

Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Mechanism of giant exchange bias in a rare earth superlattice¹

M.R. FITZSIMMONS, LANL, C. DUFOUR, K. DUMESNIL, Laboratoire de Physique des Matériaux, Université H. Poincaré Nancy, J. DOU, M. PECHAN, Department of Physics, Miami University of Ohio, J.A. BORCHERS, NIST, M. LAVER, PSI — After cooling a DyFe₂/YFe₂ superlattice [3 nm DyFe₂/12 nm YFe₂ repeated 22 times] to 12 K in a 1 T field, which aligns the Fe-spins parallel to the field, the magnetization vs. field curve of the superlattice was dramatically shifted along the *magnetization and applied field axes*. The exchange bias was -2 *Tesla*. We developed a one dimensional spin-chain-model that completely explains the polarized neutron reflectometry, magnetometry and X-ray magnetic circular dichroism data. Two in-plane domain configurations were identified in the model. Both configurations contribute to the extraordinarily large exchange bias of the DyFe₂/YFe₂ superlattice. Until just recently, we lacked direct evidence for the existence of the domain configurations; however, SANS measurements of the thin film superlattice show compelling proof that magnetization reversal is accompanied by formation of small domains in the sample plane. The domain scattering exhibits a pronounced enhancement at the exchange bias field, and remarkably, is a minimum at the cooling field rather than at high (7 T) fields.

¹Work supported by the U.S. Department of Energy.

Michael Fitzsimmons
LANL

Date submitted: 21 Dec 2009

Electronic form version 1.4