Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Localized charge and current on magnetic domain walls in Weyl semimetals[1] YASUFUMI ARAKI, AKIHIDE YOSHIDA, KENTARO NOMURA, Tohoku University — Magnetic domain walls have been intensely studied in the context of spintronics, to make use of them as carriers of information. Those in topological materials can have even more complex properties than in normal metals and insulators, due to the spin-momentum locking nature. A Weyl semimetal, characterized by the Dirac cone structure isolated in the momentum space, is one of the candidates. In this presentation, we show the properties of magnetic domain walls formed by localized magnetic moments in three-dimensional Weyl semimetals. We investigate the spectrum and the wave-function structure of electronic bound states at the domain wall both analytically and numerically, by solving the Weyl equation coupled with the domain wall texture. We find the discretized spectrum of the bound states, as a result of the Landau quantization under an effective chiral magnetic field arising from the magnetic texture of the domain wall. The lowest Landau level among them, giving rise to a Fermi arc around the domain wall, contributes to the electric charge and current localized at the domain wall. We propose that the localized charge enables one to manipulate the domain-wall motion with an external electric field without any dissipation.

[1]Y. A. is supported by JSPS KAKENHI Grant Number JP15H06023. K. N. is supported by JSPS KAKENHI Grant Numbers JP26400308 and JP15H05854.

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Date submitted: 11 Nov 2016 Electronic form version 1.4