Dynamical Phase Transitions in Topological Insulators

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The traditional concept of phase transitions has, in recent years, been widened in a number of interesting ways. The concept of a topological phase transition separating phases with a different ground state topology, rather than phases of different symmetries, has become a large widely studied field in its own right[1]. Additionally an analogy between phase transitions, described by non-analyticities in the derivatives of the free energy, and non-analyticities which occur in dynamically evolving correlation functions has been drawn[2]. These are called dynamical phase transitions and one is often now far from the equilibrium situation.

In this lecture we will give an overview of the history of these concepts, focusing in particular on the way in which dynamical phase transitions themselves can be used to shed light on topological phase transitions and topological phases.[3] We will go on to focus, firstly, on the effect of the topologically protected edge states, which are one of the interesting consequences of topological phases, on dynamical phase transitions[4]. Secondly we will study what happens in the experimentally relevant situations where the system is either in a thermal state rather than the ground state, or connected to an external environment[5].

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