Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Systematic temperature and thickness dependence of magnetic properties in nanometer-thick garnet films COLIN JERMAIN, SRIHARSHA ARADHYA, HANJONG PAIK, Cornell University, JACK BRANGHAM, MICHAEL PAGE, Ohio State University, NEAL REYNOLDS, Cornell University, CHRIS HAMMEL, FENGYUAN YANG, Ohio State University, DARRELL SCHLOM, ROBERT BUHRMAN, DAN RALPH, Cornell University — Insulating ferrimagnets are of interest for spintronic applications because they possess very small damping parameter, as low as 10^{-5} in the bulk. Making practical devices from ferrimagnetic insulators will require techniques capable of growing very thin films (few tens of nm and below) while maintaining low damping. We report systematic ferromagnetic resonance (FMR) studies as a function of temperature, frequency and film thickness in two closely related garnet films. We demonstrate molecular-beam epitaxy growth of (111)-oriented lutetium iron garnet (Lu3Fe5O12) films as thin as 2.8 nm. In these films we measure damping that is among the lowest reported for films of comparable thickness grown by other techniques [1]. We also report temperature dependent FMR linewidths in off-axis sputtered (111)-oriented 15 nm thick yttrium iron garnet (Y3Fe5O12). Here we observe a 30-times increase in the damping as the film is cooled from room temperature to cryogenic temperatures, with a peak near 25 K clear peak in the linewidth at a characteristic temperature, indicatingcharacteristic of impurity-induced relaxation. Together these studies provide insight into damping mechanisms in nanometer thick garnet films that can guide the development of improved growth and device fabrication protocols. [1] APL 109, 192408 (2016).

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Date submitted: 11 Nov 2016 Electronic form version 1.4