INTENSE SHORT PULSE LASER-INDUCED
IONIZATION AND DISSOCIATION OF O_2^+ AND N_2^+ BEAMS

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The momentum distributions for ionization and dissociation of O_2^+ and N_2^+ exposed to intense short laser pulses have been studied experimentally using an event-mode coincidence 3D momentum imaging technique. Both 790 nm laser pulses (of 8 to 120 fs at intensities up to 10^{15} W/cm^2) and 395nm pulses (of 45 fs at intensities up to 10^{13} W/cm^2) have been used. The momentum distributions yield a rich structure in kinetic energy release (KER) and angular distribution that is used to deduce the dissociation pathways.

As illustrated in Fig. 1, taking intensity slices of the KER-*cos*θ distribution of the dissociation of diatomic molecules with complex electronic structures yields multifaceted structure. We will present experimental measurements of both angular (see Fig.2) and KER distributions of O_2^+ and N_2^+ dissociation over a range of intensities and pulse durations. These data will be accompanied by interpretations of the dissociation pathways that lead to various structures seen in the KER-cosθ distributions.

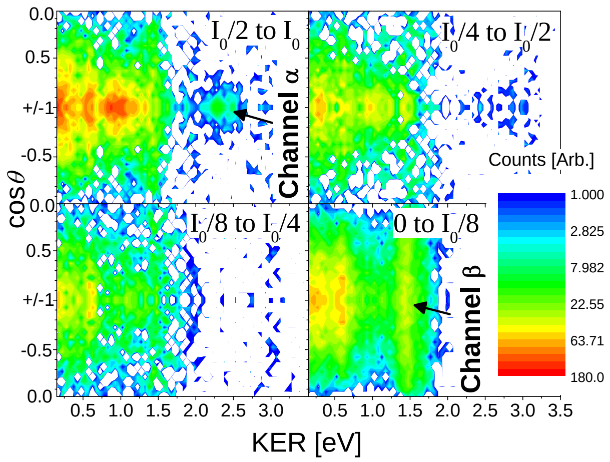

Fig. 1 KER-cosθ distributions for O_2^+, where θ is the angle between the molecular axis and the laser polarization. The four panels represent the distributions for four different intensity slices obtained using the intensity difference spectrum method [1] where $I_0 \simeq 1.3\times10^{15}$ W/cm^2.

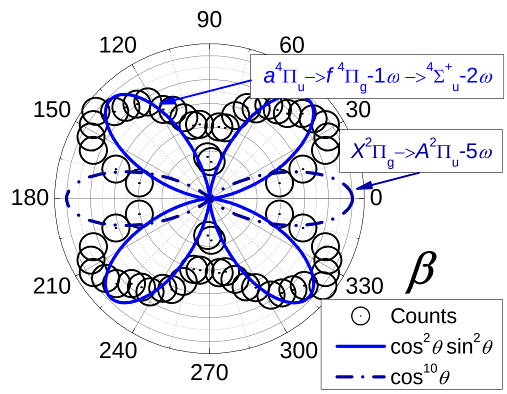

Fig. 2 cosθ distributions for the channel labeled β in the KER-cosθ distribution for O_2^+ shown in Fig. 1. This is a particularly interesting dissociation channel as the angular distribution is not aligned along the laser polarization.

In addition to dissociation, ionization of O_2^+ and N_2^+ is also measured. The angular distributions for these two molecules, which are theoretically predicted to be significantly different [2], will be presented along with probable dissociative ionization pathways.

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References

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[2] X. M. Tong *et al.*, J. Phys. B **38**, 333 (2005).