Spin-Wave Theory of the Multiple-Spin Exchange Model on a Triangular Lattice in a Magnetic Field

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The multiple-spin exchange (MSE) model on a triangular lattice has been investigated in relation to the nuclear magnetism of solid ^{3}He layers adsorbed on graphite. In particular, the possibility of the novel quantum spin-liquid state for the frustrated two-dimensional system is attracting much interest. Experimental results on the specific heat and the susceptibility of double layers strongly suggested that the MSE interactions are important in the nuclear magnetism of solid ^{3}He.

Ground-state properties and the quantum effects of the S=1/2 MSE model with two-, three- and four-spin cyclic exchange interactions on a triangular lattice in a magnetic field have been investigated by using the mean-field approximation and the linear spin-wave theory [1-3]. In zero magnetic field, the mean-field ground state is in the ferromagnetic, uuud, tetrahedral, 6-sublattice structure and 120 degrees phases depending on the ratio of the strengths of the two- and four-spin exchange interactions. In the magnetic field, other numerous ground-state phases have been found. In the present talk, we precisely review the ground-state properties of the various states and the stability against the zero-point fluctuations of the spin wave.

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