MAR17-2016-020058

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Damping in Materials for Spintronic Applications[1]

CLAUDIA MEWES, Department of Physics and Astronomy / MINT Center, The University of Alabama, Tuscaloosa

The next generation of spintronic devices relies strongly on the development of new materials with high spin polarization, optimized intrinsic damping and tunable magnetic anisotropy. Therefore, technological progress in this area depends heavily on the successful search for new materials as well as on a deeper understanding of the fundamental mechanisms of the spin polarization, the damping and the magnetic anisotropy. This talk will focus on different aspects of materials with a low intrinsic relaxation rate. Our results are based on first principles calculations in combination with a non-orthogonal tight-binding model to predict those material properties for complex materials [1-4] which can be used for example in new spin based memory devices or logic devices. However, the intrinsic damping parameter predicted from first principle calculations does not take into account adjacent layers that are present in the final device. Spin pumping is a well-known contribution that has to be taken into account for practical applications using multilayer structures [1]. More recently a strong unidirectional contribution to the relaxation in exchange bias systems has been observed experimentally [5]. To describe this phenomenon theoretically we use the formalism of an anisotropic Gilbert damping tensor that takes the place of the (scalar) Gilbert damping parameter in the Landau-Lifshitz-Gilbert equation of motion. While for single crystals this anisotropy is expected to be small, making experimental confirmation difficult, the broken symmetry in exchange bias systems provides an excellent testing ground to study the modified magnetization dynamics under the influence of unidirectional damping. References: [1] Book chapter, ISBN: 978-981-4613-04-0, [2] Appl. Phys. Lett. 104, 22412 (2014), [3] Appl. Phys. Lett. 95, 082502 (2009), [4] Appl. Phys. Lett. 95, 022509 (2009), [5] IEEE Magn. Lett. 1, 3500204 (2010).

[1] C.K.A. Mewes would like to thank her colleague T. Mewes and her students J.B. Mohammadi, A.E. Farrar. We acknowledge support by the NSF-CAREER Award No. 1452670, and NSF-CAREER Award No. 0952929.