

Abstract Submitted
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Estimates of Collisional Cooling and Quenching Rates for Atomic and Molecular Ion Collisions with Ultracold Atoms. WINTHROP SMITH, JAMES WELLS, University of Connecticut — Translational cross sections and rate coefficients for cold ion-neutral elastic and charge-exchange collisions (either atomic or molecular) are \gg larger ($\sim 10^6$ a.u.) than neutral-neutral collisions at the same CM energy. This is due to the long range polarization potential $V(R) = -C_4/R^4$, where C_4 is proportional to the polarizability of the neutral partner. Thus collisions between ultracold alkali atoms (trapped in a magneto-optic trap or MOT) and low-energy ions can be used for sympathetic cooling experiments. We are building a prototype hybrid-trap apparatus [1] that applies these principles to collisions of Ca^+ ions (which can be laser pre-cooled) with MOT-trapped ultracold Na atoms. Some calculations on this system and other related ion-neutral systems have been published [2] and some initial experiments on other ion-neutral species have begun [3]. Estimates of cooling and quenching rates in the low K-mK CM energy range for Ca^+ on Na and other cases will be presented and possible experiments described. [1] Winthrop W. Smith, Oleg P. Makarov and Jian Lin, *J. Modern Optics* **52**, 2253 (2005). [2] R. Côté and A. Dalgarno, *Phys. Rev. A* **62**, 012709 (2000); R. Côté, *Phys. Rev. Lett.* **85**, 5316 (2000). [3] A. Grier, M. Cetina, F. Orucevic, and V. Vuletic, ArXiv atom-ph/0808.3620.

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