



The Alabama Collaborative for
Materials Exploration (ACME)

Research Seminar Series

Professor Benjamin Frandsen

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Tuesday, February 8, 2022

10:00 AM CST

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Understanding technologically relevant materials from a local structure perspective using pair distribution function techniques

Local structural correlations can have a profound impact on the interactions between electrons in solids, which in turn play a crucial role in determining the observed properties of materials. As a powerful probe of local structure, pair distribution function (PDF) analysis of total scattering data can offer unique insights into structure-property relationships in numerous classes of materials. The recently developed magnetic PDF technique provides the same opportunities for investigating short-range magnetic correlations. I will present atomic and magnetic PDF investigations of two material systems of fundamental and applied interest: first, iron-based superconductors, including FeSe and the 122-type materials; and second, the magnetically enhanced high-performance thermoelectric candidate MnTe. In the first case, atomic PDF reveals short-range structural distortions at high temperatures that offer clues about the nematic symmetry breaking found ubiquitously among iron-based superconductors. In the second case, magnetic PDF provides a real-space picture of the short-range magnetic correlations responsible for the enhancement of the the thermopower above the Neel temperature. In both cases, examining the local atomic and magnetic structure through PDF analysis provides unique and valuable information about the underlying physics of these fascinating materials.

Biography: Ben Frandsen is an assistant professor in the Department of Physics and Astronomy at Brigham Young University in Utah. He earned his PhD in condensed matter physics at Columbia University in New York in 2016, working with Professors Tomo Uemura and Simon Billinge on muon spin relaxation and x-ray and pair distribution function studies of strongly correlated electron systems. Following his graduate work, he joined the group of Bob Birgeneau at UC Berkeley in California as a postdoctoral researcher, working primarily on experimental studies of iron-based superconductors. He joined the faculty at BYU in August 2018. His research at BYU is focused on investigating the local atomic and magnetic structure of materials using beams of x rays, neutrons, and muons. He was selected as a recipient of the U.S. Department of Energy Early Career Award in 2020 to study local atomic and magnetic structure in energy-relevant materials.

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