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Quantum-State-Resolved Ion-Molecule Chemistry GARY CHEN, TIANGANG YANG, WESLEY CAMPBELL, ERIC HUDSON, UCLA — We propose a method to achieve quantum-state-resolved ion-molecule chemistry by utilizing cryogenic buffer gas cooling techniques and a combination of ion imaging and mass spectrometry of targets in an RF Paul trap. Cold molecular species produced by a cryogenic buffer gas beam (CBGB) are introduced to target ion species in an linear quadrupole trap (LQT) where ion imaging techniques and time of flight mass spectrometry (ToF) are then used to observe the target ions and the charged reaction products.[1][2] By taking advantage of the large ion-neutral interaction cross sections and characteristically long ion trap lifetimes, we can utilize the precision control over quantum states allowed by an ion trap to resolve state-to-state quantum chemical reactions without high-density molecular sample production, well within proposed capabilities. The combination of these two very general cold species production techniques allows for production and observation of a broad range of ion-neutral reactions. We initially plan to study chemical reactions between sympathetically cooled carbon ions (via laser cooled beryllium ions) with buffer gas cooled water. This work is supported by the US Air Force Office of Scientific Research.

Gary Chen
UCLA

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