MA 31: Spin dynamics: Magnetic relaxation and Gilbert damping

Time: Wednesday 11:45–12:45 Location: H52

MA 31.1 Wed 11:45 H52

Gilbert damping phenomenology for two-sublattice magnets — •Akashdeep Kamra[1], Roberto Troncoso[1], Wolfgang Belzig[2], and Arne Brataas[1] — [1]Center for Quantum Spintronics, Department of Physics, Norwegian University of Science and Technology, Trondheim, Norway — [2]Department of Physics, University of Konstanz, Konstanz, Germany

We present a systematic phenomenological description of Gilbert damping in two-sublattice magnets. Our theory covers the full range of materials from ferro- via ferri- to antiferromagnets. Following a Rayleigh dissipation functional approach within a Lagrangian classical field formulation, the theory captures intra- as well as cross-sublattice terms in the Gilbert damping, parameterized by a 2×2 matrix. When spin-pumping into an adjacent conductor causes dissipation, we obtain the corresponding Gilbert damping matrix in terms of the interfacial spin-mixing conductances. Our model reproduces the experimentally observed enhancement of the ferromagnetic resonance linewidth in a ferrimagnet close to its compensation temperature without requiring an increased Gilbert parameter. It also predicts new contributions to damping in an antiferromagnet and suggests the resonance linewidths as a direct probe of the sublattice asymmetry, which may stem from boundary or bulk.

Reference: Phys. Rev. B 98, 184402 (2018).

MA 31.2 Wed 12:00 H52

Two-magnon scattering contribution to damping and its impact in the determination of the spin mixing conductance — •Andres Conca, Sascha Keller, Matthias R. Schweizer, Evangelos Papaioannou, and Burkard Hillebrands — Fachbereich Physik and Landesforschungszentrum OPTIMAS, Technische Universität Kaiserslautern, 67663 Kaiserslautern, Germany

We present angle dependent measurements of the damping properties of epitaxial Fe layers with MgO, Al and Pt capping layers. Based on the preferential distribution of lattice defects following the crystal symmetry, we make use of a model of the defect density to separate the contribution of two-magnon scattering to the damping from the isotropic contribution originating in the spin pumping effect, the viscous Gilbert damping and the magnetic proximity effect. Without the contribution of the two-magnon scattering, which depends strongly on the chosen capping layer and defect density, a value of the effective spin mixing conductance $g_{\mathrm{eff}}^{\uparrow\downarrow}$ is obtained which is closer to the $g^{\uparrow\downarrow}$ associated with spin pumping only. The influence of the defect density for bilayers systems due to the different capping layers and to the unavoidable spread in defect density from sample to sample is thus removed. This shows the potential of studying spin pumping phenomena in fully ordered systems in which this separation is possible, contrary to polycrystalline or amorphous metallic thin films.

Financial support by M-era.Net through the HEUMEM project and by the Carl Zeiss Stiftung is gratefully acknowledged.

MA 31.3 Wed 12:15 H52

Magnetization and energy relaxation in the 1D XXZ Heisenberg model — •Xenophon Zotos[1,2] and Alexandros Pavlis[1] — [1]Physics Department, University of Crete, Greece — [2]Leibnitz/IFW Dresden, Germany

We study spin and energy relaxation by the recently proposed Generalized Hydrodynamics approach (GHD) in the linear response regime. We derive a further formulation of the corresponding Drude weights from the finite wave-vector relaxation. Furthermore we analyze the dynamic structure factors in the low temperature regime and compare them to existing results in the literature.

MA 31.4 Wed 12:30 H52

In-situ study of Fe on GaAs (100) and GaAs (110) — •Babli Bhagat, Ralf Meckenstock, and Michael Farle — Center for Nanointegration (CENIDE) and Faculty of Physics, University of Duisburg Essen, Lotharstr. 1, 47057, Duisburg, Germany

Fe films have been intensively studied but there are still some unanswered questions associated to it. We are interested in studying the spin pumping effect in Fe based heterostructures. For that we investigated the growth and stability of 4nm Fe film on GaAs (100) and (110) substrate under ultra high vacuum (UHV) conditions. We have compared the surface reconstruction of Fe film on both substrate orientations in terms of structural and magnetic properties. The films were grown with electron beam evaporation and measured by in-situ Ferromagnetic Resonance (FMR), Low Energy Electron Diffraction (LEED) and Auger Electron Spectroscopy (AES) techniques as a function of time at room temperature. The FMR measurement show island growth in case of Fe\GaAs(110) substrate, which gives two resonance lines with time while on GaAs(100) it formed a flat surface giving a single resonance line with time. The surface roughness was also confirmed by ex-situ Atomic Force Microscopy (AFM) measurements. Thus (100) system has a better surface and interface to study the spin pumping effect in such heterostructures. Further we also did the LEED and AES measurement of Fe\GaAs(100) with time which shows that up-to 8-10 hours the film quality is maintained under the UHV conditions.