

Tunneling site of electrons in strong-field-enhanced ionization of molecules

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We investigate electron emissions in strong field enhanced ionization of asymmetric diatomic molecules by quantum calculations [1]. Besides electron wave packet direct ionization from the up-field site (DIU), we find another two ionization channels, the field-induced excitation with subsequent ionization from the down-field site (ESID), and the up-field site (ESIU). The contributions from these channels depend on the molecular asymmetry and internuclear distance. Here, the molecular asymmetry is defined by the parameter $A=I_{pl}/I_{pr}$, where I_{pl} and I_{pr} denote the ionization energies of the left and the right cores, respectively, when the neighboring core is removed. At large internuclear distance the dominant contribution is from the DIU ionization channel regardless of molecular asymmetry. However, at small internuclear distance the other two ionization channels dominate and their relative contributions depend on the molecular asymmetry. For the molecule with large asymmetry ($A=2.6$) the electron is preferentially ionized from the up-field site by the ESIU channel (see Fig. 1), whereas for the molecule with small asymmetry ($A=1.3$) the electron is more likely ionized from the down-field site by the ESID channel (see Fig. 2). This provides a more comprehensive physical picture for the enhanced ionization of diatomic molecules. Finally, I will introduce our idea and situation about investigation of the H₂⁺ dissociation using the adiabatic theory [2].

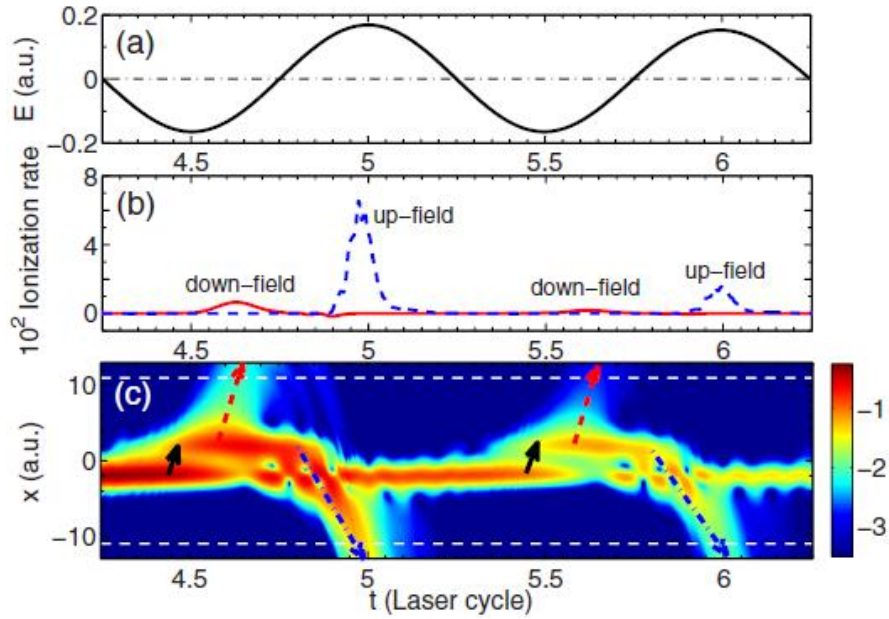


Fig. 1: (a) the laser electric field. (b) Ionization rate from the left (blue) and right (red) sides as a function of time. (c) Electron density as a function of time and the coordinate x for the asymmetry parameter $A=2.6$ at $R = 4$ a.u.

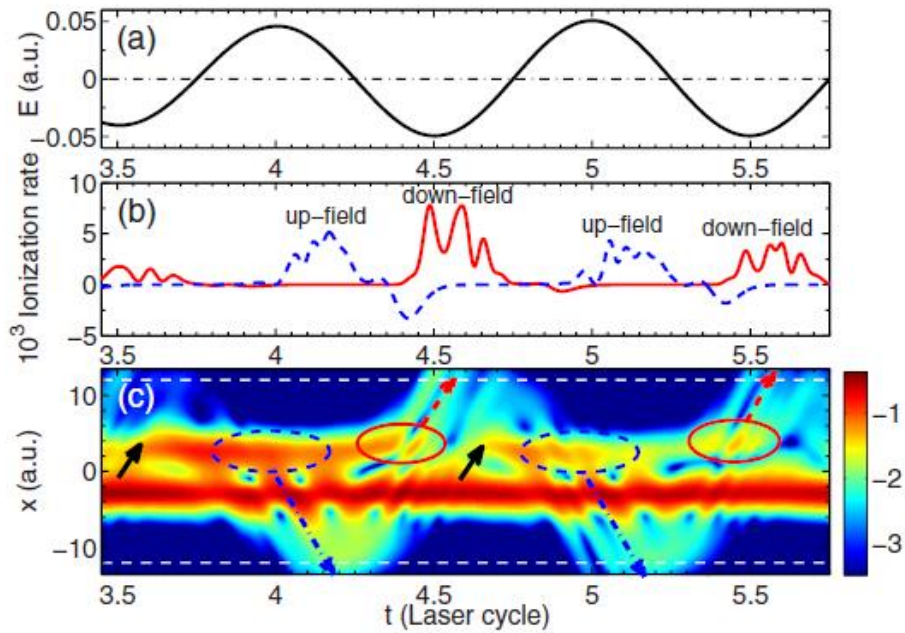


Fig. 2: (a) the laser electric field. (b) Ionization rate from the left (blue) and right (red) sides as a function of time. (c) Electron density as a function of time and the coordinate x for the asymmetry parameter $A=1.3$ at $R = 6$ a.u.

References

- [1] C. Huang *et al.*, Phys. Rev. A 90, 043420 (2014).
- [2] P. A. Batishchev, O. I. Tolstikhin, and T. Morishita, Phys. Rev. A 82, 023416(2010).