

Abstract Submitted  
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**Experimental progress toward creating optical crystals of ultracold atoms**<sup>1</sup> NATHAN SOUTHER, RICHARD WAGNER, MATTHEW BRIEL, SAMIR BALI, Department of Physics, Miami University — We propose an experiment to form an optical crystal using atoms that have been laser-cooled to temperatures of a few microKelvin. First we create an optical lattice – an array of periodic potential wells, half an optical wavelength apart, formed by intersecting laser beams, with about one well out of hundred occupied by an atom. Next, we use another beam to superpose a long-range periodicity on the lattice – causing wells located every few wavelengths apart to be deepest. This creates what is called a superlattice, where the atoms eventually collect in the lowest wells thus creating a long-range “crystal.” This is called a crystal, not a lattice, because the probability of an atom occupying the periodic array of deepest wells is unity. Such optical crystals may have far-reaching implications for nanolithography and quantum computing.

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