

Mathematical Approach to Topological Phases in Spintronics

Date: October 5th to 9th, 2015

Place: Tohoku Forum for Creativity, Tohoku University

<http://www.tfc.tohoku.ac.jp/>

Aim: Recent insights in the deep connection between the physics of Topological Insulators and the Atiyah–Singer Index Theorem inspire Mathematicians and Mathematical Physicists by the implied rich potential for discovery of new topological phases and need for their mathematical description. We will gather an interdisciplinary group of leading researchers to explore this space and discuss prospects and directions for further developments. We specially target a mathematical framework for the bulk-edge correspondence of interacting systems as well as topological phases of disordered systems.

Program

Monday, October 5th

10:00-10:50 Bruno Nachtergaele (University of California Davis)

Topological Phases in Quantum Spin Systems I

11:00-11:50 Gian-Michele Graf (ETH)

Another glance at some well-known indices

Lunch Break

14:00-14:50 Mikio Furuta (University of Tokyo)

TBA

15:00-15:40 Yosuke Kubota (University of Tokyo)

Controlled topological phases and bulk-edge correspondence I

Tea

16:10-16:50 Emil V. Prodan (Yeshiva University)

Bulk-Boundary program for complex topological insulators: From
K-theory to physics

17:00-17:50 Graeme Milton (University of Utah)

TBA

18:00 Buffet Party

Tuesday, October 6th

10:00-10:50 Spyridon Michalakis (California Institute of Technology)

Exploring topological quantum phases

11:00-11:50 Johannes Kellendonk (Université Lyon I)

The C^* -algebraic approach to topological phases

Lunch Break

14:00-14:50 Yosuke Kubota (University of Tokyo)

Controlled topological phases and bulk-edge correspondence II

15:00-15:40 Max Lein (Tohoku University)

Existence and absence of non-linear effects in photonic topological insulators

Tea

16:10-16:50 Akinori Tanaka (Riken)

Supersymmetric gauge theory on $RP^2 \times S^1$

17:00 -17:50 Koji Hashimoto (Osaka University)

Band spectrum of topological insulators is D-brane shape

Wednesday, October 7th

10:00-10:50 Spyridon Michalakis (California Institute of Technology)

The Quantum Hall Effect revisited

11:00-11:50 Liang Kong (University of New Hampshire and Harvard University)

Bulk-edge relation for topological orders with gapped edges

Lunch Break

14:00-14:50 Alan Carey (Australian National University)

Topological phases and Kasparov Theory

15:00-15:40 Christopher Bourne (Australian National University)

Real Kasparov theory and the bulk-edge correspondence

Tea

16:10-16:50 Giuseppe De Nittis (Pontificia Universidad Católica de Chile)

The topology of chiral vector bundles: Topological insulators of type AIII

17:00-17:50 Peter Bouwknegt (Australian National University)

Towards a classification of topological phases for strongly interacting systems

Thursday, October 8th

10:00-10:50 Bruno Nachtergaele (University of California Davis)

Topological Phases in Quantum Spin Systems II

11:00-11:50 Shuichi Murakami (Tokyo Institute of Technology)

Topological edge modes in condensed matter

Lunch Break

14:00-14:50 Kentaro Nomura (Tohoku University)

Chiral anomaly and coupled charge-magnetization excitations in a Weyl semimetal

15:00-15:40 Anton Akhmerov (Technical University of Delft)

TBA

15:50-16:30 Koji Sato (Tohoku University)

Anomalous Hall effect driven by dipolar spin waves in uniform ferromagnets

16:40-17:20 Rembert Duine (University of Utrecht)

Topological transport in spin-orbit coupled bosonic Mott insulators

Friday, October 9th

10:00-10:50 Shinsei Ryu (University of Illinois at Urbana-Champaign)

TBA

11:00-11:50 Franco Nori (Riken and University of Michigan)

Quantum spin Hall effect of light

Close

Tutorial lecture

13:00-13:40 Alan Carey (Australian National University)

Introduction to K-theory and generalizations I

13:55-14:35 Alan Carey (Australian National University)

Introduction to K-theory and generalizations II

15:00-15:50 Shinsei Ryu (University of Illinois at Urbana-Champaign)

Introduction to topological insulators and superconductors

Organizers: Jean Bellissard (Georgia Tech.), Pavel Exner (Czech Tech. Univ.), Peter Kuchment (Texas A&M), Graeme Milton (Univ. of Utah), Zagrebnov Valentin (AMU Université d'Aix-Marseille), Motoko Kotani (Tohoku Univ., Chair)