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**Defect-free atom arrays on demand** HANNES BERNIEN, ALEXANDER KEESLING, HARRY LEVINE, ERIC ANSCHUETZ, CRYSTAL SENKO, Harvard University, VLADAN VULETIC, Massachusetts Institute of Technology, MARKUS GREINER, MANUEL ENDRES, MIKHAIL D. LUKIN, Harvard University — Arrays of neutral, trapped atoms have proven to be an extraordinary platform for studying quantum many-body physics and implementing quantum information protocols. Conventional approaches to generate such arrays rely on loading atoms into optical lattices and require elaborate experimental control. An alternative, simpler approach is to load atoms into individual optical tweezers. However, the probabilistic nature of the loading process limits the size of the arrays to small numbers of atoms. Here we present a new method for assembling defect-free arrays of large numbers of atoms. Our technique makes use of an array of tightly focused optical tweezers generated by an acousto-optic deflector. The positions of the traps can be dynamically reconfigured on a sub-millisecond timescale. With single-site resolved fluorescence imaging, we can identify defects in the atom array caused by the probabilistic loading process and rearrange the trap positions in response. This will enable us to generate defect-free atom arrays on demand. We discuss our latest results towards reaching this goal along with schemes to implement long-range interactions between atoms in the array.

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