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(U*) Electrical Control of Magnetism in Kitaev Materials

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A fascinating class of frustrated magnetic systems are the so-called Kitaev materials, typically composed of heavy transition metals, that realize Kitaev's honeycomb model and its variants —exactly solvable models with quantum spin liquid ground states. Finding ways to control the competition between the spin liquid phase and the nearby magnetic phases is crucial in advancing our understanding of this exotic phase of matter. We explore the effect of strong magnetoelectric coupling exhibited by Kitaev materials on their magnetic phases. Using a classical approach, we map out the phase diagram as a function of combined electric and magnetic fields, through a combination of numerical algorithms and analytical techniques. For large, but finite systems, iterative minimization and simulated annealing algorithms are effective in obtaining the ground states. . Using these methods, we confirm that the classical Kitaev model spin liquid phase persists over a finite range of the magnetic field before entering the polarized phase. Conversely, applied electric fields immediately induce ordered 'stripy'states for generic field directions. To explore the possibility of incommensurate states, we employ the Luttinger-Tisza method and a single Q-ansatz. Results of the magnetic phase diagram under applied electric and magnetic fields, obtained via the above described methods, will be presented.

Primary author: Mr HOWSON, Griffin (University of Windsor)

Co-author: RAU, Jeffrey (University of Windsor)

Presenter: Mr HOWSON, Griffin (University of Windsor)

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