

Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

A hybrid quantum system of ultracold atoms and trapped ions

CARLO SIAS, LOTHAR RATSCHBACHER, CHRISTOPH ZIPKES, MICHAEL KOEHL, Cavendish Laboratory, University of Cambridge, AMOP TEAM — In the last decades, trapped ions and ultracold atoms have emerged as exceptionally controllable experimental systems to investigate fundamental physics, ranging from quantum information science to simulations of condensed matter models. Even though they share some common grounds in experimental techniques, such as laser cooling, ion trapping and atom trapping have developed very much independently, and only little cross-pollination has been seen. In our experiment we study how cold atoms can be combined with single trapped ions to create a new hybrid quantum system with tailored properties. We have deterministically placed a single ion into an atomic Bose Einstein condensate and demonstrated independent control over the two components within the hybrid system. We have studied the fundamental interaction processes and observed sympathetic cooling of the single ion by the condensate. Additionally, we have characterized elastic and inelastic atom- ion collisions and measured the energy-dependent reaction rate constants. Our experiment paves the way for coupling atomic quantum many-body states to an independently controllable single-particle, giving access to a wealth of novel physics and to completely new detection and manipulation techniques.

Carlo Sias
Cavendish Laboratory, University of Cambridge

Date submitted: 04 Feb 2011

Electronic form version 1.4