MAGNETISATION SWITCHING AND DYNAMICS IN RARE EARTH BASED EXCHANGE-SPRING MULTILAYERS

A. Ahmed[1], A.R. Buckingham[1], D. Wang[1], P.A.J. de Groot[1], V. Fedotov[2], N. Zheludev[2], R.C.C. Ward [3]

[1] *School of Physics and Astronomy, University of Southampton, Southampton, UK*
[2] *Optoelectronics Research Centre, University of Southampton, Southampton, UK*
[3] *Clarendon Laboratory, Oxford University OX1 3PU, UK*

Exchange spring multilayers and graded materials offer potential to circumvent the super-paramagnetic limit in magnetic data storage. Exchange spring magnetic systems have been increasingly considered for application in storage and devices due to their thermal stability and relatively small coercivity in respect to other nanostructured materials. They have been proposed also for permanent magnet application with superior magnetic energy products – as large as $(BH)_{MAX}$ = 1 MJm^{-3}. We are exploring magnetisation switching and dynamics in exchange-spring magnetic multilayers using a range of techniques: magnetometry, MOKE, magneto-transport, and ferromagnetic resonance (FMR). The latter is based on a Coplanar Waveguide (CPW) configuration combined with a vector network analyzer (VNA) within a microwave frequency range 1-40 GHz. The samples of interest are based on MBE-grown R-T_2 (R is a rare earth, T is a transition metal) compound superlattices with Laves-phase crystal structures, such as (110) $DyFe_2/YFe_2$. In the latter the YFe_2 layers are magnetically soft and the $DyFe_2$ layers are hard (due to the crystal field anisotropy experienced by Dy). Our studies have revealed exchange spring behaviour which dominates the magnetic properties and can be tailored by choosing layer thicknesses.

[1] Bentall, M. J. *et al.* (2003). "Structure of $DyFe_2/YFe_2$ Laves phase superlattices grown by molecular beam epitaxy" Phys.: Condens. Matter **15**: 4301-4330.
[2] Sawicki, M. *et al*. (2000). "Exchange Springs in antiferromagnetically coupled DyFe2/YFe2 superlattices." Phys. Rev. B **62**(9):5817.
[3] Bilzer, C., *et al*. (2007). "Vector network analyzer ferromagnetic resonance of thin films on coplanar waveguides: Comparison of different evaluation methods" J.App. Phys. **101**: 074505.