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Quantum Chemistry and Non-equilibrium Thermodynamics in an Atom-Ion Hybrid Trap[1] MICHAEL MILLS, PRATEEK PURI, STEVEN SCHOWALTER, ALEX DUNNING, CHRISTIAN SCHNEIDER, ERIC HUDSON, Univ of California - Los Angeles — In this presentation we describe work conducted with the MOTion trap - a hybrid atom-ion trap consisting of a linear quadrupole ion trap (LQT) and a co-located magneto-optical trap (MOT). With the long interrogation times associated with the ion trap and precisely tunable entrance channels of both the atom and ion via laser excitation, the MOTion trap is a convenient platform for the study of quantum state resolvable cold chemistry. We describe a recent study of excited state chemistry between cold Ca atoms and the BaOCH3+ molecular ion, which has resulted in the product BaOCa+, the first observed mixed hypermetallic alkaline earth oxide molecule. Further, due to the complexity of ion-ion heating within an LQT and micromotion interruption collisions, there remain many open questions about the thermodynamics of ions in a hybrid trap environment. We describe an analytical model that explains the thermodynamics of these systems as well an experimental effort confirming one of the more interesting hallmarks of this model, the bifurcation in steady state energy of ions immersed in an ultracold gas.

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