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Orientation-dependent phenomena in photoelectron angular distributions due to strong-field ionization of laser-irradiated diatomic molecules VLADIMIR USACHENKO, PAVEL PYAK, VYACHESLAV KIM, Institute of Applied Laser Physics UzAS, Tashkent, 100135, Uzbekistan, SHIH-I CHU, Department of Chemistry, University of Kansas, Lawrence, KS 66045-7582, USA — We report about orientation-dependent effects arising in molecular *photoelectron angular distributions* (PAD) due to well pronounced contribution from ionization of inner molecular valence shell(s) to strong-field above-threshold ionization of laser-irradiated homonuclear diatomic molecules (N_2, O_2 and F_2). In particular, our calculation results, obtained within the Density-Functional-Theory based Strong-Field-Approximation [V. I. Usachenko, P. E. Pyak and V. V. Kim *Phys. Rev.* A **79** 116901 (2009)], suggest that within the high-intensity field domain ($I \geq 3 \cdot 10^{14}$ W/cm^2) the molecular ionization dynamics for internuclear axis orientation angles $\pi/3 \leq \Theta \leq 2\pi/3$ (with respect to the incident laser field polarization) does become very pronounced and manifested by the well predominant contribution rather from the $1\pi_u$ inner shell than from the *highest occupied molecular orbital* (HOMO) ($3\sigma_g$ in N_2 or $1\pi_g$ in O_2 and F_2, normally predominantly contributing under standard cases).

Vladimir Usachenko
Institute of Applied Laser Physics UzAS, Tashkent, 100135, Uzbekistan

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