# FM 34: Topology: Solid State Systems

Time: Tuesday 14:00–15:15 Location: 1199

**Invited Talk** FM 34.1 Tue 14:00 1199

**Understanding the Interplay between Magnetism and Topology** — •Matthew Gilbert — Department of Electrical and Computer Engineering, University of Illinois - Urbana-Champaign, Urbana, IL 61801 USA — Department of Electrical Engineering, Stanford University, Stanford, CA 94305 USA

For many years, topological materials have been the subject of great interest from condensed matter experimentalists and theorists. While there is a continued push to predict and measure new topological phenomena there exists a large class of *known* topological materials, or those that have been thoroughly characterized for their basic topological properties, that may serve as a testbed for new physics and applications by utilizing the inherent properties of these topological materials. To this end, recent work attempting to exploit the properties of topological materials has focused on the interactions between topological and magnetic materials yet little is understood about the physics of these interactions. In this talk, I will address some of the open problems associated with magnetic interactions in topological materials with a focus on understanding recent experimental results.

FM 34.2 Tue 14:30 1199

**A fractional Weyl semimetal** — Fabian Hotz[1], Apoorv Tiwari[2], Oguz Turker[3], Tobias Meng[3], Ady Stern[4], •Maciej Koch-Janusz[1], and Titus Neupert[2] — [1]ETH Zurich, Switzerland — [2]University of Zurich, Switzerland — [3]TU Dresden, Germany — [4]Weizmann Institute of Science, Israel

We construct an exactly solvable lattice model of a fractional Weyl semimetal (FWS). The low energy theory of this strongly interacting state is that of a Weyl semimetal built out of fractionally charged fermions. We show the existence of a universally quantized and fractional circular photogalvanic effect (CPGE) and a violation of the Wiedemann-Franz law in the system. Together with a spectral gap in the single-particle electronic Green's function they provide strong experimental signatures for this exotic gapless state of matter.

FM 34.3 Tue 14:45 1199

**Chiral Majorana fermions in proximity-modified graphene** — •Petra Högl[1], Tobias Frank[1], Denis Kochan[1], Martin Gmitra[2], and Jaroslav Fabian[1] — [1]Institute for Theoretical Physics, University of Regensburg, 93040 Regensburg, Germany — [2]Department of Theoretical Physics and Astrophysics, Pavol Jozef Šafárik University, 04001 Košice, Slovakia

Chiral Majorana fermions are massless self-conjugate fermions which arise as propagating edge states of 2d topological superconductors. Recently, a scheme for topological quantum computation based on chiral Majorana fermions has been proposed [1]. We show the appearance of chiral Majorana edge modes in graphene by computing zigzag and armchair ribbon spectra. For this we use an effective model of graphene which takes into account proximity induced spin-orbit coupling and exchange field. This leads to a quantum anomalous Hall state which turns into a topological superconductor by adding superconducting proximity coupling. We prove the topological nature of the system by analyzing the Chern number of the 2d bulk. This work has been supported by DFG SFB 1277 (Project B07) and EU Seventh Framework Programme under Grant Agreement No. 604391 Graphene Flagship.

[1] B. Lian, X.-Q. Sun, A. Vaezi, X.-L. Qi, S.-C. Zhang, PNAS 115, 10938 (2018)

FM 34.4 Tue 15:00 1199

**Simulation of chiral topological phases in driven quantum dot arrays** — •Beatriz Perez-Gonzalez, Miguel Bello, Alvaro Gomez-Leon, and Gloria Platero — Instituto de Ciencia de Materiales de Madrid

Recent experimental evidence on scalable quantum dot devices demonstrates a reproducible and controllable 12-quantum-dot device, which opens up the possibility of simulating 1D topological insulators (TIs) upon quantum dot chains.

A canonical example of TI in 1D is the SSH model, displaying two topological phases. In this talk, we analyze the extension of this model to include long range hopping, and study how this affects the topological properties of the system. We conclude that for certain hopping configurations, one can have topological phases beyond those of the standard tight-binding Hamiltonian with first-neighbour couplings, hence allowing for the presence of more pairs of edge states.

Finally, we show that a quantum simulator for 1D topological phases, including those appearing in the extended SSH model, can be obtained by periodically driving an array of quantum dots with long-range hopping. Our driving protocol triggers topological behavior in an otherwise trivial setup, opening the door for the simulation of a wide range of Hamiltonians with a non-trivial band structure.