



Addis Fuhr

Alvin M. Weinberg Fellow

Where and when did you earn your PhD?

I earned my PhD in chemical engineering from UCLA in 2019 while working as an African American Partnership Program fellow at Los Alamos National Laboratory (LANL). My dissertation research was half theory (UCLA portion) and half experiment (LANL portion).

What was the subject of your dissertation?

My dissertation focused on elucidating the electronic, optical, and magnetic properties of defects in quantum dots, and theory–experiment matching.

What was your dissertation’s major contribution to your field?

Ternary copper-based quantum dots have unusual physical properties, making it difficult to determine how to optimize them for different applications. I helped unravel the mysterious origins of their unusual electronic, optical, and magnetic properties by combining theory with experiment to reveal mechanisms for defect formation and corresponding physics.

My research helped improve the performance of $\text{Cu}_x\text{In}_{2-x}\text{Se}_y\text{S}_{2-y}$ quantum dots for applications such as solar windows, solar cells, field-effect transistors, and light-emitting diodes.

Who is your ORNL mentor and where are you working on campus?

My mentor is Bobby Sumpter, ORNL Corporate Fellow and Theory and Computation section head in the Center for Nanophase Materials Sciences (CNMS). I work in the Nanomaterials Theory Institute at CNMS.

What will your fellowship research focus on?

I am researching ways to integrate machine learning with ab initio computational chemistry and experimental materials characterization methods to enrich our understanding of the chemistry and physics of heterogeneity and defects in materials and to accelerate the discovery of materials with specific, desired functionality.

What is your project's expected contribution to your field?

My project will result in accelerated discovery and understanding of the physics and chemistry of defects and heterogeneity in materials for applications such as multiferroics, quantum materials, solar energy, batteries, and refractory or nuclear materials.

What are your research interests?

I enjoy combining theory with experiment to understand structure–property relationships for defects, heterogeneity, and coexisting phases in materials. I am also interested broadly in using theory/artificial intelligence to predict experimental signatures, and aiding in the design of materials with target functionalities.

What led you to science and your specific discipline?

As a kid, I was fascinated with classifying different rock crystals by their shapes and colors but did not know of any science careers. Where I grew up, for the most part, we knew three college career paths: doctor, lawyer, or business. I started college as pre-law because I didn't see myself as a business man and wasn't comfortable with the idea of performing surgery. My pre-law advisor recommended patent law based on my interest in science, but after taking chemistry, physics, and math courses and finding out about more career opportunities, I knew scientific research was for me. I joined a synthesis/crystallography lab with an amazing mentor, but over time slowly found myself more interested in crystal imperfections and predicting their structure–property relationships.

What did you do before coming to ORNL?

I worked in industry, at the MITRE Corporation, for a year and a half as a senior modeling and simulation engineer. It was an awesome experience, and a great company. I developed many new skills and came to understand different angles of analysis, which I believe is aiding my ORNL research.

Could you share an interesting fact or two about yourself?

I love martial arts and mountaineering! I have a black belt in Goju-Ryu karate. More recently, I've gotten into Muay Thai/kickboxing, Brazilian Jiu Jitsu, and mixed martial arts. I'm not that skilled at mountaineering yet, but I did climb Cotopaxi in Ecuador, which is a 19,000-ft glacier volcano. When I was younger, I used to play bass guitar and also recently picked that back up again.

What nonscience topic or activity is important to you and why?

Diversity/outreach and the environment are very important to me. I contributed to various tasks and projects towards diversity/outreach efforts in grad school and at MITRE, and would also like to get more involved in tasks related to that at ORNL. On the environmental front, spending more time in the great outdoors has made me realize just how important it is to preserve it, and I would like to also be more involved in those efforts as well.

