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Engineering Ultrafast Magnetism

Controlling magnetic states of matter on ultrashort timescales is crucial to engineering the next-generation magnetic devices combining ultrafast data processing with ultrahigh-density data storage.

Here, we report on femtosecond laser-driven dynamics of multi-sublattice magnetic materials, with both ferromagnetic and antiferromagnetic coupling between sublattices, investigated using element-specific, femtosecond time-resolved XMCD. These measurements [1], fully supported by phenomenological and atomistic spin simulations, provide evidence for a demagnetization time that scales with the elemental magnetic moment and varies with the sign of the exchange interaction. As such, one can control the speed of magnetization processes in multi-sublattices materials, being either switching or demagnetization, by properly choosing the magnitude of the constituent magnetic moments and the sign of the exchange interaction that couples them, as exemplified for the case of a synthetic ferrimagnet.
[1] I. Radu et al., (submitted)

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