Abstract Submitted
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The theory of cluster Mott insulator: charge fluctuation and spin liquids GANG CHEN, HAE-YOUNG KEE, YONG BAEK KIM, University of Toronto — I will present recent theoretical work on cluster Mott insulators (CMI) in which interesting physics such as emergent charge lattices, charge fractionalization and quantum spin liquids are proposed. For the anisotropic Kagome system like LiZn2Mo3O8, we find two distinct CMIs, type-I and type-II, can arise from the repulsive interactions. In type-I CMI, the electrons are localized in one half of the triangle clusters of the Kagome system while the electrons in the type-II CMI are localized in every triangle cluster. Both CMIs are U(1) quantum spin liquids (QSL) in the weak Mott regime with a spinon Fermi surface and gapped charge excitations. In type-II CMI, however, the charge fluctuations lead to a long-range plaquette charge order that breaks the lattice symmetry, gives rise to an emergent charge lattice and reconstructs the mean-field spinon band structure of the underlying U(1) QSL. Such a reconstruction gives a consistent prediction of the "fractional spin susceptibility" that is observed in LiZn2Mo3O8. For the pyrochlore system, the CMI can further support a charge fractionalization with an emergent gauge photon in the charge sector in addition to the spin fractionalization in the spin sector. Experimental connection with the several cluster magnets such as LiZn2Mo3O8.

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