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Enhanced Light Collection from a Trapped Ion Using a Micromirror Integrated with Surface Trap[1] RACHEL NOEK, CALEB KNOERNSCHILD, TAEHYUN KIM, PETER MAUNZ, Duke University, TRUE MERRILL, HARLEY HAYDEN, C.S. PAI, Georgia Institute of Technology, JUNGSANG KIM, Duke University — Efficient collection of fluorescence from trapped atoms or ions is imperative for high speed, high fidelity quantum information processing. Using low f-number conventional collection optics, less than 7% of light can be collected from a small field of view (FoV, <0.2mm). We add high numerical aperture micromirrors behind each point source, and image the reflected light from the micromirrors with a conventional f/2.55 imaging system and obtain a factor of 18 improvement in collection over the same system without the micromirrors. The FoV expands to 17.8 mm and the numerical aperture is limited by the micromirror behind the ion rather than the conventional optics. We used a fluorescent microbead mounted on a glass pipette and a custom fabricated 100 um diameter Al coated Si micromirror to demonstrate this principle. Micromirrors integrated with surface ion traps are currently under development for improved ion detection and FoV.

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