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Magnetic monopole condensation transition out of quantum spin ice: application to Pr2Ir2O7 and Yb2Ti2O7 GANG CHEN[1], State Key Laboratory of Surface Physics, Fudan Univ; Perimeter Institute for Theoretical Physics — We study the proximate magnetic orders and the related quantum phase transition out of quantum spin ice (QSI). We apply the electromagnetic duality of the compact quantum electrodynamics to analyze the condensation of the magnetic monopoles for QSI. The monopole condensation transition represents a unconventional quantum criticality with unusual scaling laws. The magnetic monopole condensation leads to the magnetic states that belong to the 2-in 2-out spin ice manifold and generically have an enlarged magnetic unit cell. We demonstrate that the antiferromagnetic state with the ordering wavevector Q = 2p(001) is proximate to QSI while the ferromagnetic state with the ordering wavevector Q = (000) is not proximate to QSI. This implies that if there exists a direct transition from QSI to the ferromagnetic state, the transition must be strongly first order. We apply the theory to the puzzling experiments on two pyrochlore systems Pr2Ir2O7 and Yb2Ti2O7.

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