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Compact. On-chip, Integrated three dimensional Lattice¹ PHOEBE M. TENGDIN, Department of Electrical, Energy, and Computer Engineering, University of Colorado, Boulder, and JILA, EVAN A. SALIM, Coldquanta, Inc., DANA Z. ANDERSON, Department of Physics, University of Colorado, Boulder, JILA and NIST — We present the design of a compact atom chip system that provides a three dimensional optical lattice combined with thru-chip imaging. Optical beams are launched from fibers mounted directly to the exterior of a high resolution (0.4NA) imaging objective. Miniature polarizers, wave plates, and mirrors located on the exterior of the objective control the polarization state and alignment of the lattice, while on-chip optics are used to provide retro-reflection. Three mutually orthogonal lattice beams traverse from the ambient side of the chip through a central window of a silicon and glass substrate, intersecting 300 microns below the vacuum side chip surface. The combined atom chip and optical system fills a volume of less than 36 cm^3 . Atoms may be cooled using standard techniques [1], and directly loaded into the optical lattice. This system is designed with the intention of reducing vibrational noise, providing high resolution in-lattice imaging, combining electric and magnetic fields to generate arbitrary potentials, and performing high repetition rate experiments.

[1] Farkas, Daniel M. et al. Appl. Phys. Lett, 96, 093102 (2010).

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