

Abstract Submitted  
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**Topological Field Theory of Time-Reversal Invariant Insulators**

XIAO-LIANG QI, TAYLOR HUGHES, SHOU-CHENG ZHANG, Stanford University — We show that the fundamental time reversal invariant (TRI) insulator exists in the  $4 + 1$  dimension, where the effective field theory is described by the  $4 + 1$  dimensional Chern-Simons theory, and the topological properties of the electronic structure is described by the second Chern number. These topological properties are the natural generalizations of the time reversal symmetry breaking (TRSB) quantum Hall insulator in  $2 + 1$  dimension. The TRI quantum spin Hall insulator in  $2 + 1$  dimension and the topological insulator in  $3 + 1$  dimension can be obtained as descendants from the fundamental TRI insulator in  $4 + 1$  dimensions through dimensional reduction. The effective topological field theory, and the  $Z_2$  topological number for the TRI insulators  $2 + 1$  and  $3 + 1$  dimensions are naturally obtained from this procedure of dimensional reduction. All physically measurable topological response functions of the TRI insulators are completely described by our effective topological field theory. As a consequence of the effective theory, we predict the existence of fractional charge induced by a magnetic domain wall on the edge of quantum spin Hall insulator, which will be presented as a separate talk.

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