

# Determination of alignment dependent ionization probabilities of diatomic molecules in a double pulse pump-probe experiment

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We demonstrate the possibility of a double pulse pump-probe experiment to obtain the dependence of the ionization probabilities on the alignment of molecules with respect to the direction of laser polarization. A short weak pump pulse is used to generate a rotational wavepacket which produces aligned molecules at the periods of rotational revival, and an intense short probe pulse is used to ionize the molecules. The ionization probabilities vs the time-delay by the probe laser are calculated for different laser intensities for  $N_2$  and  $O_2$  molecules, for different relative polarization directions of the two lasers, and at different temperatures. Due to the different molecular symmetries of the outer valence shell electrons in  $N_2$  and in  $O_2$ , the alignment dependence of the ionization probabilities have been predicted to be quite

different molecular symmetries of the outer valence shell electrons in  $N_2$  and in  $O_2$ , the alignment dependence of the ionization probabilities have been predicted to be quite different based on the recently developed molecular ADK theory [1]. Using the present pump-probe experiment, the theoretical prediction on the alignment dependence can be directly tested without the use of Coulomb explosion. In Fig. 1 and 2 we showed the alignment of  $N_2$  and  $O_2$  with respect to the time delay and the predicted ionization probabilities vs time delay near the rotational revival, respectively.

## Reference

[1] X. M. Tong, Z. X. Zhao and C. D. Lin, Phys. Rev. A66, 033402 (2002).

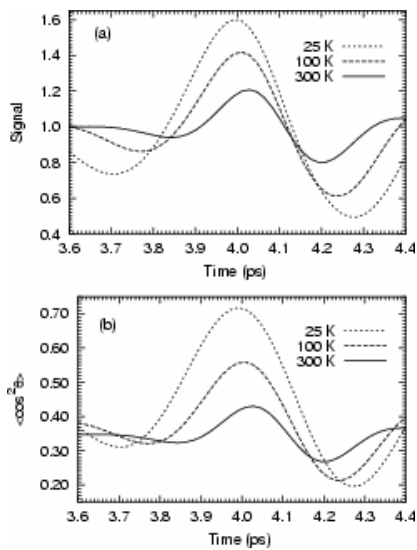


Fig. 1.  $N_2$ .

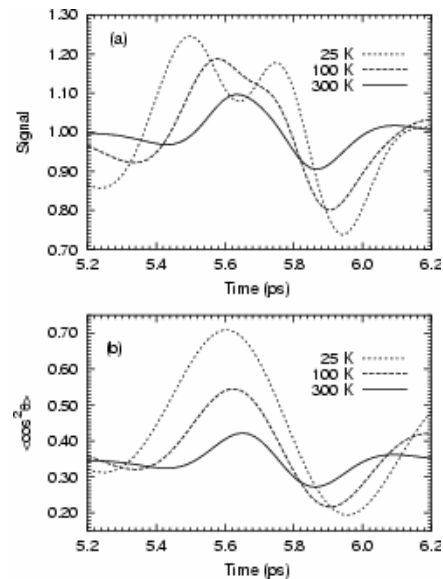


Fig. 2.  $O_2$ .