Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Time reversal of optical pulses by adiabatic coupling modulation in Coupled-Resonator Optical Waveguides CHAO WANG, CHRISTOPHER SEARCH, Department of Physics and Engineering Physics, Stevens Institute of Technology — We propose a method to time reverse optical pulses in Coupled-Resonator Optical Waveguides(CROW) by adiabatically modulating the couplings between constituent microcavities. Time reversal, also known as phase conjugation, is an inversion of the optical phase. Currently, nonlinear four-wave mixing is the primary method to realize time reversal, but the need for phase matching makes it unsuitable for broadband optical pulses and in integrated devices. Therefore time reversal of both narrow pulses and in photonic circuits are still unsolved problems. Our method to overcome these difficulties is to tune the sign of the inter-resonator evanescent couplings κ of a CROW, whose dispersion is proportional to κ. A Mach-Zehnder Interferometer inserted into the coupling region can tune κ by either electro-optic or thermo-optic modulation of the interferometer phase. For small modulations of the phase around π, time reversal is realized as a result of sign reversal of κ. The bandwidth of the pulses that can be time reversed is limited only by the resonators' Q-factor and free spectral range. Simulations based on coupled mode equations of Si microring resonators show that picosecond pulses can be time reversed with good fidelity for Q-factors as low as 10^5.

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Date submitted: 20 Dec 2012 Electronic form version 1.4