AUGER DECAY OF THE RESONANTLY EXCITED 2p $_{3/2}$-^{1}, $_{1/2}$ nl STATES OF ARGON

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The availability of intense, highly monochromatic photon beams, whose bandwidth is narrow compared to the natural width of inner shell levels, has permitted new observations in atomic physics. One example is the Auger resonant Raman effect: the deexcitation via Auger decay of a core excited atom produces spectra in which the line widths are not determined by the natural width of the core hole, but reflect the bandwidth of the exciting radiation and a linear dispersion of the Auger lines versus the photon
energy is observed. The states Kr 3d-1np (n*5) and Xe 4d-1np (n*6) have already been exstensively studied [1]. Less attention has been paid until now to the Auger decay of the resonances 2p-1nl (n*4 for l=0, n*3 for l=2) of Ar [2], because the experiment requires high photon fluxes and resolving power better than 5000, in energy ranges around 250 eV for the monochromotor and 210 eV for the electron analyser.

The spherical grating monochromator of the VUV beamline at ELETTRA is capable of achieving a photon energy resolution of 19 mev at the Ar 2p threshold, but for the present experiment the slits were opened to provide higher flux. The analyser is a 150 mm spherical deflection energy analyser (VSW Ltd.), with a nominal 8 degrees of acceptance positioned at an angle (51*) close to the magic angle and equipped with a 16 channel detector. In these conditions the Auger decay spectra of the Ar resonances 2p3/2,1/2-14s and 2p3/2-1nd (n=3,4,5) have been separately measured. The results of this study are summarised in the following:
i) the good overall energy resolution has allowed us to resolve the components of previously observed structures, distinguishing among different final states of the spectator electron;

ii) many new peaks have been detected, particularly in the low energy region of the electron spectra, previously unexplored;

iii) as the photon energy is tuned across the 2p3/2-13d absorption peak, a large variation in the branching ratio of different decay channels is observed. The relative intensity of the shake up components with respect to the electron spectator lines is reversed across the peak. To the best of our knowledge this is a new kind of observation.

The high number of observed transitions and the variation in the intensity distribution, within the same absorption peak and among different peaks, indicate the important role of electron correlation in the resonant Auger decay.

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[1] H. Aksela et al, Phys. Rev. A 51, 1291 (1995) and references therein.

[2] M. Meyer et al, Phys. Rev. A 43, 127 (1991) and references therein.