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Magnetization fluctuation in FeB nanomagnets under asymmetric magnetization-potential[1] SHINJI MIWA, Osaka Univ., HITOSHI KUBOTA, KAY YAKUSHIJI, AIST, SHOTA ISHIBASHI, Osaka Univ., TAKESHI SARUYA, AKIO FUKUSHIMA, SHINJI YUASA, AIST, YOSHISHIGE SUZUKI, Osaka Univ.
— Thermal fluctuation of magnetizations gives understandings of physics in magnetic materials and noise in magnetic devices. It is theoretically calculated using the Fokker-Planck equation and the fluctuation-dissipation theorem, [1] and is experimentally characterized using magnetoresistive devices [2]. In the present study, the magnetization-fluctuation under asymmetric magnetization potential has been investigated. Magnetic tunnel junctions (MTJs) [CoFeB(3 nm)/ MgO(1 nm)/ FeB (2 nm)] were employed to conduct the study. The FeB layer (120 nm in a diameter) is a magnetic free layer whose magnetic anisotropies are 8 mT (in-plane) and 97 mT (perpendicular). The asymmetric magnetization-potential was prepared using magnetic field application (110 mT) tilted from the film normal (10 deg.). [3] Unlike the first-order response to the thermal fluctuation, [2] the second-order response is identified as a Lorentzian power spectrum whose peak appears at 0 Hz. To derive the analytic formula, fourth-order moments are calculated using the quasi-normality hypothesis ($\langle ABCD\rangle = \langle AB\rangle\langle CD\rangle + \langle AC\rangle\langle BD\rangle + \langle AD\rangle\langle BC\rangle$). As a results, the obtained formula quantitatively reproduces the experiment.

[1] W. F. Brown, Phys. Rev. 130, 1677 (1963).
[2] S. Petit et al., PRL 98, 077203 (2007).
[3] S. Miwa et al., Nat. Mater. 13, 50 (2014).

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Shinji Miwa
Osaka Univ.

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