

## **Effective Hamiltonian Methods for Solid State**

Stephen Winter  
Wake Forest University

Quantum materials represent a broad class of systems whose experimental response relies on uniquely quantum aspects such as entanglement, Berry phases, and electronic correlations. Due to potentially high complexity of these materials, first-principles approaches often provide a vital bridge between experiments and theoretical models. In this talk, I will introduce our numerical strategies for systematically building low-energy models for quantum magnets with arbitrarily complex local charge, spin, and orbital degrees of freedom. We have recently applied these methods to treat: mixing of spin and orbital excitations in layered vdW magnets, and generic spin-phonon couplings for modeling topological thermal transport effects.