Titles and abstracts

M. Sato

Topological crystalline materials

In search for topological materials, symmetry plays a very important role. For instance, time-reversal symmetry is essential in topological insulators and particle-hole symmetry is crucial to realize Majorana fermions in topological superconductors. One of recent trends in this field is to clarify the role of crystal symmetry in topological phases. In this talk, I will explain a K-theory based formulation of topological crystalline materials, and the relation between the mathematical framework and the traditional condensed matter language.

C. Bourne

Aperiodic and amorphous topological phases

Abstract: We consider Hamiltonians associated to quasi-crystalline and amorphous lattices, which cannot be described via a Bloch decomposition or discrete crossed product. By using an operator algebraic description of such systems (initially defined by Kellendonk for aperiodic tilings), we can still consider strong topological phases and the bulk-boundary correspondence. I will aim to outline this procedure with minimal assumed mathematical background.

H. Obuse

Topological phases on quantum walks

A quantum walk, that is, a synthetic quantum system whose dynamics is described by a time-evolution operator, provides potential applications for quantum computing and information as well as quantum simulators. It is further interesting that the quantum walk possesses novel topological phases [1,2,3] akin to those of Floquet topological insulators, which are topological insulators driven by a time-periodic field. Compared with time-independent topological insulators, Floquet topological insulators have unique nature, such as versatile controls of symmetries, edge states at pi energy states, and so on.

In this talk, I present how to identify symmetries of the time-evolution operator of quantum walks, which are relevant to establish topological phases, and calculate topological invariant not only at zero energy but also at pi energy for the quantum walk in one dimension with chiral symmetry [2,3]. I also explain experimental results demonstrating edge states induced by Floquet topological phases of quantum walks. If I have time, I will explain our recent work on a quantum walk simulating parity-time reversal symmetric open quantum systems and its topological phase [4,5].

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Y. Ogata

Classification of gapped Hamiltonians in quantum spin chains

Recently, the classification problem of gapped Hamiltonians attracts a lot of attentions. We consider this problem for a class of Hamiltonians on quantum spin chains.

S. Kobayashi

Topologically stable gapless phases in semimetals and superconductors

Over the last few years, the study on gapless phases of matter has received renewed interest due to the fact that they are a kind of topological objects, i.e., their stability is ensured by topological invariants. Furthermore, the topological invariants also predict unique surface states via the bulk-boundary correspondence, which are measurable through surface-sensitive experiments. In this presentations, I talk about the topological classification of gapless phases in semimetal and superconductors and applications to several Dirac materials and unconventional superconductors. Finally, I talk about my recent study on exotic gapless phases.

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