Towards a complete dynamical description of D_2^+ in strong laser fields

XXIX International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC2015) IOP Publishing
Journal of Physics: Conference Series **635** (2015) 112138 doi:10.1088/1742-6596/635/11/112138

Towards a complete dynamical description of D_2^+ in strong laser fields

A. Tóth*[1], S. Borbély†, G. J. Halász‡, and Á. Vibók*

* Department of Theoretical Physics, University of Debrecen, H-4010 Debrecen, PO Box 5, Hungary
† Faculty of Physics, Babeş-Bolyai University, Cluj-Napoca, Romania
‡ Department of Information Technology, University of Debrecen, H-4010 Debrecen, PO Box 12, Hungary

Synopsis In the framework of the present work we investigate the ionization and dissociation dynamics of D_2^+ irradiated by strong laser fields. We propose a simple three-level model, where the nuclear dynamics on the ground, dissociative, and ionization channels are considered. Our attention was focused on the calculation of ionization probability densities.

In previous studies it was shown that light-induced conical intersections (LICIs) can be formed in diatomic molecules either by standing or by running laser waves [1, 2]. The position of these LICIs is directly controlled by the laser frequency, while the strength of the nonadiabatic couplings is defined by the field intensity. The presence of the LICI has a strong impact on the physical properties of diatomic molecules. This impact was shown in the angular and energy differential dissociation probabilities of the D_2^+ target [3, 4, 5] calculated for different laser pulse parameters.

In order to obtain a more complete picture regarding the influence of LICIs on the molecular dynamics, beside dissociation, the ionization should also be considered. We have extended our previous model [3, 4] by including these ionization channels. The ionization probabilities of the discretized continuum states are obtained as the norm of the nuclear wave packets on the ionization channels.

Here we present our first results on the ionization and dissociation of D_2^+ by linearly polarized ultrashort laser pulses. In our calculations we considered only the vibrational degree of freedom of the molecule, while keeping its orientation parallel to the laser polarization direction, and monitored the ionization probability densities as a function of the energy and ejection angle of the continuum electrons.

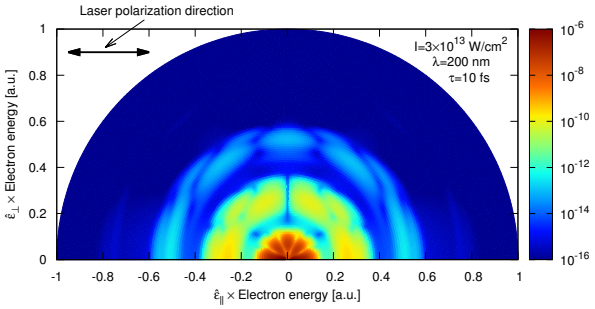

Figure 1. Ionization probability density as a function of electron energy and ejection direction ($\hat{\varepsilon}$).

The present work was supported by the OTKA (NN103251) project, the Hungarian Academy of Science, and by a grant of the Romanian National Authority for Scientific Research (CNCS UEFISCDI) project number PN-II-ID-PCE-2011-3-0192.

References

[1] N. Moiseyev *at al* 2008 *J. Phys. B* **41** 22101
[2] M. Sindelka *at al* 2011 *J. Phys. B* **44** 045603
[3] G. J. Halász *at al* 2013 *J. Phys. Chem. A* **117** 8528
[4] G. J. Halász *at al* 2013 *Phys. Rev. A* **88** 043413
[5] G. J. Halász *at al* 2014 *J. Phys. Chem. A* **118** 11908

[1]E-mail: attila.toth@ubbcluj.ro