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TOPOLOGICAL ORDER IN BULK TOPOLOGICAL INSULATORS AND SUPERCONDUCTORS

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ABSTRACT:

Three dimensional topological insulators are a new phase of matter which realizes a non-quantum-Hall-like topological state in bulk matter and unlike the quantum Hall liquids can be turned into superconductors. In this talk, I will briefly review the basic theory and experimental discovery of topological insulators. I will then discuss experimental results that demonstrate the properties of topological insulators such as spin-momentum helical locking, non-trivial Berry's phases, absence of backscattering or no U-turn, protection by time-reversal symmetry and the existence of room temperature topological order. I will also report the exotic roles of superconductivity and magnetism in doped topological insulators, electrodynamics and their potential applications.