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Magnetic excitations and ultrafast magnetisation reversal

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Ultrafast magnetic reversal stimulated by femtosecond lasers is an important area of research in terms of basic physics and potential applications. I will describe an atomistic model of thermally activated reversal in the picosecond and sub-picosecond regime based on the use of Langevin dynamics with an effective local field derived from the Heisenberg formalism. The model describes the sub-picosecond thermal demagnetisation and also longer timescales for recovery due to frustration effects. A novel linear reversal mechanism is also predicted in which rapid excitations lead to a non-precessional reversal of the macroscopic spin. This mechanism is suggested as being central to the mechanism of optically induced magnetisation reversal, which is shown to exhibit reversal times of the order of hundreds of femtoseconds.