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MEMS-based beam steering system for individual addressing of trapped ions TAEHYUN KIM, CALEB KNOERNSCHILD, EMILY MOUNT, STEPHEN CRAIN, RACHEL NOEK, Duke University, DANIEL GAULTNEY, ANDRE VAN RYNBACH, PETER MAUNZ, JUNGSANG KIM, Duke University
— One of the important components to implement large-scale trapped ion quantum information processing is a scalable technology to manipulate individual ions in a long linear chain of ions. So far, individual addressing has been demonstrated by steering a focused laser beam on individual ions with acousto-optic and electro- optic deflectors, by utilizing the Zeeman shift due to a magnetic field gradient, and by separating a single ion from the rest of the chain for individual exposure to laser light. Micro-mirrors based on microelectromechanical system (MEMS) technology can be used to design an alternative beam steering system which can handle multiple beams with different wavelengths and address locations in multiple dimensions. We will report our progress in integrating a MEMS beam steering system with an Yb ion trap experiment. Our MEMS system is designed to steer an ultraviolet beam with a waist of $\sim$1.5μm across a 20μm range. To demonstrate the individual addressing capability, we plan to measure the Ramsey interference of the differential AC Stark shift induced by an individually-focused, far-detuned laser beam.

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