MAP-fis Essay Proposal, 2014-2015

(*please write in English*)

Supervisor

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Title

Femtomagnetism: manipulation of magnetisation on the femtosecond timescale

Area

(*Materials, Optics, Condensed Theory, High Energy Theory,....*);

Magnetic materials, ultrafast optics and photonics

Summary of Proposal

The study of magnetic processes has undergone dramatic developments in recent years. Progress in this area is linked to advances in ultrafast optical techniques and in particular the use of pump - probe methodologies. Indeed, this method provides both a means of stimulating magnetic (nano)systems and observing the response of the system to this stimulus. Ultimate temporal resolutions are directly linked to the pulse duration of the laser and there is now demonstrated potential for performing measurements well below 10 femtoseconds.

By the judicious use of a stimulating optical pulse or pulses, it is possible to manipulate the magnetisation dynamics of a magnetic sample, and can also allow switching processes at unprecendented time-scales.

Since the early work by Beaurepaire et al. (1996), where the first ultrafast demagnetisation was observed on timescales of around 1 ps, there has been a concerted effort to study the process of demagnetisation and the relaxation mechanisms which return the magnetic system to equilibrium. Indeed, much of current research in ultrafast magnetism, or femtomagnetism, is dedicated to the investigation of such processes.

It is the purpose of this proposal to stimulate the study of the state-of-the-art of research in

ultrafast magnetic processes, outling the methodologies used and to show the broad range of applicability of the method as well as to discuss potential applications of ultrafast dynamical magnetisation processes. Our currently available laser technology and related pump-probe system are unique and are expected to directly provide information about fundamental (including coherent) processes behind the demagnetisation process.

References

(t*o allow students first look at topic*)

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