Near-threshold two-photon double ionization of Kr in the VUV

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Synopsis This work focuses on two-photon double ionization of Kr, upon interaction with free electron pulses in the vacuum ultraviolet (VUV). Angle-averaged and angle-resolved photoelectron measurements are reported in order to investigate the effect of the autoionizing resonances on the photoelectron angular ditrsibutions. The experimental findings are complemented by theoretical calculations.

We report angle-integrated and angle-resolved photoelectron measurements in near-threshold two-photon double ionization (TPDI) of Kr irradiated by free-electron laser (FEL) pulses in the vacuum-UV [1] photon energy region.

As shown in Figure 1, the angle-integrated measurements allow for the observation of the $^2P_{3/2}$ and $^2P_{1/2}$ components in the first ionization step, at approximately 11.20 eV and 10.50 eV, respectively. Three more photoelectron peaks, attributed to the second-ionization step, are also discernible.

Regarding the angle-resolved measurements, the photoelectron angular distributions (PADs) are compared with the results of semirelativistic R-matrix calculations [2]. As reported by Augustin et al. [3] it is found that the presence of autoionizing resonances within the bandwidth of the exciting FEL pulse strongly influences the PADs. The large spin-orbit interaction, inherent in 4p-subshell hole states of Kr, permits us to resolve and study PADs associated with some of the fine-structure components of the singly and doubly charged Kr ions.

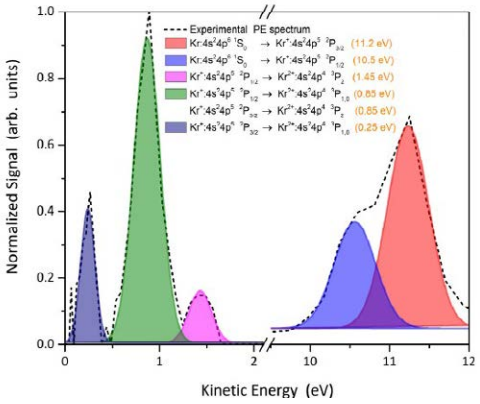

Figure 1. A representative experimental angle-averaged photoelectron spectrum for an FEL intensity of approximately 2.5×10^{13} W/cm^2.

References

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