

Arman Duha

Stillwater, OK 74075

☎ 405-612-3562 • ✉ arman.duha@okstate.edu • 🌐 armanduha8.github.io
in 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) <i>Co-advisor: Dr. Thomas Bilitewski, Oklahoma State University</i>	May 2023 – Present
--	--------------------

- 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) <i>Co-advisor: Dr. Mario Borunda, Oklahoma State University</i>	June 2020 – Present
---	---------------------

- 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) <i>Oklahoma State University, Stillwater, OK</i>	August 2019 – May 2020
--	------------------------

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

Undergraduate Research (Quantum Mechanics) <i>Advisor: Dr. S. Hasibul Hassan Chowdhury, University of Dhaka, Bangladesh</i>	June 2018 – June 2019
---	-----------------------

- 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, 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
- **Data Science & ML:** Scikit-learn, NumPy, SciPy, Pandas, Matplotlib, Seaborn, symbolic regression, feature extraction, compressed sensing
- **Materials Modeling Tools:** DFT, molecular dynamics, UCSF ChimeraX (molecular visualization)
- **Development Tools:** Git, Jupyter Notebooks, Microsoft Excel, Latex

Certifications

- | | |
|---|---------------|
| ○ <i>Fast Quantum Interconnects via Constant-Rate Entanglement Distillation</i>
QuEra Computing Inc. | February 2025 |
| ○ <i>Trained mentor</i> , Mentor Collective | August 2021 |
| ○ <i>Atomic Astrophysics with Computational Workshop</i> , 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 |
|-------------------------------------|--------------|