Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **519** Type: **Invited Speaker / Conférencier(ère) invité(e)**

(I) Magnetoelectric generation of a Majorana-Fermi surface in Kitaev's honeycomb model

Monday 7 June 2021 11:45 (5 minutes)

Recently, Kitaev materials have attracted great interest due to their potential to realize a quantum spin liquid ground state which hosts gapless Majorana excitations. In this talk, after a review of the physics of Kitaev materials, I will discuss the effects of static magnetic and electric fields on Kitaev's honeycomb model. Using the electric polarization operator appropriate for Kitaev materials, I will derive the effective Hamiltonian for the emergent Majorana fermions to second-order in both the electric and magnetic fields. While individually each perturbation does not qualitatively alter Kitaev spin liquid, the magneto-electric cross-term induces a finite chemical potential at each Dirac node, generating a Majorana-Fermi surface. I will argue this gapless phase is stable and exhibits typical metallic phenomenology, such as linear in temperature heat capacity and finite, but non-quantized, thermal Hall response. Finally, I will discuss the potential for realization of this, and related, physics in Kitaev materials such as RuCl3.

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Session Classification: M1-8 Frustrated Magnetism (DCMMP) / Magnétisme frustré (DPMCM)

Track Classification: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)