

Inner and Outer Ionization of Atomic Clusters by an Intense Attosecond Laser Pulse

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Synopsis: The dynamics of inner and outer ionization of atomic clusters irradiated by intense attosecond laser pulses has been considered. A comparison with the case of femtosecond pulses has been made.

The theory of inner and outer ionization of large atomic clusters by an intense attosecond laser pulse has been developed. Simple new expressions have been suggested for the rate of inner field ionization within the approximation of a strong sudden perturbation. It was shown that a simultaneous detachment of several electrons from atomic core inside the cluster occurs during the intense attosecond laser pulse. The charge multiplicity of atomic ions produced at the inner ionization of noble gas atomic clusters was determined. The conclusion has been made about significant difference between the action of attosecond and femtosecond laser pulses upon the atomic clusters.

Outer field ionization by an attosecond pulse was investigated also within the frames of

strong sudden perturbations. The charge of remaining ionized cluster depends significantly on the cluster size. All electrons produced during inner ionization are ejected from small atomic clusters. There is no cluster expansion during the whole attosecond laser pulse.

It was found that a significant decrease of the ionization potentials of atomic ions inside the cluster takes place due to plasma screening, analogously to the case of femtosecond pulses. The latter case was investigated by us previously [1].

References

[1] A.V. Gets and V.P. Krainov, *J. Phys. B: At. Mol. Opt. Phys.* **39** 1787-1795 (2006).

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