Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Interferometric measurement of many-body topological invariants using polarons FABIAN GRUSDT, Physics Department, Univ. of Kaiserslautern, Germany and Graduate School Materials Science in Mainz, Germany, NORMAN YAO, Physics Department, Harvard University, USA, DMITRY ABANIN, Perimeter Institute for Theoretical Physics, Waterloo, Canada and Institute for Quantum Computing, Waterloo, Canada, EUGENE DEMLER, Physics Department, Harvard University, USA — We present a scheme for the direct detection of many-body topological invariants in ultra cold quantum gases in optical lattices. We generalize single-particle interferometric schemes developed for the detection of topologically non-trivial band structures [Atala et.al., Nature Physics 9, 795 (2013)] by coupling a spin-1/2 impurity to a (topological) excitation of an interacting many-body system. Performing Ramsey interferometry in combination with Bloch oscillations of the resulting polaronic particle allows to directly detect the many body-topological invariant. In particular we consider adiabatic Thouless pumps in the super-lattice Bose-Hubbard model, which transport a quantized amount of particles across a one-dimensional lattice. In the presence of inter-atomic interactions this quantized current is given by a many-body Chern number, which can be measured using our protocol. These systems also support symmetry-protected topological phases, the invariants of which can be obtained from our protocol as well.

Fabian Grusdt
Univ Kaiserslautern

Date submitted: 23 Jan 2014 Electronic form version 1.4