

# CONDENSED MATTER SCIENCES SEMINAR

## Professor Itamar Kimchi

Georgia Institute of Technology

### Host

Cyprian Lewandowski

### Title

Lattice defects in quantum magnets and topological systems

Friday, March 27<sup>th</sup>, 2026

1<sup>st</sup> Floor – B101

15:00-16:00

### Abstract

Defects are always present in solid state materials. I will present our group's recent theoretical results showing how quantum-entangled or topological systems can enable local defects to produce surprising global effects.

First, in the Kitaev honeycomb quantum spin liquid (QSL), non-magnetic "Stone-Wales" crystallographic defects become imbued with a fluctuating magnetic chirality. The emergent Ising model for their chiralities is ferromagnetic and long ranged ( $\sim 1/r^{2.7}$ ), producing an instability to a topological chiral QSL at a finite critical temperature set by the defect density. Second, in the  $1/3$  magnetization plateau of triangular lattice magnet KCSO, IR spectroscopy observed unusual satellite lines. We show that though these lines are sharp, they arise from disorder and enable its characterization as dilute vacancies. Third, in the Dirac cones of the honeycomb lattice, magnetic impurities induce circulating currents with an associated topological Chern number. Surprisingly, for isolated impurities this induced magnetization and topology is reversed above a critical impurity strength, with a global phase transition generated by the local defect physics.