



Physical Sciences Seminar

Chiral phonons in quantum materials

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Host: Kimberly Modic

The thermal Hall effect has been proposed as a powerful tool to probe exotic topological excitations in quantum spin liquids, with the spectacular report of a half-quantized thermal Hall effect in the Kitaev material α -RuCl₃ [1,2]. These results hold much promise for quantum computing. However, it is becoming surprisingly apparent that phonons can also produce a large thermal Hall effect across a wide range of quantum materials, from cuprate superconductors [3,4] to the titanates [5] and frustrated magnets [6]. A significant phonon Hall effect is also suspected in α -RuCl₃ [7]. While phonons carry no charge and are common low energy excitations in solids, the origin of the handedness that gives rise to a phonon Hall effect in a magnetic field remains an enigma. Besides, the present ubiquity of the phonon Hall effect calls for caution when interpreting the results of quantum spin liquids candidates. During this seminar, I will share the signatures of the thermal Hall effect of phonons and how we came to discover it; why this is interesting, and how we can learn about quantum materials through this journey of serendipitous discoveries. By the end of the presentation, I hope to convince you that the thermal Hall effect is a technique that needs to be more fully/carefully exploited experimentally and the phonon Hall effect a property that needs to be better understood theoretically. References: [1] Kasahara et al., Nature 559, 277 (2018); [2] Yokoi et al., Science 373, 6554 (2021); [3] Grissonnanche et al., Nature 571, 376 (2019); [4] Grissonnanche et al., Nat. Phys. 16, 1108 (2020); [5] Li et al., PRL 105, 225901 (2020); [6] Hirokane et al. PRB 99, 134419 (2019); [7] Hentrich et al. PRB 99, 085136 (2019)

Monday, November 22, 2021 11:00am - 12:00pm

Big Seminar Room B (big) 63 seats (I23.EG.102)



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