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Scalable micro-scale optics for planar ion traps TRUE MERRILL, Georgia Institute of Technology, HARLEY HAYDEN, CHIEN-SHING PAI, Georgia Tech Research Institute, RACHEL NOEK, JUNGSANG KIM, Duke University, CURTIS VOLIN, Georgia Tech Research Institute — Efficient collection of fluorescence from atomic ions is required for fast high-fidelity measurement in ion trap quantum information processing. Conventional multi-element lens stacks can achieve photon collection efficiencies as high as 5%, however these systems typically have restricted field-of-view and are not generally scalable to image large arrays of ions. We report the development and fabrication of planar traps with integrated micro-scale spherical mirrors with an expected 15% collection efficiency. The mirror shape is controlled with a combination of silicon wet-processing and polishing techniques while maintaining a surface roughness below $\sigma_{RMS} < 10$ nm. The design allows for multiple integrated mirrors in a single chip allowing for the simultaneous measurement of many ions over a 10 mm object space.

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