PhD Project for October 2016

Physics of rare earth - transition metal permanent magnets: theory of their magnetostriction.

There are opportunities for post-graduate research available in the Warwick Theory Group on a theoretical/computational PhD project on the modelling of magnetic materials. The project will involve condensed matter physics theory, high performance computing and collaboration with leading groups in this area in the U.K., USA and Japan. We are looking for candidates with a strong interest and aptitude for theoretical development and scientific computing.

Permanent magnets are pervasive in both established and developing technologies and are found in motors and generators, transducers, magnetomechanical devices and magnetic field and imaging systems. They are also both fascinating and challenging in terms of their fundamental materials physics. At the Universities of Warwick and Birmingham we are launching (January 2016) an integrated theory/experiment programme to uncover key design principles and are looking for postgraduate students to participate. For the theory side of our EPSRC-funded PRETAMAG project ("Investigations of the Physics underlying the principles of design of Rare Earth Transition metal Permanent MAGnets") we are looking for a postgraduate student to help develop the theory for important magneto-structural effects. One of the group of magnets which we will investigate exhibits giant magnetostriction - a strong coupling between magnetism and structure. The easy axis of the magnet DyFe2 lies along [100], whereas for the same crystal structure, swapping Dy for Tb changes this to [111]. Tb(1-x)Dy(x)-Fe2 crystals, near the crossover in behaviour, show large magnetoelasticity which makes the material a leading magnetostrictive material for many applications. We will explore how to improve its properties. Recent experimental measurements at Birmingham [2] have revealed some fascinating features. This PhD project will develop the theory for magnetoelastic effects and compare the results with experimental data. It will show how elastic and magnetic degrees of freedom soften, and inform the design of new compounds.

Our PRETAMAG joint theory/experimental project provides some excellent opportunities for postgraduate students. We have funding for two students to start in October 2016, one working on the theory side and the other on experiment. The students will benefit from working in a diverse team which comprises:


For further information please contact: Julie Staunton j.b.staunton@warwick.ac.uk

References: