

Strong and Weak Field Control of Molecular Dissociation & Isomerization

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We present results from series of experiments aimed at controlling molecular fragmentation and isomerization in the gas phase. The fragmentation experiments are carried out using intense shaped laser pulses centered at 780 nm, and aim to control bond breaking in a family of halogenated methane molecules via dynamic resonances in the molecular ions. Control experiments are compared with pump-probe measurements and interpreted in terms of wave packet dynamics on ionic potential energy surfaces [1].

In the isomerization experiments, we also make use of dynamic ionic resonances in the infrared. However, in these experiments, the ionic resonances are used for detection rather than for control. Shaped ultrafast pulses in the deep ultraviolet [2] are used to initiate the electrocyclic ring-opening of 1,3-cyclohexadiene (CHD) - 1,3,5 - hexatriene (HT) reaction. The reaction is probed by following the ultraviolet pulse with an intense infrared laser pulse, which drives dissociative ionization. As the fragmentation of CHD driven by an intense infrared laser pulse is dramatically different from that of HT [2], we use the time of flight mass spectrum of the sample to monitor the pulse shape dependent isomerization dynamics. We will present preliminary control results along with pump-probe measurements.

References:

- [1] B. J. Pearson, S. Nichols and T. C. Weinacht submitted to the *Journal of Chemical Physics*
- [2] B. J. Pearson and T. C. Weinacht *Optics Express* **15**, 4385 (2007)
- [2] W Fuß, W. E. Schmid and S. A. Trushin, *Journal of Chemical Physics*, **112**. 8347 (2000)