

# CU Physics Department Colloquium

Monday, March 9, 2009 4:10 PM 428 Pupin Hall



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## Dirac Fermions, Topological Phases and Experimental discovery of Quantum Hall-like effects without Magnetic Field

Most quantum states of condensed-matter are categorized by spontaneously broken symmetries (Landau paradigm). The remarkable discovery of charge quantum Hall effects (1980s) revealed that there exists an organizational principle of matter based not on the broken symmetry but only on the topological distinctions in the presence of time-reversal symmetry breaking. In the past few years, theoretical developments suggest that new classes of topological states of quantum matter might exist that are purely topological in nature in the sense that they do not break time-reversal symmetry hence can be realized without any applied magnetic field : "Quantum Hall-like effects without magnetic field". In this presentation, I report a series of experimental results documenting and demonstrating the existence of such a topologically ordered time-reversal-invariant state of matter and discuss the exotic electromagnetic (Wilczek's theta vacuum) properties this novel phase of quantum matter might exhibit and outline their potential use.

Hosted by Boris Altshuler – Meet the Speaker will be held at 3:30 PM in 705 Pupin