Abstract Submitted
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High-resolution imaging of a single atom for direct detection of atomic motion[1] JAIME WONG-CAMPOS, KALE JOHNSON, BRIAN NEYENHUIS, Joint Quantum Institute, University of Maryland Department of Physics, JONATHAN MIZRAHI, Sandia National Laboratories, Albuquerque, New Mexico, CHRISTOPHER MONROE, Joint Quantum Institute, University of Maryland Department of Physics, MONROE LAB TEAM — We present the high-resolution detection of the motion of a single trapped 171Yb+ ion using high quality imaging optical elements. Light scattered from a trapped ion is collected in a lens system with 0.6 input numerical aperture and working distance of 11.5 mm. Near diffraction-limited performance from the imaging system is verified through the use of a Zernike expansion over the point spread function, giving a minimum spot size (FWHM) of 375nm. By means of a position sensitive detector, we measure a photon shot-noise limited sensitivity on the position of the trapped ion to be $\sim$ 5 nm/sqrt(Hz), bottoming out to an minimum absolute sensitivity of $\sim$ 1nm. We use this technique perform to directly measure the rf-induced micromotion of the trapped ion, and this technique can also be used to directly sense the thermal or driven secular motion of the trapped ion.

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