Investigation of Spin Wave Dynamics in Si/Ti/Au/CoFeB/Au Multilayers with PMA

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Magnonics is an emerging research and technological field, focused on study of spin waves (SWs), which can transfer a spin for large distance without charge transfer, what minimizes the energy cost of logic operations. This is an experimental investigation of interaction between SWs, based on ferromagnetic/heavy metal multilayers with Perpendicular Magnetic Anisotropy (PMA). Here we employed Brillouin Light Scattering (BLS) method to quantify energy of magnons in thin-film samples composed of magnetic and non-magnetic layers deposited on Si substrate. This composition exhibits small pumping effect (hence low damping) together with PMA effect, will promising for future applications in magnonics. Measurements were taken in 180 degree backscattering geometry. At appropriate angle of incidence, it permits the observation of Brillouin spectra of magnons. Magnetostatic configuration applied here is Damon- Eshbach. We observed Dzyaloshinskii-Moriya Interaction (DMI) and characterized the strength of interfacial DMI in these perpendicularly magnetized thin films. This synergy of PMA and DMI can be considered as interesting thing here due to their necessities to make chiralities which change the whole magnetic properties. Moreover, here we emphasis field dependent studies by FMR and BLS as well. Spin wave dispersion relations were extracted and studied the nonlinear effect as well as system behaviour. Opposed to the conventional dispersion relations of magnetic multilayers, it shows anomalous characteristics[1-3]

Keywords: Perpendicular Magnetic Anisotropy, Brillouin Light Scattering, Dzyaloshinskii-Moriya Interaction, Backscattering geometry, Damon-Eshbach.

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