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Femtosecond response of exchange biased bilayers[1]

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Ultrafast heating by femtosecond laser pulses can decouple the ferromagnetic and antiferromagnetic layers in exchange biased bilayers, and induce a precession of the magnetization if a reverse magnetic field is applied. In Ni/FeF_2 bilayers, however, the ultrafast excitation produces novel magnetization dynamics that have not been observed before. An unexpected precession of the magnetization is initiated by a weak excitation, which does not decouple the layers, in reverse magnetic fields that exceed the exchange bias. The precession results from an abrupt change, as a function of the temperature, of the favorable orientation of frustrated spins at the interface. Another remarkable response is obtained when the laser heats the interface above the blocking temperature. The precession is then accompanied by reversal of the exchange bias. The reversal can be induced by a single excitation pulse, and shows that the antiferromagnet is also strongly affected by the optical perturbation. This non-trivial response cannot be extrapolated from the known slow dynamics of the bilayers, and provides important information on the physics of the interlayer coupling.

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