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Control of atom-ion reactions at low temperatures MICHAEL MILLS, PRATEEK PURI, ELIZABETH WEST, CHRISTIAN SCHNEIDER, ERIC HUDSON, Univ of California - Los Angeles — We discuss experiments performed in the MOTion trap, a hybrid atom-ion trap comprised of a linear quadrupole trap and a co-located magneto-optical trap. We first present the synthesis of $BaOCa^+$, the first molecule of its type to be observed. With the tools of the MOTion trap, we identify and investigate the mechanism of its formation via the barrierless reaction of Ca (^3P_J) with $BaOCH_3{}^+$. Next, we describe our studies of charge exchange reactions at low temperatures. We observe a suppression of the reaction rate at low temperatures due to the electric field of the ion shifting the transition energies of the neutral, and we propose a general method to eliminate this suppression, enabling control of low-temperature atom-ion reactions. Finally, we introduce a new method of controlling collision energy. By varying the axial confinement voltages of our ion trap, we shuttle the ions through the cloud of neutral atoms, providing a general technique with energy resolutions improved over current methods by an order of magnitude for collision temperatures ranging from a few mK to 10s of K.

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