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Quantum Chemistry and Non-equilibrium Thermodynamics in an Atom-Ion Hybrid Trap PRATEEK PURI, MICHAEL MILLS, STEVEN SCHOWALTER, ALEX DUNNING, CHRISTIAN SCHNIEDER, KUANG CHEN, ERIC HUDSON, Univ of California - Los Angeles — Hybrid atom-ion traps allow for the precise control and investigation of atom-ion collisions in the ultracold regime. Recently our group has utilized these platforms for the study of quantum chemistry and non-equilibrium thermodynamics. With the long interrogation times associated with the ion trap environment and precisely tunable entrance channels of both the atom and ion via laser excitation, LQT-MOT hybrid traps are 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, as parameterized by total ion number.

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