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LETTER TO THE EDITOR

Comment on the letter 'Photoionisation cross section and spin polarisation of photoelectrons from thallium' by N A Cherepkov

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Abstract. The author's remarks on the halfwidth of the polarisation curve and the utility of the process discussed as a source of polarised electrons are corrected.

Part of the conclusions in Cherepkov (1977) needs correction.

(i) On pages L655–6 the author tries to explain the strong disagreement in shape between his calculated polarisation curve and the experimental one by saying that the width of the measured peak is 'purely instrumental'. Since the experimental error bars are clearly given in the experimental paper (Heinzmann *et al* 1975, 1976) it is easy for the reader to check that this statement is erroneous.

In this connection it may be worthwhile to point out that the halfwidths of the cross section $Q(\lambda)$ and of the polarisation curve $P(\lambda)$ are not necessarily comparable. For illustration, let us consider a simple example. In the case of thallium one has

$$Q = Q_S + Q_D \qquad P = (Q_S - 0{\cdot}5\, Q_D)/(Q_S + Q_D) \tag{1}$$

(Q_S and Q_D are the cross sections for transitions into the S and D continua, respectively). Consequently, in a situation where due to a resonance one has $Q_S \gg Q_D$ the halfwidth of $P(\lambda)$ is much larger than that of $Q(\lambda)$ as is shown in figure 1 for a simplified example.

(ii) The author propagates photoionisation of thallium as an efficient source of polarised electrons. However, among the other interesting aspects of this polarisation effect, we purposely did not mention this point when publishing our measurements in order to avoid adding another item to the list of unrealistic prophecies of the past 15 years on powerful sources of polarised electrons. The author overlooks the fact that it does not suffice to consider the yield of polarised photoelectrons per incident photon. One also needs a powerful source of circularly polarised photons. Unfortunately synchrotron radiation is not such a source, contrary to what Dr Cherepkov assumes. It is true that for several reasons synchrotron radiation is a useful tool for studying spin polarisation in photoionisation (that is why we are doing such experiments at the Bonn synchrotron). It is, however, at present impossible to produce more than 5×10^9 circularly polarised VUV photons per second in this way at a wavelength of 1500 Å with a bandwidth of 1 Å (because of the small halfwidth of

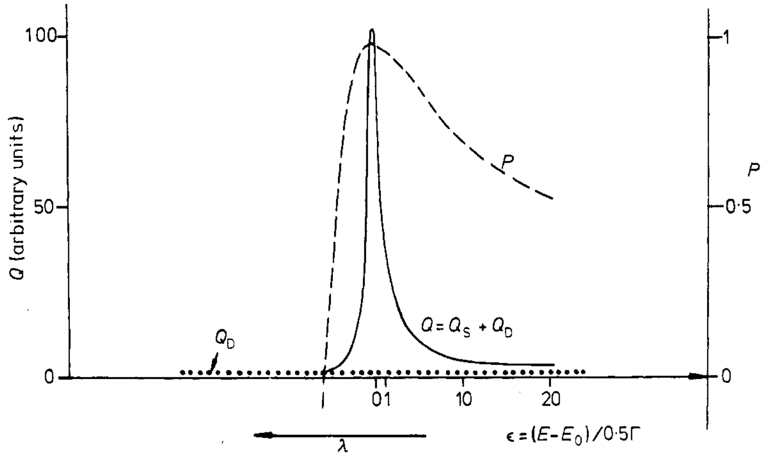

Figure 1. Energy dependence of photoionisation cross section and polarisation according to equation (1). In this simplified qualitative example which serves as an illustration we have assumed that $Q_S = Q_S^0\,[(\epsilon + 10)^2/(1 + \epsilon^2)]$ and that the non-resonant part Q_S^0 equals Q_D (dotted line) which has no resonance at the wavelengths considered (notation as Heinzmann *et al* 1975).

the cross section a bandwidth of not more than a few ångströms would be appropriate). This photon flux is seven orders smaller than that obtained in the photoionisation of alkali atoms using polarised UV (not VUV[↓]) radiation. Using these numbers for the photon flux and those for the efficiency given by the author, one sees quite clearly the inferiority of the source based on thallium. The same conclusion can be drawn from a comparison with other sources of polarised electrons (Kessler 1976, Lubell 1977).

References

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