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Simulation of Optical Topological Edge States in Ring Resonator Lattices GUANQUAN LIANG, YIDONG CHONG, Nanyang Tech Univ — Several recent studies have reported on photonic analogs of the quantum Hall effect and topological insulators. The most striking property of these systems is the existence of topologically protected photonic one-way edge states. However, the systems thus far proposed either have non-optical operating frequencies or are difficult to fabricate. In this talk, we describe an optical topological insulator realized by a periodic lattice of coupled ring resonators. This system uses only periodic elements made of ordinary dielectric material, and should be simple to design and fabricate. The working frequency is scalable up to the optical range. The system consists of a ring resonator on each lattice (square or honeycomb) site, whose modes are coupled to modes on neighboring resonators having the same "spin" (clockwise or anti-clockwise direction of propagation). Using finite-difference time-domain (FDTD) simulations, we demonstrate the band structure and the existence of robust edge states. We demonstrate also that a transition between topological and conventional insulator behaviors can be achieved by tuning the inter-ring coupling strength.

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