Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Observation of chiral edge states with fermionic atoms in a synthetic Hall ribbon GUIDO PAGANO, MARCO MANCINI, University of Florence, GIACOMO CAPPELLINI, LORENZO LIVI, LENS European Laboratory for Nonlinear Spectroscopy, CARLO SIAS, JACOPO CATANI, INO Istituto Nazionale di Ottica del CNR, MARIE RIDER, MARCELLO DALMONTE, PETER ZOLLER, Institute for Quantum Optics and Quantum Information, Austrian Academy of Sciences, MASSIMO INGUSCIO, INRIM Istituto Nazionale di Ricerca Metrologica, LEONARDO FALLANI, University of Florence — Edge states are a direct manifestation of the effects of topology in fermionic many-body systems. A prominent example is the quantum Hall effect, where chiral edge states are responsible for basic phenomena such as quantized transport. Neutral ultracold fermionic atoms offer a complementary platform to condensed-matter experiments thanks to the high degree of control and tunability over all microscopic parameters. Here we report on the experimental realization of chiral edge states in an ultracold gas of neutral fermions subjected to an effective gauge field. The atoms are confined in a ribbon geometry, with a lattice structure and a tunable width that is provided by a finite-sized "synthetic" dimension encoded in the atomic spin. In particular, by imaging individual sites along this synthetic dimension, we detect the existence of chiral edge states and we investigate the breakdown of chirality as a function of the bulk-edge and edge-edge couplings. Our work paves the way towards the investigation of the resilience of chirality against controlled perturbations and to the observation of new topological states of fermionic matter in otherwise inaccessible regimes.

Guido Pagano
University of Florence

Date submitted: 31 Jan 2015 Electronic form version 1.4