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Comprehensive study of the dynamics of a classical Kitaev Spin Liquid ANJANA SAMARAKOON, Univ of Virginia and ORNL, ARNAB BANERJEE, ORNL, CRISTIAN BATISTA, Univ. of Tennessee; ORNL, YOSHITOMO KAMIYA, RIKEN, Japan, ALAN TENNANT, STEPHEN NAGLER, ORNL — Quantum spin liquids (QSLs) have achieved great interest in both theoretical and experimental condensed matter physics due to their remarkable topological properties. Among many different candidates, the Kitaev model on the honeycomb lattice is a 2D prototypical QSL which can be experimentally studied in materials based on iridium or ruthenium. Here we study the spin-1/2 Kitaev model using classical Monte-Carlo and semiclassical spin dynamics of classical spins on a honeycomb lattice. Both real and reciprocal space pictures highlighting the differences and similarities of the results to the linear spin wave theory will be discussed in terms dispersion relations of the pure-Kitaev limit and beyond. Interestingly, this technique could capture some of the salient features of the exact quantum solution of the Kitaev model, such as features resembling the Majorana-like mode comparable to the Kitaev energy, which is spectrally narrowed compared to the quantum result, can be explained by magnon excitations on fluctuating onedimensional manifolds (loops). Hence the difference from the classical limit to the quantum limit can be understood by the fractionalization of a magnon to Majorana fermions. The calculations will be directly compared with our neutron scattering data on α-$RuCl_3$ which is a prime candidate for experimental realization of Kitaev physics.

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