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Investigation of Isotope Effects in Single Ion Reactions JAMES GOEDERS, CRAIG CLARK, NCAMISO KHANYILE, KENNETH BROWN, Georgia Institute of Technology — Cold molecular ions are of great interest for studying chemical reactions. At the ultralow temperatures achievable using laser cooling techniques, chemical reactions are dominated by quantum effects not generally observed at higher temperatures. Studying reactions at these low temperatures allows for probing of the reaction mechanisms and the topology of potential energy surfaces, providing tests of *ab initio* and reactive- scattering calculations. Many chemical reactions are dominated by isotope effects. Ion beam studies have looked at reactions of alkaline earth ions with HD and observed different patterns of reactivity between Period 2 and Period 3 elements. Magnesium was shown to have a larger reaction cross-section for forming MgD^+ than MgH^+ by a factor of 2 - 4. Single ion experiments involving reactions between Mg^+ in the $3p^2P_{3/2}$ excited state and HD, utilizing trapped atomic ions, were done by Staanum *et al.*, showing a branching ratio on the order of the results seen in the beam studies. Ion beam experiments have also been done on ground-state $^{40}Ca^+$ with HD. In those experiments, the ratio of formation of CaH^+ to CaD^+ was observed to be $\sim$4, opposite and in stark contrast to the magnesium ratio. The current work compares single atomic calcium ion data with molecular beam data, looking at both the $4p^2P_{3/2}$ and the $4p^2P_{1/2}$ excited states, similar to the work done with Mg^+.

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