Signatures of topological phase transition in 3d topological insulators from dynamical axion response

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Abstract

Axion electrodynamics, first proposed in the context of particle physics, manifests itself in condensed matter physics in the topological field theory description of3d topological insulators and gives rise to magnetoelectric effect, where applying magnetic (electric) field B(E) induces polarization (magnetization) p(m).We use linear response theory to study the associated topological current using the Fu-Kane-Mele model of 3d topological insulators in the presence of time-dependent uniform weak magnetic field.By computing the dynamical current susceptibility, we discover from its static limit
an 'order parameter' of the topological phase transition between weak topological (or ordinary) insulator and strong topological insulator, found to be continuous.The dynamical current susceptibility shows a sign-changing singularity at a critical frequency with suppressed strength in the topological insulating state.
Our results can be verified in current noise experiment on 3d TI candidate materials for the detection of such topological phase transition. Reference:I. Makhfudz, Phys. Rev. B **93**, 155124 (2016).

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