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Phase-resolved ferromagnetic resonance detection using heterodyning SEUNGHA YOON, ROBERT D. MCMICHAEL, National Institute of Standards and Technology — We have developed a new phase-resolved ferromagnetic (FMR) detection method using a heterodyne method. Phase resolution is important to determine the characteristics of spin transfer torques in magnetization dynamics under microwave excitation [1]. Specifically, field-like torques and damping-like torques result in magnetization precession with different phases. In this method, we drive spin precession in a Permalloy thin film using microwaves. The resulting precession is detected using 1550 nm laser light, that is modulated at a frequency slightly shifted with respect to the driving frequency. In the reflected light, beating of the spin precession and the light modulation produces an oscillating Kerr rotation signal with a phase equal to the precession phase plus a phase due to the path length difference between the excitation microwave and the optical signal. This detection method eliminates the need for field modulation and allows detection at higher frequencies where the 1/f noise floor is reduced. [1] M. Weiler, J. M. Shaw, H. T. Nembach, and T. J. Silva, Phys. Rev. Lett. 113, 157204 (2014).

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