What is new on the mode-specific and bond-selective chemistry in bimolecular reactions?

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This talk will highlight our recent studies on the reaction of atoms/radicals with stretch-excited methane isotopomers. The experiments were performed under crossed-beam conditions, using a time-sliced, ion velocity-imaging detection scheme, which enables us to acquire the quantum-state correlation of the coincidently formed product pairs [1,2]. Such product pair-correlation measurements can reveal dynamics information that are often hidden or lost by conventional measurements [3]. To explore the mode-specific and bond-selective reactivity, a narrowband IR OPO/OPA was used to prepare the stretch-excited methane reactants [4-8]. A number of fundamental issues in reaction dynamics will be elucidated when compared to the ground state reactivity. In particular, a conceptual framework that links the mode-selective chemistry to the stereo-specific reactivity will be proposed, which in turn leads to a complementary view of the Polanyi's rules [9,10] from different perspective. More recently, the polarization property of the IR pumping laser was exploited to actively control the reaction outcomes in stretch-excited reactions [11].

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