Nonlinear enhancement of nondipole effects in atomic photoionization

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The development of X-Ray Free-Electron Laser facilities caused significant progress in investigations of nonlinear atomic processes [1]. Here we propose the investigation of two simple systems where nondipole effects can be enhanced by nonlinear processes in comparison with single photon ionization by synchrotron radiation [2].

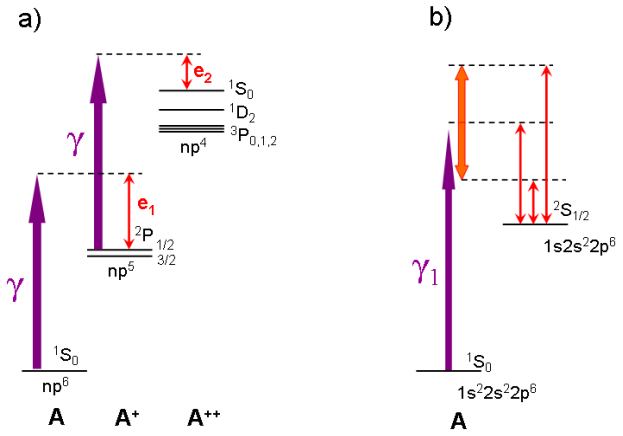

Fig. 1 Schemes of sequential two-photon double ionization (a) and two-color single ionization (b).

The first process is sequential two-photon double ionization (fig.1a). Here the atomic ionization (first step) is memorized and affects the ionization of the ion (second step) via polarization of the intermediate ionic state [3]. The memory of the first step leads to more complicated photoelectron angular distributions (PAD) in comparison with linear single photon ionization. The second process is two-color single ionization of inner atomic shell (fig. 1b). In this case the VUV photon causes dipole (E1) and quadrupole (E2) transitions into the atomic continuum and the additional optic laser with appropriate polarization can enhance or suppress a particular E1 or E2 branch. Thus the nondipole effects in the PAD of the sidebands can be more pronounced in comparison with the main photoelectron line. We calculated and analyzed PADs for both processes and can predict the optimal conditions to observe the nondipole effects. The results will be presented at the conference.

References:

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