Abstract Submitted
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Limits to optical imaging of trapped ions[1] ERIK STREED[2], Griffith University — Trapped ions are an important system for quantum information processing, molecular analysis, and precision metrology. Recent efforts have focused on development of large aperture optics for efficient fluorescence detection, coherent coupling to single mode fibres, and imaging with wavelength-scale resolution. The latter opens up the prospect of applying super-resolution imaging techniques to increase the sensitivity of precision metrology experiments with atomic ions or to probe the structure and dynamics of single well-isolated biomolecular ions. Laser-cooled atomic ions have frequently been approximated as point sources due to their strong confinement and low temperatures relative to the resolution and depth-of-focus of their associated imaging systems. We expand upon this to account for the effect of quantum or thermal motion in imaging trapped ions. To minimise the imaged spot size we calculate the optimal confinement geometry for a trapped ion based on the imaging system performance. Excursions along the optical axis introduce Laguerre-Gaussian "donut-mode" components to the imaged spot. Other factors that would increase the imaged size, such as Brownian motion in a buffer gas environment, are also considered.

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