

Physics & Astronomy Colloquium

Presents



Chen-Ting- Liao

He/Him/His

Research Scientist

JILA, University of Colorado Boulder & NIST

Thursday, February 16, 2023

12:10 pm, Webster Room 11

Please meet our guest speaker and share in refreshments

11:45 a.m. -12:10 p.m.

on the ground floor above the lecture hall

“Topological states of spin and light: hedgehogs, skyrmions, optical vortices, and beyond.”

Broken symmetries are ubiquitous in physics and are associated with ferromagnetism, nonreciprocal effects, optical activity, molecular chirality, and vortex beams of photons and electrons. In some cases, symmetry breaking also leads to the formation of various topological states, excitations, or defects of a continuous field. In the first part of the talk, I will show how we developed state-of-the-art x-ray nanoscale microscopic [1] and femtosecond time-resolved scattering methods to probe topological spin textures. Our new x-ray imaging method provides world-record 3D vector imaging at 10nm resolution [2]. We then used it to study emergent topological magnetic monopoles (i.e., magnetic hedgehogs) and magnetic skyrmion lattice. In the second part of the talk, I will introduce the topological states of light carrying orbital angular momentum (OAM). The OAM of light can be static, dynamic, or spatiotemporal. Static OAM of light has been known for three decades and has found numerous applications. On the contrary, time-varying and spatiotemporal OAM of light are new properties discovered over the past few years [3, 4]. Lastly, the potential pathways to generate quantum x-rays will be introduced, which could serve as a new quantum sensing tool for probing quantum materials and molecules in the future.

References: [1] Science Advances 5, eaax3009 (2019); [2] Nature Nanotechnology (2023), DOI: 10.1038/s41565-022-01311-0; [3] Science 364, eaaw9486 (2019); [4] Nature Photonics 15, 608 (2021).

Host: Dr. Matthew McCluskey

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