

The 10Tb/in² Seminar Series

Multiscale Magnetic Models: From Electronic Structure to Device Design

Speaker

Prof Roy Chantrell

Physics Department, The University of York
Visiting professor, Department of Materials Science & Engineering,
National University of Singapore

Abstract

Magnetic materials make a vital contribution to a number of technologies, including of course magnetic recording. Increasingly, materials are structured on the nanoscale in order to produce the desired properties for specific applications. In addition, future applications may require heating of the material up to and beyond the Curie temperature characteristic of the magnetic phase transition. The important consequence is that the usual formalism, termed 'micromagnetics', cannot be used to investigate such complex phenomena. I will describe the development of new approaches linking electronic structure calculations and atomistic spin models of magnetic materials and outline applications to the fundamental understanding of ultrafast magnetisation reversal. In particular I will show that magnetisation reversal in a timescale of 300 femtoseconds is possible, and will describe the implications for heat assisted magnetic recording. Finally, I will outline recent developments which allow the bridging of the atomistic and mesoscopic lengthscales, allowing the models to be applied to the understanding of macroscopic experiments and ultimately to device design. This model will be applied to the investigation of opto-magnetic reversal, in which magnetisation reversal occurs in response to a pulse of circularly polarised laser light. It is shown (in agreement with experiment) that switching times on the sub-picosecond timescale are possible, with important implications for magnetic recording and spin-electronic devices.

Biography

Prof Chantrell has made outstanding contributions to the theory of magnetism and of the effects of thermal fluctuations on magnetisation reversal. His career has been primarily as an academic, and during some 30 years he has developed a group carrying out research into magnetic materials which is internationally recognized as world class. He has published around 340 refereed research papers with over 5000 citations and has given invited papers at the major international magnetism conferences (MMM and Intermag) and at specialist magnetism meetings. Until 1989 he was Professor at the University of Central Lancashire, moving to the Universities of Keele (1989), Bangor (1996) and Durham (1999). His research group consisted of around 7 students and postdoctoral researchers and received extensive support from the national funding councils, the EU and industry. In 2001 he moved to Seagate research (Pittsburgh) to establish and lead a theory group, consisting of 8 permanent staff members and visiting scientists carrying out work on lengthscales ranging from ab-initio calculations to large-scale micromagnetic simulations. Here he initiated pioneering research into the development of atomistic calculations with parametrised ab-initio information. This was applied especially to nanoparticles of FePt, to an understanding of the physics of heat assisted magnetic recording, and to the development of atomistic models of read elements. He was the recipient of a Seagate Technical Achievement Award in 2004. In August 2004 he was appointed to a chair of Condensed Matter Theory at the University of York, UK. He leads a group comprising 1 academic member of staff, 1 postdoctoral researcher and 5 postgraduate students (8 students from October 2009). The York group specialises in the development of atomistic models of nanostructured materials, including nanoparticles and structured films including the effects of coupling between FM and AFM layers.

Prof Chantrell is Editor of the Journal of Magnetism and Magnetic Materials (the premiere specialist journal in the field), is a member of the advisory board of a number of international conferences, and makes regular contributions as member of the programme and publications committees of these meetings. He was a member of the management committee of the UK EPSRC Advanced Magnetism Programme (1995-1998). He is a member of the AdCom of the IEEE Magnetism Society, and is Coordinator of the IEEE Magnetism Society Distinguished Lecturer Programme. In 1994 he was honoured as the Wohlfarth Lecturer and was Distinguished Lecturer of the IEEE Magnetism Society in 1999/2000. He is Fellow of the American Physical Society and of the IEEE.

▪ **Venue :**
Training Room
Data Storage Institute,
5 Engineering Drive 1,
Singapore 117608

▪ **Date :**
17 September 2009

▪ **Time :**
10:00am – 12:00pm

▪ **Registration at**
09:45am

▪ Please confirm your
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16 September 2009.

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