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Integration of ion trap and optical cavity towards efficient entanglement generation between remote ions TAEHYUN KIM, PETER MAUNZ, RACHEL NOEK, CALEB KNOERNSCHILD, EMILY MOUNT, JUNGSANG KIM, Duke University — Entanglement of remote ions [1] could lead to an alternative way to scale quantum information processing (QIP). The heralded entanglement generation relies on the collection and interference of two photons from different ions. In current experiments, the success probability of this protocol is very small mainly due to limited photon collection probability. Increasing the photon collection probability from a single ion is thus essential to make the remote entanglement protocol useful for scalable QIP. Here, we present progress towards an experiment in which a single trapped Ytterbium ion will be coupled to the mode of a small high finesse cavity. A surface ion trap will be patterned on a fiber ferrule to trap an ion in the center of a tightly focused light mode. The cavity will be formed by the fiber tip and a mirror with 5mm radius of curvature. We will analyze trap characteristics and the photon extraction probability that is realizable with available technology.

[1] S. Olmschenk et al., Science 323, 486 (2009).

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