

Abstract Submitted
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Surpassing the mass restriction of buffer gas cooling: Cooling of low mass ions by localized heavier atoms¹ SOURAV DUTTA, RAHUL SAWANT, S. A. RANGWALA, Raman Research Institute, C. V. Raman Avenue, Sadashivanagar, Bangalore - 560080 — Cooling of trapped ions has resulted in fascinating science including the realization of some of the most accurate atomic clocks. It has also found widespread application, for example, in mass spectrometry and cold chemistry. Among the different methods for cooling ions, cooling by elastic collisions with ultracold neutral atoms is arguably the most generic. However, in spite of its widespread application, there is confusion with regards the collisional heating/cooling of light ions by heavier neutral atoms. We address the question experimentally and demonstrate, for the first time, cooling of light ions by co-trapped heavy atoms [1]. We show that trapped $^{39}\text{K}^+$ ions are cooled by localized ultracold neutral ^{85}Rb atoms. The atom-ion mass ratio ($= 2.18$) is well beyond any theoretical predictions so far. We further argue that cooling of ions by localized cold atoms is possible for any mass ratio. The result opens up the possibility of reaching the elusive s-wave collision regime in atom-ion collisions. [1] S. Dutta et al., Collisional cooling of light ions by co-trapped heavy atoms, *arXiv*: 1512.04197

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