

# 687<sup>th</sup> ASRC Seminar

Date: 13:30 - 15:00 Monday, June 19

Location: 302 Meeting Room, ASRC Bldg.

Speaker: Dr Tomohiro Taniguchi  
(National Institute of Advanced Industrial  
Science and Technology)

Title: Spin-transfer torque originated from  
anomalous Hall effect

**Abstract:**The spin-orbit interaction in nonmagnetic heavy metal generates spin current flowing in the transverse direction to an external voltage, which was named as the spin Hall effect (SHE). The SHE induces the magnetization dynamics, such as switching and auto-oscillation, in an adjacent ferromagnet through the spin-transfer effect [1]. Substantial efforts have been made to develop practical devices based on the SHE, for example, magnetic random access memory, microwave generators, and new direction such as bio-inspired computing [2]. The spintronics devices based on the SHE, however, face serious problem because of the geometrical restriction of the spin torque direction. In this work, we propose another mechanism exciting spin-transfer torque through the anomalous Hall effect (AHE) and anisotropic magnetoresistance (AMR). Contrary to the SHE, the direction of the spin torque by the AHE or AMR can be tuned due to a large exchange coupling between the local magnetization and spin of the conducting electron allowing a precise control of the magnetization dynamics in ferromagnetic multilayer [3]. We also show that the magnetization switching of a perpendicular ferromagnet becomes possible by performing numerical simulations.

[1] L. Liu *et al.*, Phys. Rev. Lett. 109, 096602 (2012), *ibid* 109, 186602 (2012).

[2] W. Borders *et al.*, Appl. Phys. Express 10, 013007 (2017). K. Kudo and T. Morie, Appl. Phys. Express 10, 043001 (2017).

[3] T. Taniguchi, J. Grollier, and M. D. Stiles, Phys. Rev. Applied 3, 044001 (2015).

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