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Time-resolved detection of spin-transfer-driven ferromagnetic resonance and spin torque measurement in magnetic tunnel junctions[1]
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Several experimental techniques have been introduced in recent years in attempts to measure spin transfer torque in magnetic tunnel junctions (MTJs). The dependence of spin torque on bias is important for understanding fundamental spin physics in magnetic devices and for applications. However, previous techniques have provided only indirect measures of the torque and their results to date for the bias dependence are qualitatively and quantitatively inconsistent. Here we demonstrate that spin torque in MTJs can be measured directly by using time-domain techniques to detect resonant magnetic precession in response to an oscillating spin torque. The technique is accurate in the high-bias regime relevant for applications, and because it detects directly small-angle linear-response magnetic dynamics caused by spin torque it is relatively immune to artifacts affecting competing techniques. At high bias we find that the spin torque vector differs markedly from the simple lowest-order Taylor series approximations commonly assumed.

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