Novel Magnetoelectric Effects -- Current-Driven Domain Wall Dynamics and Inverse Spin Hall Effect

G. Tatara
Department of Physics, Tokyo Metropolitan University, Japan

Abstract: Present information technology is based on electron transport and magnetism. Magnetism has been most successful in high-density storages such as hard disks. For integration of magnetic storages into electronic circuits, mechanisms are necessary to convert electric current/voltage into magnetic information and vice versa. The most common and oldest electro-magnetic coupling is the one arising from Maxwell's equations. Ampere's law or Oersted's law, discovered in the early nineteenth century, describes the magnetic field created by an electric current, and the Faraday's law provides us means to convert magnetic information into electric current or voltage.

In the talk, novel magnetoelectric effects in solids are discussed. They arise from the quantum mechanical sd interaction, and have higher efficiency in small systems than the Maxwell's mechanism.

The first is the current-induced magnetization switching[1], and the second is the generation of electric current by magnetization dynamics (the inverse spin Hall effect)[2-4].

[1] G. Tatara, H. Kohno and J. Shibata, Phys. Rep. 468, 213 (2008).
[2] E. Saitoh et al., Appl. Phys. Lett. 182509 (2006).
[3] J. Ohe, A. Takeuchi and G.Tatara, Phys. Rev. Lett. 99, 266603 (2007).
[4] A. Takeuchi,G. Tatara, J. Phys. Soc. Jpn. 77, 074701 (2008).