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Controlling Neutral Atoms Near a Photonic Crystal Waveguide Transported via Optical Lattices ALEX BURGERS, JUAN MUNIZ, LUCAS PENG, ANDREW MCCLUNG, H. JEFF KIMBLE, California Institute of Technology — Integrating ultracold atoms with nanophotonics enables the exploration of new paradigms in quantum optics and many body physics. Advanced fabrication capabilities for low-loss dielectric materials provide powerful tools to engineer light-matter coupling of photons and atoms. For example, dispersion-engineered photonic crystal waveguides (PCWs) permit not only stable trapping and probing of atoms via interactions with guided mode (GM) light, but also the possibility to study the physics of strong, photon-mediated interactions between atoms, as well atom mediated photon-photon interactions. Our current system at Caltech consists of a quasi-one-dimensional PCW whose band structure arises from periodic modulation of the dielectric structure. Here, we report a moving optical lattice utilized for transport of trapped atoms into and through the PCW in a phase-sensitive fashion. Single atoms can then be transferred from the moving lattice into optical traps formed in unit cells of the PCW by GMs of the waveguide. We present data for the optical spectra of the GM transmission and reflection that allow inference of coherent atom transport. Progress towards trapping atoms along the PCW will also be discussed.

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