Spin Pumping and inverse Spin Hall effect in YIG/Pt heterostructure

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Abstract

Spintronics is one of the great success stories of condensed matter physics in the last three decades. Many of the spintronics concepts, such as spin-transistor, rely on efficient charge-to-spin signal conversion. Spin pumping which excites the spin current from a ferromagnetic material (FM) into a nonmagnetic material (NM) exhibits a promising route toward energy-efficient spintronic devices. Yttrium iron garnet (YIG) which has the smallest known damping parameter material is well suited for experiments that involve the propagation of spin waves. Pt is widely used for detecting spin currents generated by ferromagnetic resonance (FMR).

In this work, YIG thin films with thickness ranging from 7nm to 25nm have been successfully grown on (111) Gadolinium Gallium Garnet (GGG) substrates by Pulsed laser deposition. High uniformity of the thin film is revealed by high resolution X-ray diffraction, which shows phase purity and clear Laue oscillations. Atomic flat YIG surface with root mean square roughness varying from 100pm to 300pm has been demonstrated by Atomic force microscopy. The Gilbert damping constants of YIG thickness dependence are measured by FMR, which decrease as thickness increases. The Gilbert damping constant of 25nm YIG thin film is $9 \times 10^{-4}$ and its coercive field is smaller than 0.5Oe. Two order of magnitude enhancement of damping constants is observed in YIG/Pt bilayers.

Speaker Xie Qidong

Xie Qidong graduated from Xi'an Jiao Tong University with a Bachelor Degree in Material Science and Engineering. He is currently pursuing his Ph.D. degree in Materials Science & Engineering under Prof. Chen Jingsheng. His research focus on spintronics.

ALL ARE WELCOME!

Host: A/P Xue Junmin