TX.
- Lead-free All-perovskite Tandem Solar Cell, 2022 APS March meeting, Chicago.
- EPR Paradox and Bell's Inequality, 2017 Blackboard Lunch Seminar, University of Dhaka, Bangladesh.

Technical Skills

- **Programming & Scientific Computing:** Python (NumPy, SciPy, Pandas, Scikit-learn), C++, Mathematica, MATLAB, Bash/Shell scripting
- **Numerical Modeling:** Differential equation solvers, Fourier transforms, and time-evolution algorithms
- **High-Performance Computing (HPC):** Experience with HPC clusters, batch scheduling systems (Slurm), parallelization concepts (MPI), job automation
- **Machine Learning & Data Science:** Symbolic regression, compressed sensing, feature extraction
- **Materials Modeling Tools:** DFT, molecular dynamics, UCSF ChimeraX (molecular visualization)
- **Development Tools:** Git, Jupyter Notebooks, Microsoft Excel, data visualization (Matplotlib, Seaborn)

Certifications

- *Fast Quantum Interconnects via Constant-Rate Entanglement Distillation* — February 2025
  QuEra Computing Inc.
- *Trained mentor*, Mentor Collective — August 2021
- *Atomic Astrophysics with Computational Workshop*, University of Dhaka — November 2017

Honors and Awards

- 2024 APS DAMOP Student Travel Award — June 2024
- 4th i-CoMSE DFT Workshop Travel Award — June 2023
- 2023 APS GERA Energy Workshop Travel Award — March 2023
- 2022 TSAPS Student Travel Award — October 2022
- 2nd position: Atomic Astrophysics with Computational Workshop — November 2017

Volunteering Experience

- Organizer, AMO journal club for undergraduate and graduate students — 2024
- Physics demonstrator, OSU outreach program for middle school — 2024
- Mentor, OSU Sophomore Mentor Collective — 2021-2022
- Examiner, Bangladesh Physics Olympiad — 2017-2019

Professional Associations

- Member, American Physical Society — 2021-Present