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Experimental Progress Towards the Development of Neutral Atom Quantum Computing Architecture Based on 2D Optical Lattices on a Chip RAJANI AYACHITULA, ANDREW MORSS, Ohio State University, KATHARINA GILLEN, California Polytechnic State University, San Luis Obispo, GREGORY LAFYATIS, Ohio State University — In previous theoretical work, we showed that optical lattices can be created above an optical waveguide by destructively interfering laser light in two different waveguide modes. Single atoms can be tightly trapped at the nodes of a lattice, serving as individually addressable qubits of a quantum memory. Theoretically, we have examined moving the atoms within the lattice. We have also studied ways to carry out one- and two-qubit gates. In subsequent experimental work, we developed and characterized optical waveguides suitable for making these optical lattices. We measure losses $\lesssim$1db/cm for TE0 and TE1 modes. To address individual modes, we couple light into the waveguide modes using gratings fabricated on the waveguide surface. We have observed >15% coupling efficiency. Our initial scientific studies characterize samples of cold atoms dropped onto the waveguide. We will discuss recent experimental progress.

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