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Preparation of Atom Transfer to 2D Pinhole Diffraction Trap Array for Quantum Information Applications JUSTIN JEE, SEBASTIAN PARDO, ELLIOT LEHMAN, SERGIO AGUAYO, GLEN GILLEN, KATHARINA GILLEN-CHRISTANDL, California Polytechnic State University, San Luis Obispo — Quantum computing requires a system of qubits with two distinguishable quantum states. Conditions for successful quantum computer implementation are system scalability, the ability to initialize qubit states, long decoherence times, execution of universal quantum gates, and read out of these states. Neutral atom quantum computers use light patterns to trap neutral atoms and meet all of the above criteria, save scalability, though much progress has recently been made. Our experiment aims to fill and characterize novel atomic dipole traps in the diffraction pattern of a pinhole [1]. The traps will be projected via a lens into the chamber of a magneto-optical trap containing laser cooled atoms [2]. A two-dimensional array of pinholes would create a two-dimensional qubit array that would be suitable for quantum computing [3]. We will present an experiment schematic and progress toward experimentally verifying our simulations of these traps. [1] G. D. Gillen, et al., Phys. Rev. A 73, 013409 (2006), [2] K. Gillen-Christandl, et al., Phys. Rev. A 82, 063420 (2010), [3] K. Gillen-Christandl, et al., Phys. Rev. A 83, 023408 (2011).

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