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Spin-transfer-driven parametric resonance in magnetic nanodomains[1] C. WANG, H. SEINIGE, T. STAUDACHER, M. TSOI, Physics Department, University of Texas at Austin — We study experimentally the parametric excitation of a magnetic nanodomain by spin-transfer-torque (STT). In our experiments, we use a nanoscale point contact to inject high-density ac (microwave frequency) and dc currents into an exchange-biased IrMn/NiFe/Cu/NiFe spin valve (EBSV) and to produce STT [1] on NiFe moments in a small contact region. Here a time-dependent STT associated with the microwave current produces a time-dependent modulation of the effective damping parameter which, in turn, drives the magnetic moments into parametric resonance [2]. The resonance was detected electrically by measuring a small rectified dc voltage which appears across the contact at resonance [3]. We study this resonance signal as a function of frequency and power of the applied microwaves. As expected for parametric excitation, this resonance has an ac threshold and occurs at double the natural frequency of magnetic precession (FMR frequency). We found that both the excitation threshold and the width of the resonance depend on the applied dc bias. Detailed dc bias dependent measurements of the resonance signal provide a means to characterize instability regions in parameter space known as Arnold tongues. The parametric excitation can be potentially used in magnetic memory technology for reducing power and increasing speed of logic and memory devices. [1] J. C. Slonczewski (1996); L. Berger (1996); M. Tsoi et al. (1998). [2] M. Faraday (1831). [3] T. Staudacher and M. Tsoi (2011).

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