Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Spin chirality and thermal Hall effect in quantum magnets HOSHO KATSURA, KITP, UCSB, NAOTO NAGAOSA, CMRG, RIKEN, Dept. of Appl. Phys., Univ. of Tokyo, PATRICK LEE, Dept. of Phys., MIT — We theoretically study the thermal Hall effect in insulating quantum magnets [1]. In contrast to itinerant magnets, there are no charge degrees of freedom in the localized spin systems and hence the heat current is totally carried by charge-neutral objects such as magnons and spinons. We consider the effect of the coupling between the scalar chirality and external magnetic fields or the effect of the Dzyaloshinskii-Moriya interaction which is related to the vector spin chirality, and find two distinct classes of thermal Hall responses. For ordered magnets, the intrinsic thermal Hall effect for magnons arises if the lattice geometry and the magnetic order satisfy certain conditions. A TKNN-type formula for the thermal Hall conductivity is also obtained. For a spin liquid, the thermal Hall effect for spinons due to the "Lorentz force" is expected if the spinons are deconfined. These results offer a new experimental method to study the ground state and low energy excitations in quantum magnets using thermal transport measurements. [1] H. Katsura, N. Nagaosa, and P. A. Lee, arXiv:0904.3427[cond-mat.str-el].

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Date submitted: 22 Dec 2009 Electronic form version 1.4