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# Optimized Cooling of Ions by Collisions with Cold Parent Atoms

We present a combined ion-atom trap which consists of a linear Paul trap and a magneto optical trap (MOT). It traps ions and atoms simultaneously with spatial overlap, and enables us to study interaction between the trapped ions and cold atoms.[1]
In the experimental configuration described above, cooling of ions has been unambiguously established even for equal mass of ion and the atom due to the localized MOT atom distribution leads to cooling of ions.[2] A single ion-atom resonant charge exchange collision bringing a fast ion to a complete stop will be discussed. The experimental conditions, when such collisions are favorable, are enumerated. The ion cooling processes have to be numerically computed in the quantum collisions framework for low temperatures.
It has been shown that this cooling of the ions is limited by the micro-motion of ions in the trap in such systems.[3] Numerical calculation and efficient trap designs for minimizing the radio frequency heating and micro-motion effects and there by optimizing the collisional cooling of ions will be presented. Finally the utility and future prospects of this method [4] are discussed.

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