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Wavelength scale imaging of trapped ions for quantum networking[1] ERIK STREED, BENJAMIN NORTON, ANDREAS JECHOW, MATT PETRASIUNAS, DAVID KIELPINSKI, Griffith University — We have demonstrated wavelength scale imaging of Ytterbium ions with a microfabricated phase Fresnel lens. Near diffraction limited ion spot sizes of 440 nm (FWHM) were observed by fluorescence imaging on the 369.5 nm transition. The phase Fresnel lens was integrated in-vacuum with a needle style radio frequency Paul trap. To reduce the ion motion below the imaging resolution the ions were laser cooled close to the Doppler limit on the 369.5 nm transition This is the first demonstration of imaging trapped ions with a resolution on the order of the transition wavelength, an important step towards obtaining high efficiency mode-matching of the ion fluorescence emission to a single optical mode.

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