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Collecting light emitted by a single atom into a single optical mode RACHEL NOEK, TAEHYUN KIM, EMILY MOUNT, DANIEL GAULTNEY, ANDRE VAN RYNBACH, CALEB KNOERNSCHILD, PETER MAUNZ, JUNGSANG KIM, Duke University — Connecting trapped ions with a photonic quantum link is a promising approach for long distance quantum communication and large scale quantum computation. Entanglement, quantum teleportation, private random number generation and a quantum gate [1] have been demonstrated between remote trapped ions. These probabilistic remote quantum operations can be made deterministic by using local Coulomb gates; however, the success probability is limited by the photon collection probability into a single mode and is currently too small to be useful. Here, we investigate the use of a cavity with a tightly focused mode and, alternatively, a spherical micro mirror in order to improve the photon collection from single trapped ions. Furthermore, we will report experimental progress on the realization of an ion trap within a cavity formed by a high-reflectance coated fiber tip and a spherical mirror. The rf-Paul trap will be patterned directly on the tip of a fiber ferrule.

[1] P. Maunz, et al., *Phys. Rev. Lett.* 102, 250502 (2009).

Rachel Noek
Duke University

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