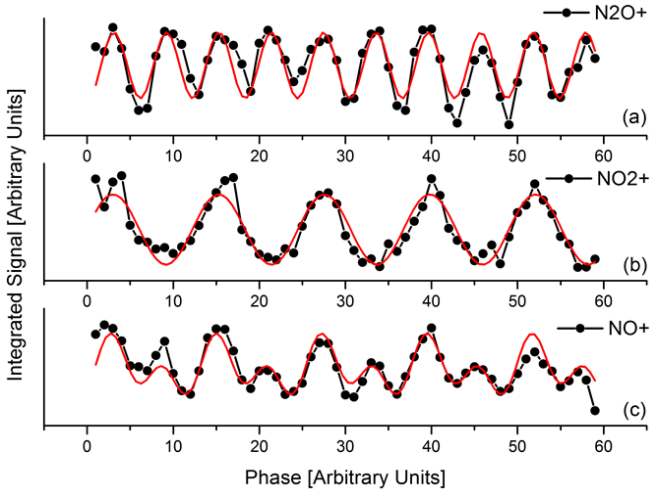
Interaction of N_2O molecules with asymmetric fs laser field

Kotsina N., Kaziannis S., Danakas S., Kosmidis C*.
Department of Physics, University of Ioannina, 45110 Ioannina, Greece
*kkosmid@uoi.gr

Phase control using dual-color fs laser fields have attracted a lot of attention in the last few years. The combination of the fundamental frequency of a Ti: Sapphire laser and its second harmonic ($\omega/2\omega$) has been applied in high harmonic generation, molecular orientation and controlling the reaction dynamics in gas phase.

In this work, we have employed a two-color ($\omega/2\omega$) intense (5×10^{15} W/cm^2) 40 fs laser field in order to study the ionization/dissociation of the linear triatomic nitrous oxide (N_2O) molecule. By means of time of flight mass spectrometry we were able to record the mass spectra as a function of the ($\omega/2\omega$) phase difference. Due to its asymmetric profile, the fs field interacts more efficiently with molecules that are oriented towards its polarization vector (selective ionization of geometrically oriented molecules). As a consequence, the released fragments exhibit directionality that can be altered by adjusting the relative phase between the two colors.The integrated signal of each fragment exhibits a sinusoidal form, whilst the singly charged parent molecule oscillates with the double frequency [1] (Fig. a and b). On the contrary, fragments generated from the photodissociation reaction $N_2O^{2+}\rightarrow N^+ + NO^+$ exhibit a peculiar behavior (Fig. c). This observation is attributed to the contribution of two dissociation channels leading to NO^+ fragments of the same kinetic energy. Based on the data these channels have been identified. Thus, the selective ionization technique is utilized in order to get more insight on the molecular dynamics by comparing the different dependence of the involved channels on the $\omega/2\omega$ phase. Moreover, a detailed analysis of the ionization/dissociation processes is given.



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