David Beckwitt, Ph.D.

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Ph.D. Candidate Physicist specializing in quantitative modeling and machine learning analysis of structural defects in van der Waals materials.

Education

May 2026 **University of Missouri, Columbia, MO — Ph.D. in Physics**

- Dissertation: *Investigating Disorder in van der Waals Thin Films*
- Advisor: Dr. Paul Miceli

May 2022 **University of Missouri, Columbia, MO — M.S. in Physics**

May 2020 **Missouri State University, Springfield, MO - B.S.in Physics**

Minor: Mathematics, Chemistry

Research Experience

2021–Present **Graduate Research Assistant**, University of Missouri

- Developed **Python**-based quantitative Grazing-Incidence Wide-Angle X-ray Scattering (GIWAXS) simulations with Reverse Monte Carlo methods to extract occupancies, anisotropic Debye–Waller factors, mosaicity, and experimental geometry. (APS March Meeting 2023)
- Extended GIWAXS to model diffuse scattering from stacking faults to quantify defect densities. (APS March Meeting 2024)
- Grew controlled-phase PbI_2 thin films via **Chemical Vapor Deposition** (CVD); validated simulated polytype fractions experimentally. (ACS Appl. Mater. Interfaces 2023)
- Implemented CNNs trained on simulated GIWAXS data using PyTorch for automated structural analysis of van der Waals thin films.

2019–2020 **Research Intern**, NASA Space Consortium

- Synthesized graphene films via pulsed laser deposition (PLD) and pulsed vapor deposition (PVD); characterized via Raman spectroscopy and electron microscopy.

2017–2020 **Research Assistant**, Missouri State University; Advisors: Dr. Kartik Ghosh, Dr. Saibal Mitra

- Designed, built, and operated a PLD system; characterized thin films via XRD, Raman, SEM/EDS, and profilometry. (MRS Spring Meeting 2019)

2019 **R&D Intern**, Dynatek Labs

- Developed software for biomedical testing and automated hardware systems.

Research Publications

Journal Articles

- C. J. Arendse, R. Burns, **D. Beckwitt**, *et al.*, "Insights into the Growth Orientation and Phase Stability of Chemical-Vapor-Deposited Two-Dimensional Hybrid Halide Perovskite Films," *ACS Applied Materials & Interfaces*, vol. 15, no. 50, pp. 56 692–56 703, Dec. 2023. DOI: 10.1021/acsami.3c14559.

In Review / In Preparation

- **D. Beckwitt** *et al.*, "Simulation-Guided Control of Polytypism in CVD-Grown PbI_2," In Preparation—Anticipated Spring, 2026.
- **D. Beckwitt** *et al.*, "Supervised Convolutional Neural Networks Trained on Simulated GIWAXS Patterns for Structural Analysis of Thin Films," In Preparation—Anticipated Spring, 2026.
- **D. Beckwitt** *et al.*, "Quantitative Modeling of Grazing-Incidence Wide-Angle X-Ray Scattering Patterns from Van der Waals Thin Films," In Review—Anticipated Summer, 2025.
- **D. Beckwitt** *et al.*, "Quantitative Simulation of Stacking Faults and Structural Disorder in CVD-Grown PbI_2 Thin Films," In Review—Anticipated Fall, 2025.

Conference Proceedings

- **D. Beckwitt**, "X-Ray Diffraction Investigation of Disorder in Van der Waals Thin Films," in *APS March Meeting, ACNS, and MSU Seminar (3 Talks)*, Presented at APS Prairie Section 2023 and at multiple venues 2024, 2024. URL: http://dx.doi.org/10.13140/RG.2.2.25835.04649.
- **D. Beckwitt**, "Fabrication and Characterization of 2D Heterostructure of Graphene and Transition-Metal Oxides," Missouri State University, 2020.
- **D. Beckwitt**, "Development of a Sol-Gel TiO_2 Buffer Layer for Perovskite Solar Cell Applications," in *Einhellig Interdisciplinary Forum*, Springfield, MO, 2018.
- **D. Beckwitt**, "Investigation of Solid-State LiPON Thin Films Grown by Pulsed Laser Deposition for Application as an Electrolyte," in *Arkansas INBRE Poster Presentation*, University of Arkansas, Oct. 2018. URL: https://bpb-us-e1.wpmucdn.com/wordpressua.uark.edu/dist/9/86/files/2015/08/2018-INBRE-program-A3c-Final-1m51yhx.pdf.
- **D. Beckwitt**, "Synthesis of PbO_2 Thin Films for Perovskite CH_3PbX_3-Based Solar Cell," in *Einhellig Interdisciplinary Forum*, Springfield, MO, 2017. URL: https://science.missouristate.edu/_Files/AbstractsCNAS_UGRD_2019.pdf.

Technical Projects

2025–Present **2D_Mosaic_Sim** – X-ray Diffraction Simulator

- Developed interactive Python tools to visualize X-ray diffraction patterns, emphasizing materials with specific crystal orientations.
- Created visualizations that help analyze and understand diffraction measurements beyond standard software.

2024–Present **ra_sim** – Crystal Analysis Software

- Built specialized software to simulate and analyze X-ray diffraction data from R-Axis IV++ detectors.
- Integrated an intuitive user interface and optimization methods, tailored specifically for this detector type.

2024 **OSC_Reader** – Detector Data Converter

- Developed a user-friendly tool to convert proprietary detector files into accessible formats.
- Included interactive features allowing detailed examination of diffraction images without commercial software.

2025 **Ising_Model** – Physics Simulation Tool

- Created an interactive simulation demonstrating fundamental physics concepts, with customizable parameters and real-time visualization.
- Included analysis scripts to explore and visualize key properties in a straightforward way.

Technical Skills

Programming	**Python** (7 years), Fortran, C++, R, Git, MPI, Bash scripting, LaTeX, SQL, **Excel**, **Visual Basic Advanced**
Data Analysis	Monte Carlo methods, Machine Learning (**PyTorch**, TensorFlow), **NumPy**, pandas, SciPy
Data Visualization	**Matplotlib**, **Plotly**, OriginLab, MATLAB, Jupyter Notebooks, Dash
Instrumentation	**X-ray/neutron scattering**, Chemical Vapor Deposition (CVD), Pulsed Laser Deposition (PLD), Scanning Electron Microscopy (SEM), Raman spectroscopy
Communication	**Technical writing**, Video and Animation creation/editing, Grant proposal development, Peer-review process

Teaching Experience

2018–2023 **Instructor and Teaching Assistant**, University of Missouri and Missouri State University Student Reviews

- Calculus-based Mechanics, Electricity & Magnetism, and Introductory C++ Programming

2021–Present **Academic Tutor**, Physics Courses, University of Missouri, Columbia, MO

2018–2021 **ACT Prep Tutor**, Club Z!, Springfield, MO

2014–2020 **Martial Arts Coach**, Dunham's Martial Arts, Springfield, MO

Leadership, Service & Outreach

Outreach and Service

2023–2024 **Vice-President, Physics and Astronomy Graduate Student Association (PAGSA), University of Missouri.**

2022–2024 **Director, PAGSA Mental Health Wellness Program, University of Missouri.**

Research Outreach, University of Missouri.

2022–2023 **President, Physics and Astronomy Graduate Student Association (PAGSA), University of Missouri.**

Coalition of Graduate Workers Diversity Officer, University of Missouri.

2022 **Sigma Pi Sigma Physics Congress – Presentation/Poster Judge, Washington, DC.**

2018–2019 **College of Natural and Applied Sciences Leadership Board, Missouri State University.**

2017–2020 **SPS High School Engagement, Missouri State University.**

Awards

2023 **Outstanding Student Research Presentation, Neutron Scattering Society of America.**

Excellence in Physics Fergason Scholarship, University of Missouri.

Green Chalk Teaching Award, University of Missouri.

Rangel-Boain Travel Award, University of Missouri.

2022 **Newell S. Gingrich Physics Scholarship, University of Missouri.**

Excellence in Student Leadership, Graduate Professional Council, University of Missouri.

Excellence in Undergraduate Teaching, University of Missouri.

2021 **O.M. Stewart Scholarship, University of Missouri.**

Professional Contacts

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