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Optical lattices with periodicity well below $\lambda/2$ SARTHAK SUBHANKAR, YANG WANG, TSZ-CHUN TSUI, JAMES V. PORTO, STEVEN ROLSTON, University of Maryland, College Park — Optical potentials based on the ac-Stark shift are used extensively in the investigation of lattice models of quantum many body systems. But these potentials are limited by diffraction to have a lattice constant no less than $\lambda/2$, where λ is the wavelength of light used. This sets a temperature scale in these lattices given by $T \sim E_R/k_B$, where $E_R = h^2/(8md^2)$ and d is the lattice constant. Study of phenomena like superexchange and magnetic dipole interactions require much lower temperatures than that set by E_R. By engineering lattices with subwavelength lattice constants, the temperature requirements to study these phenomena can be relaxed. Recently, we have demonstrated an optical lattice based on dark states with sub-wavelength barriers of width $\lambda/50$ [1]. By stroboscopically dithering the phase of this lattice while remaining in a dark state, a time-averaged potential with sub-wavelength lattice spacing of $\lambda/(2N)$ can be realized [2]. Here we report our progress on the realization of such a lattice. [1] Phys. Rev. Lett. 120, 083601 [2] Phys. Rev. Lett. 115, 140401

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