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Magnetization-Induced Electromagnetic Spin-Orbit Coupling in Magneto-Optic Media MIGUEL LEVY, DOLENDRA KARKI, Michigan Technological Univ — We present a formulation of nonreciprocal electromagnetic transverse-spin to orbital angular momentum coupling in magneto-optic media. Transverse-spin angular-momentum-density shifts for evanescent waves in magneto-optic waveguides are shown to result in nonreciprocal unidirectional coupling into orbital momenta in silicon-on-insulator waveguides with iron garnet claddings. Experimental results of geometrical confinement of light in ultra-thin magnetic garnet films evince significant enhancement of Faraday rotation and magnetic circular dichroism and impact the electromagnetic spin-orbit coupling. We describe the diamagnetic electronic transition processes responsible for these results. Transverse-spin to orbital angular momentum coupling into magneto-optic waveguide media are shown to engender magneto-optic-gyrotropy-dependent unidirectional propagation. We demonstrate that magnetization-induced electromagnetic spin-orbit coupling as a result of Faraday rotations in waveguide media leads to nonreciprocal spin to orbital angular momentum conversions. The spin-helicity- and magnetization-gyrotropy dependence of free-space helicoidal beams based on this conversion are described.

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