

TOWARD THE USE OF RYDBERG STATES FOR STATE-SELECTIVE PRODUCTION OF MOLECULAR IONS

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The usual simplified view of Rydberg states of molecules as consisting of a single Rydberg electron loosely bound to a molecular ion core in a well-defined rotation-vibration state suggests an attractive possibility for state-selective production of molecular ions. A Rydberg electron excited above the energy of the ground state of the ion core will spontaneously autoionize, leaving behind a molecular ion. The autoionizing states are of strongly mixed character due to the ubiquitous nonadiabatic interactions between Rydberg series associated with different states of the ion core. Using our complete Multichannel Quantum Defect Theory (MQDT) fit model for CaF, we have predicted the locations and strengths of special autoionizing resonances that decay into a single rotation-vibration state of a molecular ion. Few molecules are as well characterized as CaF, nor as elegantly simple. We additionally describe the use of core nonpenetrating states as a general method to produce an ensemble of molecular ions in a single, selectable quantum state.