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Towards an all-optical FMR measurement using ultrafast magnetic fields excited at a Schottky interface PRERNA KABTIYAL, MATTHEW SHEFFIELD, YU SHENG OU, Department of Physics, Ohio State University, PATRICK ODENTHAL, Department of Physics and Astronomy, University of California-Riverside, JACK BRANGHAM, FENGYUAN YANG, ROLAND KAWAKAMI, EZEKIEL JOHNSTON-HALPERIN, Department of Physics, Ohio State University — All optical time-domain ferromagnetic resonance (FMR) is an attractive technique for studying the dynamic behavior of magnetic materials as it avoids many of the technical challenges inherent in traditional microwave frequency measurements of magnetic resonance. For example, the excitation timescale is limited by the dynamics of photo-excited currents and the measurement timescale is limited by the time resolution of ultra-fast optics (roughly 10s of picoseconds and 100 femtoseconds, respectively). This allows an excitation bandwidth of 100 GHz and a measurement bandwidth from DC up to 10 THz without the need for sophisticated microwave engineering. Prior work has relied on direct deposition of a metallic ferromagnet (Fe) onto a GaAs Schottky diode [Acremann et al, Nature 414, 51 (2001)], but given that the excitation mechanism relies on transient Oersted fields to tip the magnetization, epitaxial contact between the ferromagnetic film and the diode is not clearly required. Here, we present work towards the development of a materials-generic approach to all optical FMR that exploits this flexibility to allow the ultrafast excitation and measurement of the magnetization dynamics of disparate materials that are not readily deposited onto semiconducting substrates.

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