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Radiative effects in cold atom-ion chemistry and the development of a molecular ion qubit PRATEEK PURI, MICHAEL MILLS, ELIZABETH WEST, CHRISTIAN SCHNEIDER, ERIC HUDSON, University of California, Los Angeles — We present results from a set of experiments investigating cold atom-ion chemistry in an ion trap-MOT hybrid system. With the ability to tune reagent electronic state, identify reaction product masses and branching ratios, and manipulate atom-ion collision energy from 0.01-50 K, the capabilities of our hybrid trapping apparatus are well suited for the study of quantum chemical dynamics. Utilizing these tools, we discuss studies where optical fields are employed to enhance the rate of excited state reactions that are otherwise difficult to probe. We also describe how spontaneous emission dynamics can dramatically suppress chemical reactions in the cold regime, an effect that may be crucial for next-generation atom-ion sympathetic cooling experiments where such reactions may be a limiting mechanism. Lastly, we present our progress on developing a method for reading out the rotational state of a sample of polar molecular ions placed within an ultracold atomic bath, a precursor for developing a high-fidelity molecular ion qubit.

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