Correlated Topological Phases: From Condensed-Matter Systems to Artificial gauge Fields

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Abstract:

During the last decade, experiments have established the existence of unconventional states of matter in a variety of low-dimensional quantum systems. This includes equilibrium states characterized by topological properties as well as stationary states in and out of equilibrium situations. In this Talk, we focus on topological phases of matter, their experimental signatures, and possible ways of utilizing them as platforms for topologically protected quantum computation. With the important progress on the quantum control of light-matter interaction, one can now also engineer very tunable artificial complex quantum networks. We pedagogically introduce novel topological phases in correlated materials and artificial quantum networks, such as in cavity QED systems and cold atoms. Sodium-Iridates are in particular very appealing since exotic quantum states of matter have been predited such as the topological Mott insulator and the possible realization of the long-sought Kitaev model with bond-dependent spin-spin interactions.