PHYSICS COLLOQUIUM:
Chiral quantum materials

Dr. Shizeng Lin
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Date:
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Time:
10:30 AM – 11:50 AM

Location:
GRAN 135

About The Speaker:

Shizeng Lin completed his Ph.D. at the National Institute for Materials Science and the University of Tsukuba in Japan. After earning his Ph.D., he joined Los Alamos National Laboratory (LANL) in 2011, initially as a postdoctoral researcher in the Theoretical Division. In 2014, he was appointed as a scientist at LANL. He is also currently affiliated with the Center for Integrated Nanotechnology at LANL, one of the five nanoscale Science Research Centers funded by the U.S. Department of Energy. Lin's research primarily focuses on theoretical studies of novel quantum materials, with a particular emphasis on systems characterized by correlation and topology. He received the LANL Laboratory-Directed Research and Development Program Early Career Award in 2017 and the LANL Fellows Prize for Outstanding Research in 2024.

Abstract:

Chirality is a ubiquitous organizing principle in nature and a powerful route to new quantum functionalities. In quantum materials, chirality can be encoded in crystal structure, induced by external magnetic fields, or emerge spontaneously through symmetry breaking. It underlies a broad class of phenomena, including magnetic skyrmions, fractional quantum Hall states and their lattice analogs (fractional Chern insulators), and chiral superconductivity. These phases are robust, often topologically protected responses that are attractive for future quantum technologies. In this talk, I will present my group's effort on chiral quantum matter through the lens of topology and strong correlations, focusing on three interconnected themes: skyrmion physics, fractional Chern insulators, and routes to high temperature chiral/topological superconductivity. A central emphasis will be placed on realistic materials and material specific modeling, enabled by a tight integration of electronic-structure theory, effective modeling, many-body calculations, and close collaboration with experiments. I will also discuss how we incorporate AI to learn features of many-body wave functions, moving toward an AI-accelerated discovery engine for chiral quantum materials.

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