DISTINGUISHED
STAFF FELLOWS
AT ORNL

Brenden Ortiz

Eugene P. Wigner Fellow

Where and when did you earn your PhD?

I earned my PhD in material science in 2019 from Colorado School of Mines.

What was the subject of your dissertation?

My dissertation research focused on accelerating the discovery and optimization of thermoelectric materials by developing techniques that aimed to accelerate both the theoretical and experimental aspects of material science. Through two parallel approaches, I combined high-throughput computational modeling mixed with semi-empirical learned models to dramatically expedite the identification of new thermoelectric candidate materials. I also developed the thermodynamic framework to control defects in materials and combined this knowledge with quasi-high-throughput bulk synthesis methods to hasten the optimization of candidate materials.

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

My dissertation research resulted in the discovery of a new family of metals, the AV3Sb5 (A: K, Rb, Cs) materials. These compounds show a unique type of quasi-2D kagome lattice, named for an ancient pattern used in Japanese basket-weaving. These materials also exhibit superconductivity, a charge density wave, and potential non-trivial topology. The coalescence of all these properties together, on the kagome lattice, had never been seen before and over 350 additional manuscripts on this family have been published in the past two years.

Who is your ORNL mentor and which group and division are you working in?

I'm working in the Correlated Electron Materials Group for the Materials Science and Technology Division. My mentors are Michael McGuire and Andrew May.

What will your fellowship research focus on?

My research will focus on developing methods to control and predict the emergence of electronic instabilities in correlated metals. Understanding the connection between the electronic structure of materials, the high-dimensional chemical space, and the emergence of correlated electron properties, such as superconductivity and charge density waves, will allow us to design the next generation of quantum materials.

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

My work provides the material platforms for the exploration of fundamental materials physics and will address questions regarding the interaction of chemistry, physics, and thermodynamics in real material systems.

What are your research interests?

I've always been drawn to the connection between chemistry and thermodynamics in complex materials and I'm fascinated by high-dimensional chemical spaces and how our influence over alloys, dopants, and defects can radically alter material properties.

What led you to science and your specific discipline?

My childhood dream was to be a scientist and I was fascinated by rocks and minerals while living in Colorado. When I was exposed to metallurgy and material science in my undergraduate studies, I saw a route to marry chemistry, physics, and geology all at once.

What did you do before coming to ORNL?

I was a postdoctoral researcher at the University of California, Santa Barbara (UCSB) with a primary focus on metals or small-gap semimetals, searching for routes towards topological superconductivity, Majorana Fermions, and chiral charge density wave states in quasi-2D materials. My emphasis was on the synthesis of new materials, particularly towards the development of single crystal methods for triangular, kagome, and pyrochlore lattices.

Could you share an interesting fact or two about yourself? (Something you like to do in your free time, something unique you can do or a unique experience you've had, unique vacation)

Food science has always been an interest of mine, and I enjoy formulating new types of low-calorie, nutrient-dense baked goods. I'm working on developing my own protein bar and I'm a certified nutrition coach.

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

Physical activity is very important to me. I've learned that movement is the best way to maintain both my physical and mental well-being.