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surface-electrode ion trap loaded by laser ablation PAUL AN-
TOHI, WASEEM BAKR, ISAAC CHUANG, JAROSLAW LABAZIEWICZ, KEN
BROWN, MIT — traps operated at liquid helium temperatures offer many advan-
tages

for exploring new physics, such as quantum interactions between ions and superconductors; cooling may also reduce anomalously high ion heating rates currently observed and attributed to surface charge fluctuations. However, cryogenic traps are traditionally experimentally challenging to realize, due to the careful attention required to thermally anchor the trap, and due to the incompatibility of standard high-temperature ion sources with a cryogenic environment. We demonstrate a new approach to these challenges using a millimeter scale printed-circuit board trap with surface electrode geometry, operated in a liquid helium bath cryostat, to trap and cool strontium 88 ions. The planar aspect of this trap simplifies anchoring to the helium baseplate, and provides clear access for loading ions from an ablation plume produced by <7 mJ pulses of a Q-switched Nd:YAG laser incident on a Sr/Al alloy target. We are able to load traps with depths as low as 0.7 eV, and with laser cooling we observe small ion crystals with between one and twenty six optically resolved ions, with individual ion lifetimes averaging 2 hours. Initial estimates based on the observed residual gas collision rates are consistent with a vacuum pressure below 10^{-9} torr, and the true pressure is likely much lower.

Paul Antohi
MIT

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