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Theory on Magnetic Excitation Spectra in Pyrochlore Iridates[1]
ERIC KIN-HO LEE, University of Toronto, SUBHRO BHATTACHARJEE, University of Toronto, McMaster University, YONG BAEK KIM, University of Toronto, Korea Institute for Advanced Study — Metal-insulator transitions in pyrochlore iridates ($A_2Ir_2O_7$) are believed to occur due to subtle interplay of spin-orbit coupling, geometric frustration, and electron interactions. In particular, the nature of magnetic ordering of iridium ions in the insulating phase is crucial for understanding of several exotic phases recently proposed for these materials. We study the spectrum of magnetic excitations in the intermediate-coupling regime for the so-called all-in/all-out magnetic state in pyrochlore iridates with non-magnetic A-site ions (A=Eu,Y), which is found to be preferred in previous theoretical studies. We find that the effect of charge fluctuations on the spin-waves in this regime leads to strong departure from the lowest-order spin-wave calculations based on models obtained in strong-coupling calculations. We discuss the characteristic features of the magnetic excitation spectrum that can lead to conclusive identification of the magnetic order in future resonant inelastic x-ray (or neutron) scattering experiments. Knowledge of the nature of magnetic order and its low-energy features may also provide useful information on the accompanying metal-insulator transition.

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