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Nonreciprocal State Conversion between Microwave and Optical Photons[1] LIN TIAN, School of Natural Sciences, University of California, Merced, CA 95343, USA, ZHEN LI, Dept. of Applied Physics, Xian Jiaotong University, Xian 710049, China — Nonreciprocal devices are of critical importance in the realization of noiseless and lossless quantum networks. Despite previous efforts, it is still challenging to implement nonreciprocal devices that connect distinctively different frequency scales. Optomechanical quantum interfaces can be utilized to connect systems with different frequencies in hybrid quantum networks. Here we present a scheme of nonreciprocal quantum state conversion between microwave and optical photons via an optomechanical interface. By introducing an auxiliary cavity and manipulating the phase differences between the linearized optomechanical couplings, uni-directional state transmission can be achieved. The interface can function as an isolator, a circulator, and a two-way switch that routes the input states to a selected output channel. We show that under a generalized impedance matching condition, the state conversion can reach high fidelity and is robust against the thermal fluctuations in the mechanical mode. [1] L. Tian and Z. Li, eprint arXiv:1610.09556.

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Lin Tian
School of Natural Sciences, University of California, Merced, CA 95343, USA

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