Abstract Submitted
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Sympathetic cooling of $^{171}Yb^{+}$ qubit ions on a scalable ion trap chip using Yb isotopes[1] YEONG-DAE KWON, ASRI/ISRC and Department of Electrical and Computer Engineering, Seoul National University, JUN SIK AHN, Quantum Tech. Lab., SK Telecom, SEOKJUN HONG, MINJAE LEE, HONGJIN CHEON, DONGIL DAN CHO, ASRI/ISRC and Department of Electrical and Computer Engineering, Seoul National University, TAEHYUN KIM, Quantum Tech. Lab., SK Telecom — To achieve ion trap based large-scale quantum computing devices, motional states of qubit ions must be regulated against heating from ion transportation or noise on the chip surface while leaving internal states of the ions intact. Sympathetic cooling is a natural solution for this problem, but trapping two different species of ions generally requires two sets of optical devices including separate lasers for each ion type, increasing the complexity and the cost of the setup. We tested Doppler-cooled $^{174}Yb^{+}$ ions to sympathetically cool $^{171}Yb^{+}$ qubit ions. Since these two isotopes have energy levels close to each other, the optical setup can be vastly simplified. We also verified that the tail of non-ideally focused cooling beam and the scattered light from the surface create excited state population in the $^{171}Yb^{+}$ qubit ions, as expected. This leads to occasional spontaneous emission events, which currently limits the coherence time of our qubit to a few seconds. We will also discuss our plans for optimizing the experiment, which may increase the coherence time by one or two orders of magnitude.

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