Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

An efficient 2D array of blue-detuned optical traps[1] TRENT GRAHAM, XIAOYU JIANG, CODY POOLE, Physics, University of Wisconsin-Madison, YUAN SUN, Interdisciplinary Center for Quantum Information, National University of Defense Technology, Changsha 410073, P.R.China, MARTIN LICHTMAN, Joint Quantum Institute, University of Maryland, MARK SAFFMAN, Physics, University of Wisconsin-Madison — We demonstrate a 2D lattice of blue-detuned optical traps which uses laser power efficiently, is tolerant to perturbations in beam alignment, and is insensitive to interferometric phases. Blue traps have several advantages over red traps despite requiring a more complicated beam geometry. Since atoms in a blue trap sit at an intensity minimum, Stark shift noise and site-to-site calibrations are minimized. However, constructing a blue lattice which efficiently converts laser power into trap depth, is challenging. For example, a lattice of bottle beams is inefficient because neighboring sites are separated by two walls, limiting the number of traps that can be formed. An array of tightly spaced Gaussian beams is a more efficient blue trap, but the trap potentials are susceptible to alignment perturbations. We demonstrate an array which uses diffractive optical elements to create a cross-hatched pattern of lines in the focal region where the atoms are trapped in up to 121 sites. This "line array" is almost twice as efficient as the Gaussian beam array and is more resilient to perturbations in beam alignment.

[1]This research was supported by the ARL-CDQI under cooperative agreement W911NF-15-2-0061 and NSF award PHY-1720220.

Trent Graham
Physics, University of Wisconsin-Madison

Date submitted: 26 Jan 2018 Electronic form version 1.4