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Photonic pulling force in one-way waveguides DANLU WANG, Univ of Texas, Austin, Department of Physics, CHENGWEI QIU, National University of Singapore, Department of Electrical and Computer Engineering, PETER RAKICH, Yale University, Department of Applied Physics, ZHENG WANG, Univ of Texas, Austin, Department of Electrical and Computer Engineering — Light can apply pulling force on dielectric particles through forward scattering, i.e, scattering that increases photon momentum. The forward scattering typically requires delicate conditions in free space, e.g. large incident angle, excitation of dipole-quadrapole interaction on spherically shaped particles. Here we demonstrate photonic pulling forces on dielectric particles in photonic crystal defect waveguides supporting one-way chiral edge modes. Intuitively, momentum discrepancy between two co-existing one-way modes facilitate forward scattering on arbitrarily configured particles inside the waveguide, over a broad frequency range, upon proper choice of incident mode. The pulling forces are also topologically protected against bending of the waveguide. Moreover, we rigorously related the direction and amplitude of photonic forces to the phase response of output modes versus the particle's displacement. While the phase response of output modes is determined by wave functions of the involved modes.

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