# Enhanced ionization of $C_2H_2$ as a function of CC inter-nuclear separation

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**Synopsis** We observe enhanced ionization in acetylene by using pump probe technique with COLTRIMS

Molecular fragmentation is a process of fundamental importance in chemistry and biology. Numerous studies have investigated ionization-triggered fragmentation of molecules irradiated by strong laser pulses. In molecules ionization rate strongly depends upon the inter-nuclear separation and reaches a maximum value at some critical distance $R_c$. This process is called charge resonance enhanced ionization (CREI) [1]. Mechanism of enhanced ionization in hydrocarbons and poly atomic molecules is a matter of interest.

We study the acetylene molecule in order to understand the mechanism of CREI by using pump probe technique with few cycle laser pulses together with COLTRIMS (Cold Target Recoil Ion Momentum Spectroscopy). Since dication of acetylene can dissociate into a number of fragments via different pathways, we are focusing in symmetric breakup channel in which acetylene dissociates into two identical fragments similar to a diatomic molecule.

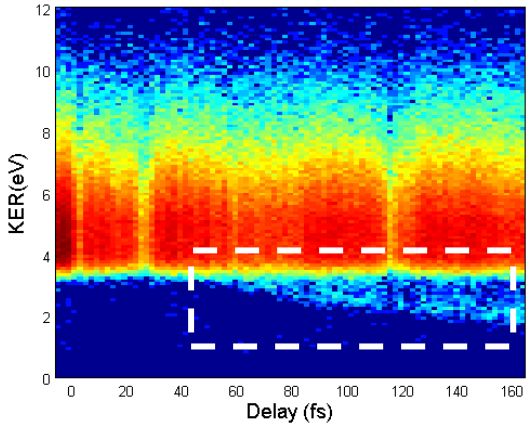


**Figure 1**: Kinetic energy release (KER) spectrum for symmetric breakup.

Figure 1 shows the kinetic energy release KER spectrum of the symmetric breakup channel as a function of delay between pump and probe. High KER region is due to dissociation of molecule from the pump pulse alone. Area inside the box is the time-dependent KER where molecular dissociation exhibits signatures of CREI In order to check the R-dependent ionization rate we run the experiment at different probe intensities to establish the intensity dependence of the symmetric dissociation channel.

The KER region from 1.6-3.0 eV is delay dependent for delay larger than 60fs. Figure 2 shows the average KER of the region from 1.6 to 2.9 eV after 60 fs delay.

Preliminary analysis indicates that $C_2H_2^+$ behaves in a manner similar to a diatomic molecule for symmetric breakup and shows the sign of enhanced ionization.

**References**

[1] *Han Xu, Feng He, D. Kielpinski, R.T.Sang and Igor Litvinyuk, Scientific Reports, 2015.*

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