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Sensitive imaging of magnetization structure and dynamics using picosecond laser heating[1] JASON BARTELL, COLIN JERMAIN, SRIHARSHA ARADHYA, Cornell University, JACK BRANGHAM, FENGYUAN YANG, The Ohio State University, DANIEL RALPH, GREGORY FUCHS, Cornell University
— We demonstrate the time-resolved longitudinal spin Seebeck effect (TRLSSE) as the basis for an ultrafast, high-resolution, and sensitive microscope for imaging ferromagnetic insulator/normal metal spintronic devices. By focusing a picosecond laser to 0.7 μm, we generate a sub-100 ps electrical signal from the combination of the TRLSSE and the inverse spin Hall effect in yittrium iron garnet (YIG)/platinum (Pt) bilayers. This signal is a spatiotemporal measurement of the local, in-plane magnetic orientation of YIG with outstanding sensitivity better than $0.3°/\sqrt{Hz}$ in samples with 20 nm of YIG. Static imaging of YIG/Pt devices reveals variations in the local magnetic anisotropy on a few micron scale. Phase-sensitive ferromagnetic resonance imaging reveals corresponding variations in the resonance field, amplitude, phase, and linewidth. These results show the TRLSSE is a powerful tool for static and dynamic studies of spintronic devices made with ferromagnetic insulators.

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