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MAGNETO-OPTIC ENHANCEMENT IN NANO-SCALE IRON GARNET FILMS ASHIM CHAKRAVARTY, MIGUEL LEVY, Physics Department, Michigan Technological University, 49931, USA — This work addresses dimensionality-induced magneto-optic effects in liquid-phase-epitaxy magnetic garnet thin films. It is found that the Faraday rotation (FR) per unit length evinces a marked and steady enhancement as the film thickness is reduced approximately below 100 nm in $Bi_{0.8}Gd_{0.2}Lu_2Fe_5O_{12}$, although it remains constant in the micron- and most of the sub-micron-regime. The reported specific FR change in such reduced dimensions is due to size-dependent modifications in diamagnetic transition processes in the garnet film. These processes correspond to the electronic transitions from the singlet ^6S ground state to spin-orbit split excited states of the Fe^{3+} ions in the garnet. A measurable reduction in the corresponding ferrimagnetic resonance linewidths is found, thus pointing to an increase in electronic relaxation times and longer lived excitations at reduced thicknesses than in the bulk. These changes together with a shift in vibrational frequency of the Bi-O bonds in the garnet at reduced thicknesses result in magneto-optical enhancement in ultra-thin garnet films.

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