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Integrated optics approach towards ion trap quantum computation TAEHYUN KIM, CALEB KNOERNSCHILD, JUSTIN MIGACZ, RACHEL NOEK, MICHAEL SILVER, JUNGSANG KIM, Duke University — A recent proposal for realizing scalable quantum computation is based on a microfabricated ion trap and its integration with micro-optical components performing various functionalities required for state preparation, gate operation, and state detection. In this work, we present our recent progress in implementing a micro-cavity system integrated with an ion trap. In our scheme, a circular-symmetric planar Paul trap will be fabricated on a fiber tip, and a micro-cavity will be formed between the fiber tip and a micro-mirror fabricated on a silicon wafer by isotropic etching. This cavity can dramatically enhance the coupling efficiency into the fiber by the increased spontaneous emission rate into the cavity mode. The enhanced coupling increases the state detection efficiency of trapped ions and entanglement probability of two remote ions. The trapped ion inside a cavity can also allow us to implement cavity QED system between the ion and photons inside the fiber.

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