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Broadband Multi-Spot Optical Beam Steering with Independent 2D Addressability for Quantum Information Processing[1] CALEB KNOERNSCHILD, CHANGSOON KIM, Duke Univ, FELIX LU, Duke Univ and Applied Quantum Tech., JUNGSANG KIM, Duke Univ. — While quantum computation utilizing trapped ions or neutral atoms has seen significant advances in recent years, the necessary scalability of such implementations is limited in part by the distribution of laser resources. The capability to address multiple qubit locations with a single laser is an essential element in moving these experiments beyond individual quantum gate demonstrations. An optical system utilizing micro-electromechanical system (MEMS) technology can provide a scalable solution to address a qubit array with multiple independent beams concurrently. Broadband coatings can accommodate a large range of wavelengths, while fabrication techniques allow expansion to multiple parallel laser beams over a large number of trap locations. We demonstrate a two-spot beam steering system using MEMS mirrors that can simultaneously and independently illuminate any of 25 different locations within a 5x5 array with 2 laser beams of different wavelengths. Mirrors with settling times of $< 5\mu$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.

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