Dynamics and Phase Transitions in Multiferroic Helimagnets

HOSHO KATSURA, Department of Applied Physics, University of Tokyo,
SHIGEKI ONODA, Condensed Matter Theory Laboratory, RIKEN,
JUNG HOON HAN, Department of Physics and Institute for Basic Science Research,
Sungkyunkwan University, NAOTO NAGAOSA, Department of Applied Physics,
University of Tokyo, CERC, CREST — The strong coupling between magnetism
and ferroelectricity in multiferroics has recently been attracting much attention due
to the fundamental physics involved and promising applications. The representa-
tive materials are helical magnets $R$MnO$_3$ ($R=$Gd,Tb,Dy) and they have been
extensively studied experimentally. We theoretically study the dynamics and phase
transitions in cycloidal helical magnets showing the multiferroic behavior. Our ap-
proach reproduces several novel features such as the anomalous dielectric response
revealed by recent experiments on $R$MnO$_3$ [1,2]. We also study the nature of the
phase transition from collinear to helical spin structure. [1] N. Kida, Y. Ikebe, Y.
Takahashi, J. P. He, Y. Kaneko, Y. Yamasaki, R. Shimano, T. Arima, and Y. Tokura,
Ivanov, and A. M. Balbashov, [arXiv:0707.3614].