Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Cold ion-neutral chemistry: Measurement of charge-exchange reaction rates in the Na + Ca^+ system using a hybrid atom- ion trap JONATHAN KWOLEK, Naval Research Laboratory, DOUGLAS GOODMAN, Quinnipiac University, BENJAMIN SLAYTON, Wentworth Institute of Technology, REINHOLD BLUMEL, Wesleyan University, JAMES WELLS, Claremont McKenna, Pitzer, and Scripps Colleges, FRANK NARDUCCI, Naval Postgraduate School, WINTHROP SMITH, University of Connecticut — We present new state-selective measurements of charge-exchange reaction rates between Na[^{2}S, ^{2}P] and Ca^+[^{2}S, ^{2}D] using a hybrid trap consisting of a linear Paul trap and a concentric magneto-optical trap (MOT). We measure reaction rates by monitoring the decay of the trapped ion population when overlapped with a MOT, which depend strongly on the ion-cloud temperature and laser-controlled quantum states of the Na and Ca^+ reactants. The optically dark Ca^+[^{2}S, ^{2}D] ion temperature is controlled by either excess micromotion heating or sympathetic cooling from the Na MOT. We find evidence of both endothermic and exothermic reactions, the strongest of which is the Na[^{2}P] on Ca^+[^{2}D] with a reaction rate 10^{-8} cm^3/s, which exceeds the classical Langevin limit. This work was supported by NSF PHY-1307874.

Jonathan Kwolek
University of Connecticut

Date submitted: 01 Feb 2019 Electronic form version 1.4