Micromagnetic Investigation of Magnetic Dynamics Induced by Spin-Transfer-Torque

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As predicted by Slonczewski [1] and Berger [2], the magnetization switching [3] and the microwave excitation [4] in a nanomagnet by a spin-polarized current has been experimentally demonstrated. It is ascribed to spin-angular-momentum-transfer of incoming electrons to local magnetizations, i.e. spin-transfer-torque. The spin-transfer-torque is attracting a considerable interest because of its applicability to various spintronic devices. A micromagnetic study using numerical calculations is essential to understand this new physics because the dynamic magnetization state is not described within the framework of single domain in some cases.

In this talk, we will discuss micromagnetic investigation of magnetic dynamics which includes lots of incoherent spin-waves. The incoherence is caused by spatial inhomogeneities of local demagnetization fields which generate distributions of local precession frequencies [5]. It results in the telegraph noise with GHz frequencies at zero temperature. It affects averaged dwell time of each quasi-stable state (Parallel or Antiparallel state) at room temperature. We will show a circular magnetic field induced by charge currents has a significant role in the incoherence and causes a big increase in the switching time depending on the amplitude of current.

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