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Cascaded Magneto-Optical Ring Resonator Structures for Tunable Faraday Rotation and Reduced Isolator Footprint MEHMET CENGIZ ONBASLI, Massachusetts Institute of Technology, JUEJUN HU, University of Delaware, LEI BI, Micron Technology, GERALD F. DIONNE, Massachusetts Institute of Technology Lincoln Laboratory, CAROLINE A. ROSS, Massachusetts Institute of Technology — On-chip optical isolators are indispensible components of integrated optics, and can be modified to enable four-port and multi-port circulators and modulators. We have implemented an on-chip optical isolator by placing a racetrack resonator next to a single mode waveguide and coating half of the resonator with a uniformly magnetized magneto-optical film, which breaks the time-reversal symmetry of light propagation and provides different refractive indices and phase shifts for forward and backward propagating waves. At every pass, the optical mode inside the resonator accumulates Faraday rotation in addition to phase shift due to propagation. The transmission from the output port of the waveguide has a Lorentzian dip due to the resonance peak of the resonator. Light can only propagate in the clockwise direction inside the resonator. Here we model how cascading multiple ring resonators can increase the overall quality factor of the isolator and narrow the resonance linewidth, due to the longer photon lifetime inside the cavity. As a result of better control of Faraday rotation, the isolation ratio is enhanced and the device footprint is reduced with respect to Mach-Zehnder waveguide isolators.

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