Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Orbital coupling of noncollinear antiferromagnets to magnetic fields[1] HUA CHEN, QIAN NIU, The University of Texas at Austin, GUANG-YU GUO, National Taiwan University, ALLAN H. MACDONALD, The University of Texas at Austin — The same symmetry considerations that imply a non-zero anomalous Hall effect in certain noncollinear antiferromagnets also imply non-zero total spin magnetization due to canting and finite orbital magnetization. It has been understood recently that the orbital magnetization of periodic crystals has a so-called "itinerant" contribution related to the Berry curvature of Bloch bands, which is not necessarily small, in contrast to the canting-induced total spin magnetization. We have explicitly calculated the orbital magnetization of several noncollinear antiferromagnets. In all cases we find that they are orders of magnitude larger than the total spin magnetization. Coupling between orbital magnetization and external magnetic fields is thus expected to be dominant in switching the direction of the magnetic order, and hence the anomalous Hall effect. Our calculation points to the important role of the transverse spin-orbital susceptibility in noncollinear antiferromagnets, compared to spin-spin and orbital-orbital susceptibilities. We use simple models as well as first-principles calculations to demonstrate a number of unique behaviors associated with magnetic field-induced order parameter switching in noncollinear antiferromagnets, and discuss their experimental implications.

[1]HC and AHM were supported by ONR-N00014-14-1-0330 and Welch Foundation grant TBF1473. QN is supported by NBRPC (No.2012CB921300 and No.2013CB921900), and NSFC (No.91121004)

Hua Chen
The University of Texas at Austin

Date submitted: 11 Nov 2016 Electronic form version 1.4