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MEMS-based Flexible Optical Beam Steering for Quantum Information Processing in Atomic Arrays JUNGSANG KIM, CALEB KNOERNSCHILD, Duke University, FELIX LU, Applied Quantum Technologies, CHANGSOON KIM, KYLE MCKAY, Duke University — The main attraction of quantum computation utilizing arrays of atoms trapped in optical lattice is their potential scalability where a large array of individual atoms is made available. The main bottleneck in this vision is the availability of appropriate technology to realize flexible manipulation of the laser beams that control the individual qubits. Microelectromechanical systems (MEMS) technology provides a very flexible technology platform for steering of multiple simultaneous laser beams in one or two dimensions over a very wide range of spectrum. Since the nature of the steering mechanism is based on mechanical motion of mirrors, limited operational speed has been the major bottleneck of the MEMS approach. In this paper we report a two-spot beam steering system based on MEMS technology that is capable of simultaneously and independently illuminating any of 25 different locations within a 5x5 array with 2 laser beams of different wavelengths. Mirrors with settling times of $< 3\mu$s have been fabricated allowing fast access times between qubits. Such systems can be used to implement two-qubit gates in a 1D or 2D array of qubits.

Jungsang Kim
Duke University

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