Title

“Homotopic insights and non-Abelian invariants in topological band theory”

Abstract

Homotopy theory is a branch of mathematics that classifies maps between a pair of spaces. In particular, two maps are marked as equivalent in the homotopic description if they can be continuously deformed into one another. Such a definition of equivalence resembles topological invariants of energy band structures, which characterize features unaffected by continuous deformations of the Bloch Hamiltonian in the momentum space.

In this seminar, I will first outline how homotopy theory provides insights into topological band theory which are complementary to both *K*-theory and symmetry indicators. Afterward, I will go through three concrete applications of these ideas. As a warm-up, a classification of band nodes in semimetals and superconductors will be presented [1]. I will then spend the bulk of the seminar shedding light on the non-Abelian band topology, which we reported to arise in *PT*-symmetric spinless models, and which enables non-trivial braiding of band nodes in the momentum space [2,3]. Finally, I will briefly comment on our recent prediction of a new class of topological insulators, termed “delicate”, which are revealed by homotopy theory while being invisible to both *K*-theory and symmetry indicators [4].

[1] T. Bzdušek and M. Sigrist, Phys. Rev. B **96**, 155105 (2017)

[2] Q.S. Wu, A. A. Soluyanov, and T. Bzdušek, Science **365**, 1273 (2019)

[3] A. Bouhon, Q.S. Wu, R.-J. Slager, H. Weng, O. V. Yazyev, and T. Bzdušek, Nat. Phys. **16**, 1137 (2020)

[4] A. Nelson, T. Neupert, T. Bzdušek, and A. Alexandradinata, arXiv:2009.01863 (2020)