DAMOP19-2018-000002
Abstract for an Invited Paper
for the DAMOP19 Meeting of
the American Physical Society

New approaches to topological phases with ultracold atoms

CHRISTOF WEITENBERG, University of Hamburg

Ultracold atoms in optical lattices constitute a versatile platform to study the fascinating phenomena of gauge fields and topological matter. Periodic driving can induce topological band structures with non-trivial Chern number of the effective Floquet Hamiltonian and paradigmatic models, such as the Haldane model on the honeycomb latticce, can be directly engineered. In this talk, I will report on recent experiments, in which we realized new approaches for measuring the Chern number in this system. This includes the observation of quantized circular dichroism, which is revealed in chiral spectroscopy between the Floquet bands. Furthermore, we study the dynamics of the system after a quench into the topological regime using time-resolved Bloch-state tomography and obtain the Chern number from topological properties of the emerging dynamical vortices. We also apply state-of-the-art deep learning techniques to our momentum-space images and train a network to recognize the Chern number from single images, which allows mapping out the full two-dimensional Haldane phase diagram. These new approaches to topology also define a promising starting point for probing topological order of interacting systems such as fractional Chern insulators.