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Dynamic Interplay of Coherent Rotations and Domain Wall Motion in Faraday Rotators based on Ferromagnetic Crystals. ANTHONY GARZARELLA, DONG WU, MANNIX SHINN, Naval Research Laboratory — Under small, externally-applied magnetic fields, the Faraday rotation in magneto-optic material containing ferromagnetic domains is driven primarily by two principal mechanisms: domain wall motion and coherent domain rotations. Domain wall motion yields a larger Faraday responsivity but is limited by magnetically induced optical incoherence and by damping effects. Coherent domain rotation yields smaller Faraday rotations, but exhibits a flatter and broader frequency response. The two mechanisms occur along orthogonal principal axes and may be probed independently. However, when probed along an oblique angle to the principal axes, the relationship between the Faraday rotation and the external field changes from linear to tensorial. Although this may lead to more complicated phenomena (e.g. a sensitivity axis that depends on RF frequency), the interplay of domain rotation and domain wall motion can be exploited to improve responsivity or bandwidth. The detailed experimental data can be understood in terms of a quantitative model for the magnitude and direction of the responsivity vector. Applications to magnetic field sensors based on arrayed bismuth doped iron garnet films will be emphasized in this presentation.

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