

Abstract Submitted
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A hybrid trapped ion system with ultrafast pulse lasers SHUOMING AN, MARK UM, DINGSHUN LV, JING-NING ZHANG, KIHWAN KIM, LUMING DUAN, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing — We report the experimental progress to realize a hybrid trapped ion system, where Barium and Ytterbium ions share vibrational modes in the same radio-frequency trap. The hybrid system is considered to be essential for the realization of a large scale quantum system with trapped ions. For the system with a few tens ions, continuous cooling of the whole ion chain is required during massive quantum operations. We can use the internal state of Ba ion for quantum computation and transitions of Yb for refrigeration of the system or vice versa. For the trapped ion based quantum repeater, a local entangling operation between different atomic ions is critical procedure to protect qubit information during enormous trials of probabilistic photon connection. We can realize the entangling operation between Ba and Yb ions by applying two pairs of picoseconds laser beams at the wavelengths of 355nm and 532nm, which are generated by frequency doubling and tripling of Nd:YAG laser. This work was supported by the National Basic Research Program of China Grant 2011CBA00300, 2011CBA00301, 2011CBA00302, the National Natural Science Foundation of China Grant 61073174, 61033001, 61061130540. KK acknowledges the support from the Thousand Young Talents Plan.

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