European XFEL

THEORY GROUP MEETING

Thursday, 18th February 2016

15:00

AER 19 Seminar Room 4.14

Ultrafast magnetization dynamics: how fast can we go?

by

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Traditionally, the direction of magnetization of a magnetic material is switched by the application of a reversing magnetic field. In the case of magnetic recording the field is generated inductively, leading to limitations on the magnitude of the field and speed at which it can be generated; the latter defining a limitation in the data transfer rate. I will review the measurements and theoretical understanding of the responses of magnetic thin films to field pulses as short as a few picoseconds duration and continue to describe the current work on ultrafast magnetization reversal using femtosecond laser pulses. This involves the development of an atomistic level model approach which gives excellent agreement with experiment and also led to the prediction that magnetization reversal can occur as a response to an ultrafast heat pulse in the absence of an externally applied field. This Thermally Induced Magnetization Switching (TIMS) has switching times of around 1 picosecond, giving potential increases in data rate of 2 orders of magnitude greater than currently possible. The physics of the TIMS phenomenon and potential technological implications will be discussed.