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Coupling between optically-induced coherent spin and lattice dynamics in epitaxial Fe films VLADIMIR STOICA, University of Michigan, DON WALKO, Argonne National Laboratory, ERIC LANDAHL, DePaul University, YUELIN LI, Argonne National Laboratory, ROY CLARKE, University of Michigan — Spin dynamics excitation using femtosecond optical pulses in ferromagnetic thin films is a powerful technique to study spin dependent interactions in solids. One topic of interest is the temporal separation of relaxation processes related to fundamental interaction mechanisms, which include spin-orbit, spin-lattice and exchange coupling. Establishing experimentally the relaxation timescales for these couplings is an important step that assists the development of new spintronic applications. We employ time-resolved magneto-optical and X-ray diffraction probes to separate spin and lattice dynamics in epitaxial Fe samples grown by molecular beam epitaxy on Ge and MgO substrates. We study the connection between the magnetic and lattice relaxation transients excited by optical pulses. We find that coherent spin precession dynamics correlates well with thermo-elastic strain relaxation from picosecond to nanosecond time scales.

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