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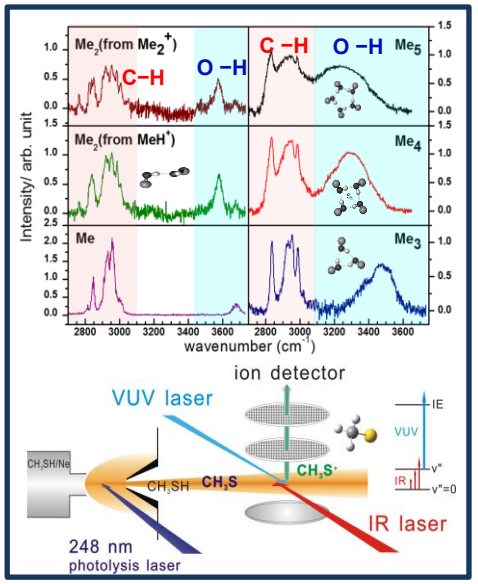
Free Radicals, Atmospheric/Combustion/Planetary Chemistry, Time-resolved Infrared, Photoionization, Matrix Isolation

We are interested in unstable species or free radicals that are important in atmospheric , combustion, or planetary chemistry, but are difficult to detect using conventional techniques. We study their spectroscopy, kinetics, and dynamics experimentally and use theoretical computations to help. Representative techniques are: **(a) Step-scan FTIR:** In the absorption mode, we detect reaction intermediates such as Criegee intermediates CH_2OO and their reaction intermediates. In the emission mode, we observed the rotational and vibrational states of products in photodissociation or bimolecular reactions to understand their dynamics. **(b) Mass-selected IR:** We used VUV photoionization/time-of-flight mass to detect ions. By observing the variations in signals of various ions when a tunable IR laser light is applied prior to ionization, we can derive mass-selected IR spectra of clusters or free radicals. **(c) Para-hydrogen Matrix Isolation:** Para-hydrogen, a quantum solid, has emerged as a novel matrix host for investigating unstable species at 3 K . Taking advantage of its diminished cage effect, we produced various free radicals and detect them by IR or fluorescence. We also applied electron bombardment to produce protonated species. **(d) Ultrafast Spectroscopy:** Investigate dynamics of materials or solutions in femtosecond range.

Key Facilities: femtosecond laser systems, excimer lasers, Nd:YAG lasers, dye lasers, IR lasers, step-scan FTIR, cryogenic systems (3K or 10K), TOF-mass, cavity ringdown systems.



IR-VUV ionization/time-of-flight detection