# Topological Phases in Condensed Matter Physics: Three Case Studies

**Alexander Altland**
Institute of Theoretical Physics, University of Cologne
alexal@thp.uni-koeln.de
http://www.thp.uni-koeln.de/alexal

In these talks we will develop key ideas of topological phases and transitions between them within the framework of three concrete case studies. The first is a simple model of a topological insulator, the so-called Su-Schrieffer-Heeger chain. The second is the Kosterlitz-Thouless transition, a topological phase transition in two dimensions which defines the universality class of a large number of two-dimensional phase transitions. And the third is the so-called Z2 lattice gauge theory, an effective theory relevant to a large number of condensed matter contexts, and to applications at the interface to quantum information science. We will aim to emphasize common concepts relevant to these examples and to a wider class of transitions between phases discriminated by different types of topology.

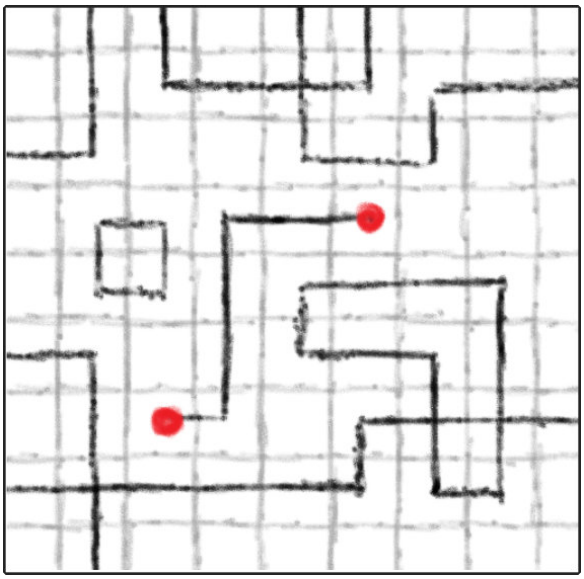

Figure 1: Cartoon of a two-fold excited Z2 spin liquid.