Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Experimental demonstration of cooling of trapped ions by atoms of higher mass SOURAV DUTTA, Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai 400005. , S. A. RANGWALA, Raman Research Institute, C. V. Raman Avenue, Sadashivanagar, Bangalore 560080. — Buffer gas cooling is one of the most widespread methods to cool ions trapped in a Paul trap. The method relies on elastic collisions of the ions with pre-cooled atoms. However, cooling by a uniformly distributed buffer gas has a limitation – the ion cooling occurs only if the coolant atoms are lower in mass compared to the trapped ion. We surpass this limitation by using a localized ensemble of ultracold atoms. We experimentally demonstrate, for the first time, that cooling of low-mass trapped ions by atoms of higher mass is possible. In particular, we show that trapped $^{39}K^{+}$ ions are cooled by magneto-optically trapped ultracold ^{85}Rb atoms. The atom:ion mass ratio (= 2.18) is well beyond any theoretical predictions for uniform buffer gas cooling. The result opens up the possibility of cooling trapped H_2^+ using ultracold ^{6}Li atoms.

Sourav Dutta
Tata Institute of Fundamental Research

Date submitted: 31 Jan 2019 Electronic form version 1.4