Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Magnetization Process of Spatially Anisotropic Kagome Heisenberg Model RYUI KANEKO, TAKAHIRO MISAWA, YOUHEI YAMAJI, Department of Applied Physics, University of Tokyo, HIROKI NAKANO, Graduate School of Material Science, University of Hyogo, MASATOSHI IMADA, Department of Applied Physics, University of Tokyo — Motivated by recent experiments on volborthite, a typical spin-1/2 antiferromagnet with a kagome lattice structure, we study magnetization process of a Heisenberg model on a kagome lattice with a spatial anisotropy in applied magnetic fields. First, for the classical Heisenberg model, by using the Monte Carlo method, we find a magnetization step due to the anisotropy at low temperatures and low magnetic fields. The magnetization step signals a first-order transition, between two phases distinguished by distinct and well-developed short-range spin correlations, one characterized by a local 120° structure and the other by a partially spin-flopped structure. These states are also evident in magnon dispersions based on a classical spin configuration for each phase. Then, to clarify how quantum fluctuations affect the magnetization process, we calculate the sublattice magnetization by using the exact diagonalization method. We find that the sublattice magnetization process of the quantum model looks qualitatively similar to that of the classical model, which indicates that the spin structure observed in the classical model also appears in the quantum model. Finally, we point out the relevance of our results to the magnetization steps observed in volborthite.

Ryui Kaneko
Department of Applied Physics, University of Tokyo

Date submitted: 07 Nov 2011 Electronic form version 1.4