Two-colour photoionization of atoms using extreme ultraviolet and optical laser radiation: what can we learn?

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Synopsis Two-colour photoionization of atoms together with electron imaging and coincidence techniques give access to very detailed descriptions of the photoionization dynamics.

Two-colour photoionization of atoms in combination with the measurement of photoelectron angular distributions (PADs) by imaging of the emitted electrons and photoion-photoelectron coincidence spectroscopy allows access to detailed information on the photoioniation dynamics not available from single photon ionization. To illustrate this we describe briefly the information available from two-photon ionization of He via the He*^{1}P 1snp states and how the extracted experimental parameters allow us a complete description of the photoionization dynamics [1].

The situation is already more complicated when we examine the ionization of the Ne* $2p^5\,(^2P_{1/2})\,3d\,[3/2]_1$ and Ne* $2p^5\,(^2P_{3/2})\,3d\,[3/2]_1$ states where the ionization channels are more numerous. The direct relation of the experimental quantities to the parameters describing the dynamics is no longer possible [2].

In the case of the ionization of the Xe* $5p^5(^2P_{3/2})5d[\frac{3}{2}]_1$ state via the $5p^5(^2P_{1/2})4f[\frac{5}{2}]_2$ autoionizing state we need to consider even more parameters. Here also the coupling of the nuclear spin with the total electronic angular momentum in the intermediate state need to be taken into account in order to properly describe the dynamics [3, 4].

Finally, we turn to the discussion of the dynamics of excited He* atoms inside He droplets as monitored by free-electron-laser pump (FERMI, Trieste) and optical-laser probe experiments employing the time-resolved photoelectron spectroscopy of the excited atoms as a diagnostic of the dynamics [5].

References

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