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Seeing the light: Observing photons in quantum spin ice OWEN BENTON, Okinawa Institute of Science and Technology, OLGA SIKORA, National Taiwan University, NIC SHANNON, Okinawa Institute of Science and Technology
— Spin ice, with its magnetic monopole excitations, is perhaps the best studied example of a classical spin liquid. Quantum mechanical tunnelling between the classical ground states of spin ice leads to an exciting new scenario- a quantum spin liquid ground state with emergent photon excitations [1, 2]. Here we explore how this "artificial electromagnetism" would manifest itself in neutron scattering experiments on putative "quantum spin ice" materials. Using lattice gauge theory we make explicit predictions for the ghostly, linearly dispersing magnetic excitations which are the "photons" of this emergent electromagnetism. We find that "pinch points," which are the signal feature of a classical spin ice, fade away as the system approaches its zero-temperature ground state. The predictions of this field theory are shown to be in excellent quantitative agreement with quantum Monte Carlo simulations at zero temperature [3].

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