Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Breakdown of a topological phase: Quantum phase transition in a loop gas model with tension SIMON TREBST, Microsoft Research, Station Q, PHILIPP WERNER, Columbia University, MATTHIAS TROYER, ETH Zurich, KIRILL SHTENGEL, UC Riverside, CHETAN NAYAK, Mirosoft Research, Station Q and UC Los Angeles — We discuss the stability of topological order against local perturbations by considering the effect of a magnetic field on a spin model – the toric code – which is in a topological phase. The model can be mapped onto a quantum loop gas where the perturbation introduces a bare loop tension. When the loop tension is small, the topological order survives. When it is large, it drives a continuous quantum phase transition into a magnetic state. The transition can be understood as the condensation of 'magnetic' vortices, leading to confinement of the elementary 'charge' excitations. We also show how the topological order breaks down when the system is coupled to an Ohmic heat bath and discuss our results in the context of quantum computation applications.

Simon Trebst
Microsoft Research, Station Q

Date submitted: 17 Nov 2006 Electronic form version 1.4