Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Toroidal ordering in metals: band shift, magnetotransport, and magnetoelectric effect SATORU HAYAMI, Dept. of Appl. Phys., Univ. of Tokyo, HIROAKI KUSUNOSE, Dept. of Phys., Ehime University, YUKITOSHI MOTOME, Dept. of Appl. Phys., Univ. of Tokyo — The electromagnetic effect, interplay between electronic and magnetic properties, is one of the most interesting issues in condensed matter physics. Recently, it has been studied intensively in magnetic insulators without spatial-inversion and time-reversal symmetries. Especially, a toroidal moment defined by a vector product of magnetization and electronic polarization has attracted interest because it leads to intriguing phenomena, such as a linear electromagnetic effect and nonreciprocal directional dichroism. It, however, has not been fully understood how such toroidal ordering affects the electronic structure and transport property in metallic systems. In order to clarify this issue, we investigate a microscopic model for locally noncentrosymmetric systems. Starting from an *s*-*p* four-band tight-binding model with local inversion symmetry breaking, we derive an effective model with the antisymmetric spin-orbit coupling. By analyzing the model at the mean-field level, we find that a ferroic ordering of a microscopic toroidal moment acts as an effective gauge field, which leads to a center-of-mass momentum shift in the band structure. Furthermore, within the linear response theory, we show that toroidal ordering induces anomalous magnetotransport and magnetoelectric effects.

Satoru Hayami
Dept. of Appl. Phys., Univ. of Tokyo

Date submitted: 11 Nov 2013 Electronic form version 1.4