

Single and double electron photodetachment from the oxygen anion at 41.7 nm

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The XUV-photodetachment of the oxygen anion O^- has been investigated at 41.7 nm (29.8 eV) with a newly developed crossed ion-photon beams experiment [1] using intense photon pulses from the free-electron laser FLASH [2-3] at DESY in Hamburg.

The ratio of single ($O^0 + e^-$) and double ($O^+ + 2e^-$) detachment was directly determined to be $\sigma(O^0)/\sigma(O^+) = 4.12 \pm 0.17$ as identified from the yield of O^0 and O^+ fragments measured with "DET 2" after XUV irradiation. Absolute cross section for the dominating single detachment channel was measured to $\sigma(O^0) = (2.1 \pm 0.6) \times 10^{-19} \text{ cm}^2$.

Analysis of photoelectrons detected in coincidence with neutral fragments (O^0) suggests that single photodetachment primarily happens via the ground (3P) or possibly lowest excited (1D) state of oxygen. The results demonstrate the feasibility and advantage of crossed beams experiments for complete studies of photodetachment reactions.

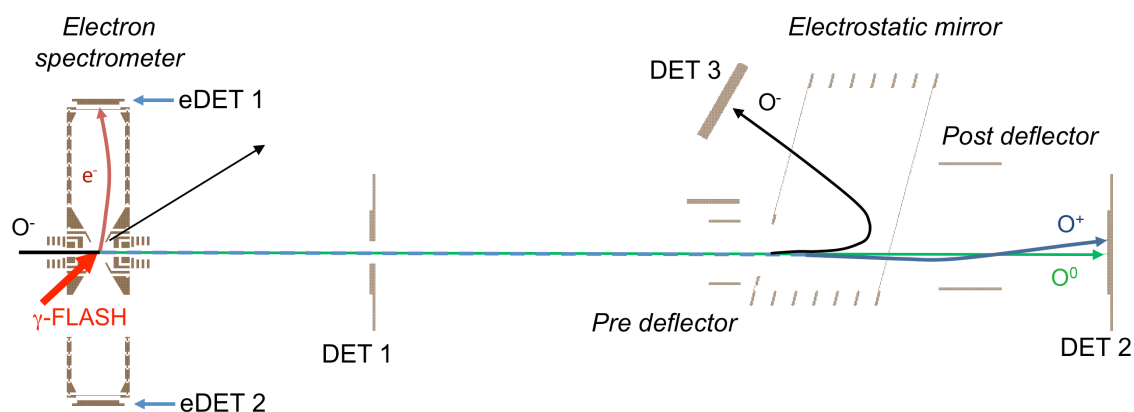


Figure 1. Schematic drawing of the interaction region and fragment detectors of crossed ion-photon beam [1] setup at the FLASH facility at DESY in Hamburg [2-3]. The lines show calculated fragment trajectories for O^0 (green) and O^+ (blue) after photodetachment in the interaction zone.

References:

- [1] L. S. Harbo *et al.*, Phys. Rev. A **86**, 023409 (2012).
- [2] W. Ackermann *et al.*, Nat. Photon. **1**, 336 (2007).
- [3] K. Tiedtke *et al.*, New J. Phys. **11**, 023029 (2009).