

# CONDENSED MATTER SCIENCES SEMINAR

## Professor Yong Baek Kim

University of Toronto

### Host

Dr Hitesh Chaglani

### Title

Fractionalized excitations and emergent photons in dipolar-octupolar quantum spin ice

Friday, April 17<sup>th</sup>, 2026

1<sup>st</sup> Floor – B101

15:00-16:00

### Abstract

Quantum spin ice is a three-dimensional quantum spin liquid that hosts gapped spinons and emergent photons. It has been regarded as a canonical example of the lattice realization of emergent quantum electrodynamics. Despite intensive efforts, the realization of quantum spin ice in quantum materials remains an outstanding issue. Recently, significant theoretical and experimental progresses have been made regarding the Ce-based dipolar-octupolar pyrochlore systems,  $\text{Ce}_2\text{Zr}_2\text{O}_7$ ,  $\text{Ce}_2\text{Hf}_2\text{O}_7$ , and  $\text{Ce}_2\text{Sn}_2\text{O}_7$ , which suggest that these materials may host the so-called  $\pi$ -flux quantum spin ice. We present our theoretical works on unique signatures of fractionalized excitations and emergent photons in these systems, which include dynamical spin structure factors and thermodynamic responses. We provide detailed comparison between our theoretical results and recent neutron scattering experiments as well as thermodynamic measurements.