Decay Properties of Higher Vibrational States in CO for the C1s -> p* Excitation

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With the availability of third-generation synchrotron light sources for the soft X-ray regime in combination with high-resolution photoelectron spectrometers, the investigation of very weak processes, often hitherto not possible at all to study, has become feasible. The first example is the N1s $\rightarrow \pi^*$ resonant Auger decay to the B final state in N_2^+ [1] which demonstrates that a classification of decaying core-hole processes into "spectators" (2h-1e final state) and "participators" (1h-1e final state) is too rough in some cases. Another example is the observation of the spin selectivity in the vibrational progression of the X-participator decay following the $2p \rightarrow 6\sigma^*$ excitation in HCl which revealed a novel type of propensity mechanism [2]. In this work we reinvestigate the resonant Auger decay following C1s $\rightarrow \pi^*$ excitation in CO at high resolution. We will demonstrate that one can investigate the decay properties of higher vibrational levels than only $\nu' = 0, 1, 2$, even if these higher vibrational states are not "visible" in a total ion or total electron yield absorption spectrum.

The experiments were performed at the recently comissioned undulator beamline I 411 [3,4] at the third-generation storage ring MAX II at MAX-lab, Lund, Sweden. This beamline is equipped with a modified Zeiss SX 700 plane-grating monochromator, covering the energy range between 50 eV and 1200 eV at high photon flux, and a rotatable hemispherical Scienta SES 200 high-resolution electron spectrometer.

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