Arman Duha

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Professional Summary

Computational condensed matter and AMO physicist, specializing in quantum many-body dynamics, quantum simulation, metrologically useful entanglement generation, and topological materials. Experienced in designing and simulating complex quantum systems, including 2D materials and Floquet-engineered spin models, to advance applications in quantum sensing, computing, and topologically protected states. Proficient in leveraging high-performance computing (HPC) clusters for scientific computing tools (Python, Mathematica).

Education

Ph.D. in Physics, Oklahoma State University, Stillwater, OK — Expected May 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
- Numerically investigated non-equilibrium spin dynamics using Python for quantum simulation and quantum-enhanced sensing (1st project published in PRA, 2nd project ongoing)

Graduate Research Assistant (Solid-state Physics) — June 2020 – Present
Co-advisor: Dr. Mario Borunda, Oklahoma State University
- Performed symbolic regression-based machine learning predictions of threshold displacement energy in materials (arXiv preprint)
- Utilized Mathematica and HPC clusters to simulate quantum transport in two-dimensional Dirac fermions for van der Waals material (published in PRB)
- Simulated efficient perovskite solar cell, funded by NASA Oklahoma EPSCoR (published in Optical Materials)
- Performed molecular dynamics of catalysts for Fischer-Tropsch synthesis using density functional theory (preparing 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 in 2-dimensional noncommutative quantum mechanics (published in Annals of Physics)

Publications

- 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

- 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 Languages:** Python, Mathematica, C++
- **Quantum Simulation:** Quantum spin systems, 2D Dirac fermions, van der Waals materials
- **Machine Learning:** Symbolic regression
- **Tools:** DFT (SIESTA) molecular dynamics, Unix shell scripting, UCSF ChimeraX

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