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Spectral Line Shape and Line Width of a Single-Mode Spin Torque Oscillator ILYA KRIVOROTOV, CARL BOONE, JIAN ZHU, XIAO CHENG, Department of Physics and Astronomy, University of California, Irvine, JORDAN KATINE, JEFF CHILDRESS, Hitachi Global Storage Technologies — Spin torque auto-oscillators are strongly nonlinear dynamical systems that are highly susceptible to external perturbations such as spin-polarized current and temperature. To understand the effect of thermal fluctuations on the oscillator dynamics, we measure power spectrum of single-mode spin torque oscillators based on a GMR nanocontact to a permalloy nanowire. Our measurements reveal deviations of the power spectral line shape from a simple Lorentzian. These deviations can be understood in terms of dephasing induced by the oscillator amplitude fluctuations. The measured spectral line shape is in a good agreement with a recent analytic theory of spin torque oscillator dynamics at a non-zero temperature [1]. We show that precise measurements of the line shape give information on important oscillator parameters such as Gilbert damping in the large-amplitude regime of current-driven magnetization dynamics. [1] V. S. Tiberkevich, A. N. Slavin, J.-V. Kim, Phys. Rev. B 78, 092401 (2008).

Ilya Krivorotov
Department of Physics and Astronomy, University of California, Irvine

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