



Department of  
Mathematical Sciences

# Colloquium

Dr. Tomas Bzdusek

Ambizione Fellow

Paul Scherrer Institute, Villigen, Switzerland  
University of Zurich, Switzerland

Friday,  
Feb. 28, 2020  
EMS Building  
Room E495  
2:00 pm



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## Mathematics of Topological Insulators and Semimetals

Many properties of crystalline materials, such as conductivity or the tendency to become magnetically ordered at low temperatures, derive from their so-called “electronic band structure”. Although this is an established notion in solid state physics, dating back to the early days of quantum mechanics, our understanding of electronic band structure has been greatly challenged and revolutionized over the past 15 years by the discovery of so-called topological materials.

In this colloquium, I will first show how topology enters the description of electrons in crystalline solids – whether they are insulators, semimetals or metals. This is achieved by encoding the electron Hamiltonian as a fiber bundle, and by characterizing this bundle using homotopy theory. In the second part, I will focus on our latest results, which reveal a previously overlooked non-Abelian topological invariant. This discovery suggests possible braiding phenomena in the electronic band structure, which I illustrate on a material example ZrTe.

*Light refreshments will be served at 1:30pm in E424A.*



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