Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Measurement Protocol for the Topological Uhlmann Phase OSCAR VIYUELA, Universidad Complutense de Madrid & Massachusetts Institute of Technology, ANGEL RIVAS, Universidad Complutense de Madrid, SIMONE GASPARINETTI, ETH Zurich, STEFAN FILIPP, IBM Research - Zurich, ANDREAS WALLRAFF, ETH Zurich, MIGUEL ANGEL MARTIN-DELGADO, Universidad Complutense de Madrid — Topological insulators and superconductors at finite temperature can be characterised by the topological Uhlmann phase. However, the direct experimental measurement in condensed matter systems has remained elusive. We explicitly demonstrate that the topological Uhlmann phase can be measured with the help of ancilla states in systems of entangled qubits that simulate a topological insulator. We propose a novel state-independent measurement protocol, which does not involve prior knowledge of the system state. With this construction, otherwise unobservable phases carrying topological information about the system become accessible. This enables the measurement of a complete phase diagram including environmental effects. We explicitly consider a realization of our scheme using a circuit of superconducting qubits. This measurement scheme is extendible to interacting particles and topological models with a large number of bands. arXiv: 1607.08778 (2016)

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Date submitted: 13 Apr 2017 Electronic form version 1.4