Fig. 3.2 Electronic levels in krypton.

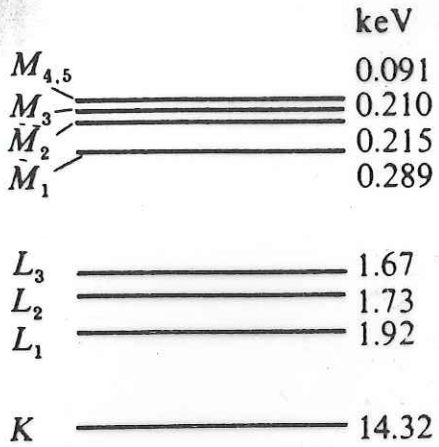


Fig. 3.3. Energy levels for a singly-ionized atom. The diagrams contain all the lines for which specific symbols are listed by Bearden (1967), except a few weak quadrupole transitions. Many additional lines have been identified, especially in the heavier elements. (Dyson, 1975).

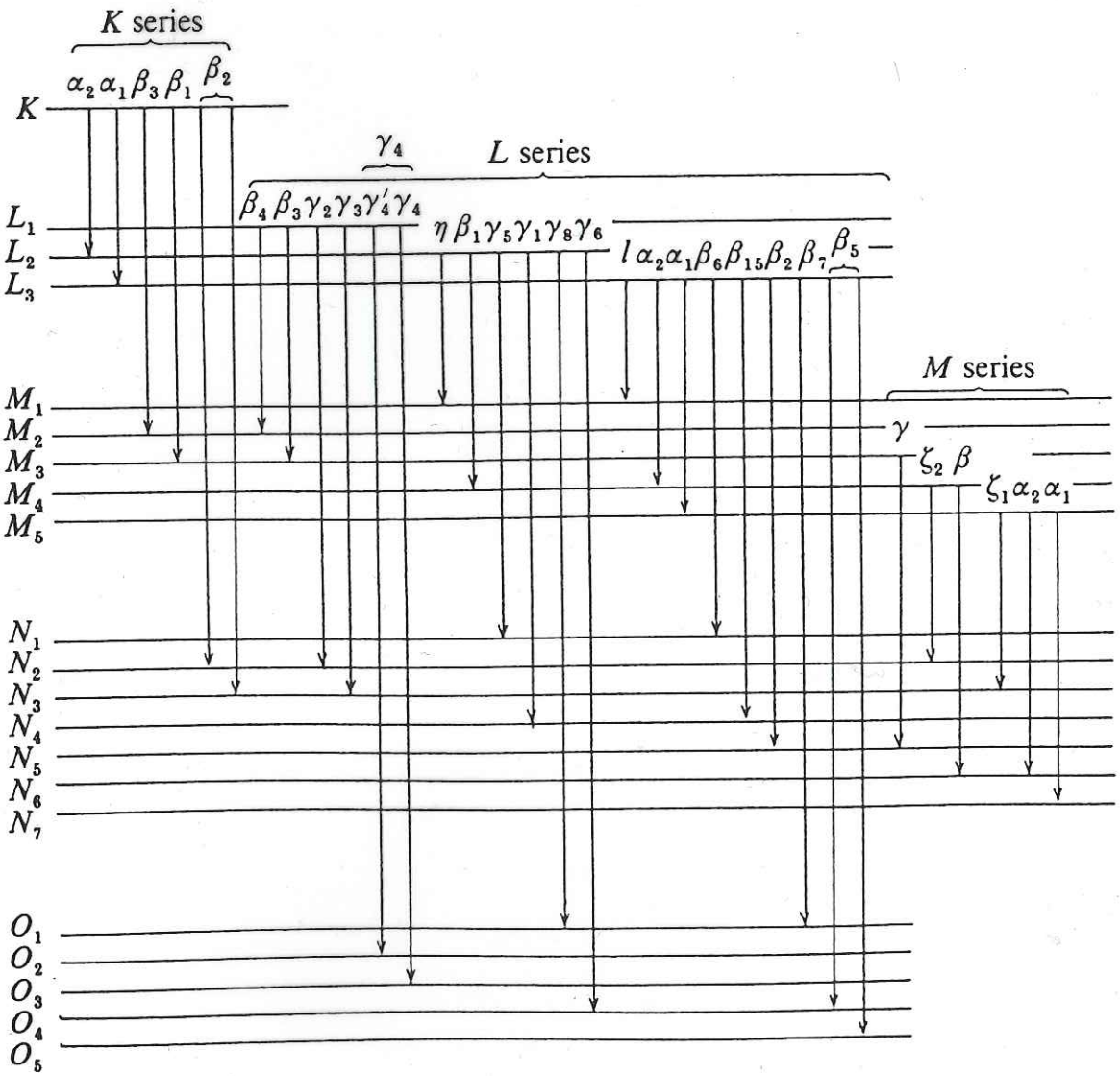


Fig. 3.4. Energy level diagram for cadmium. (White, 1934).

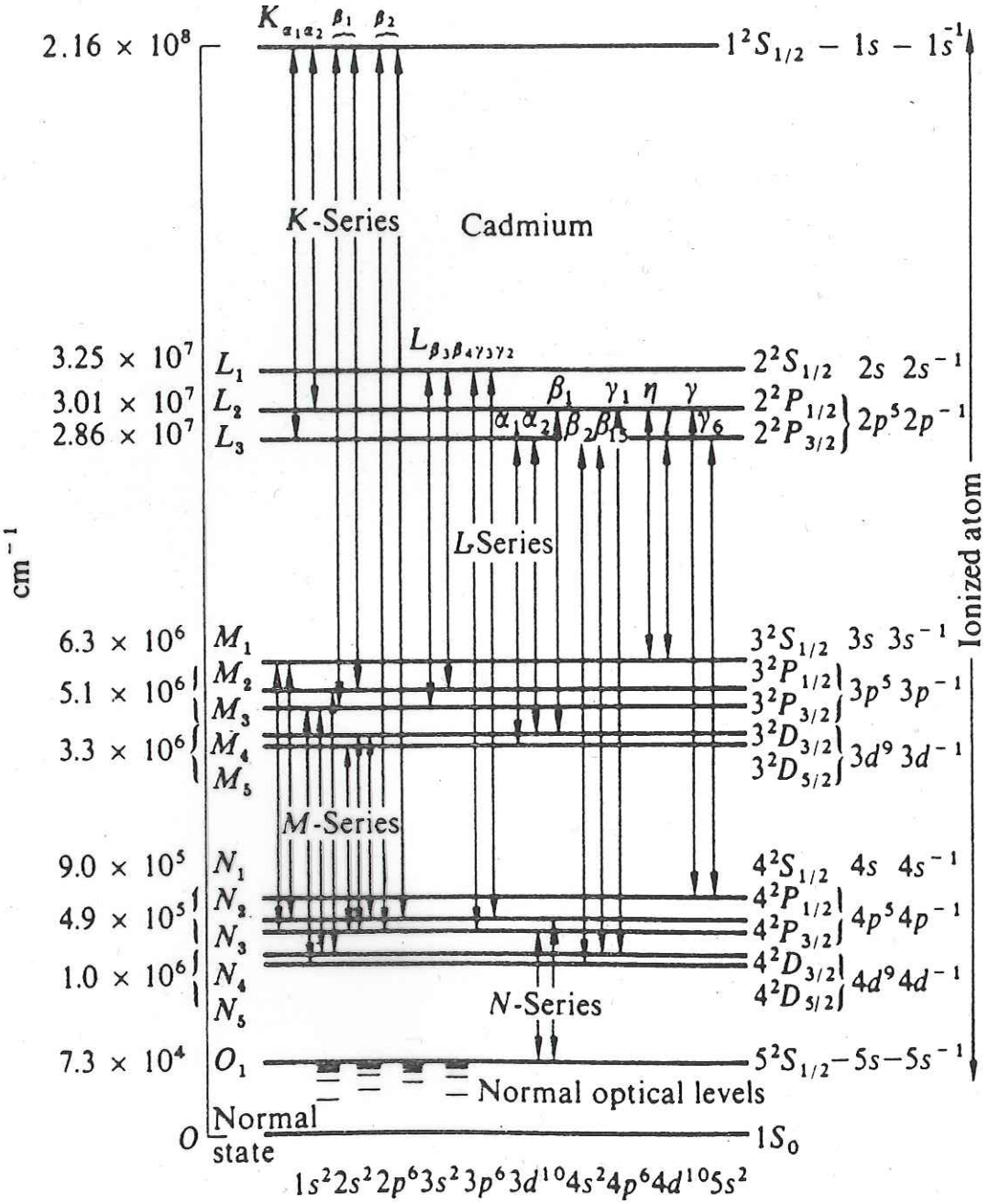


Fig. 3.7. Fluorescence yield (K-shell) as a function of atomic number (data from Bambynek *et al.*, 1972).

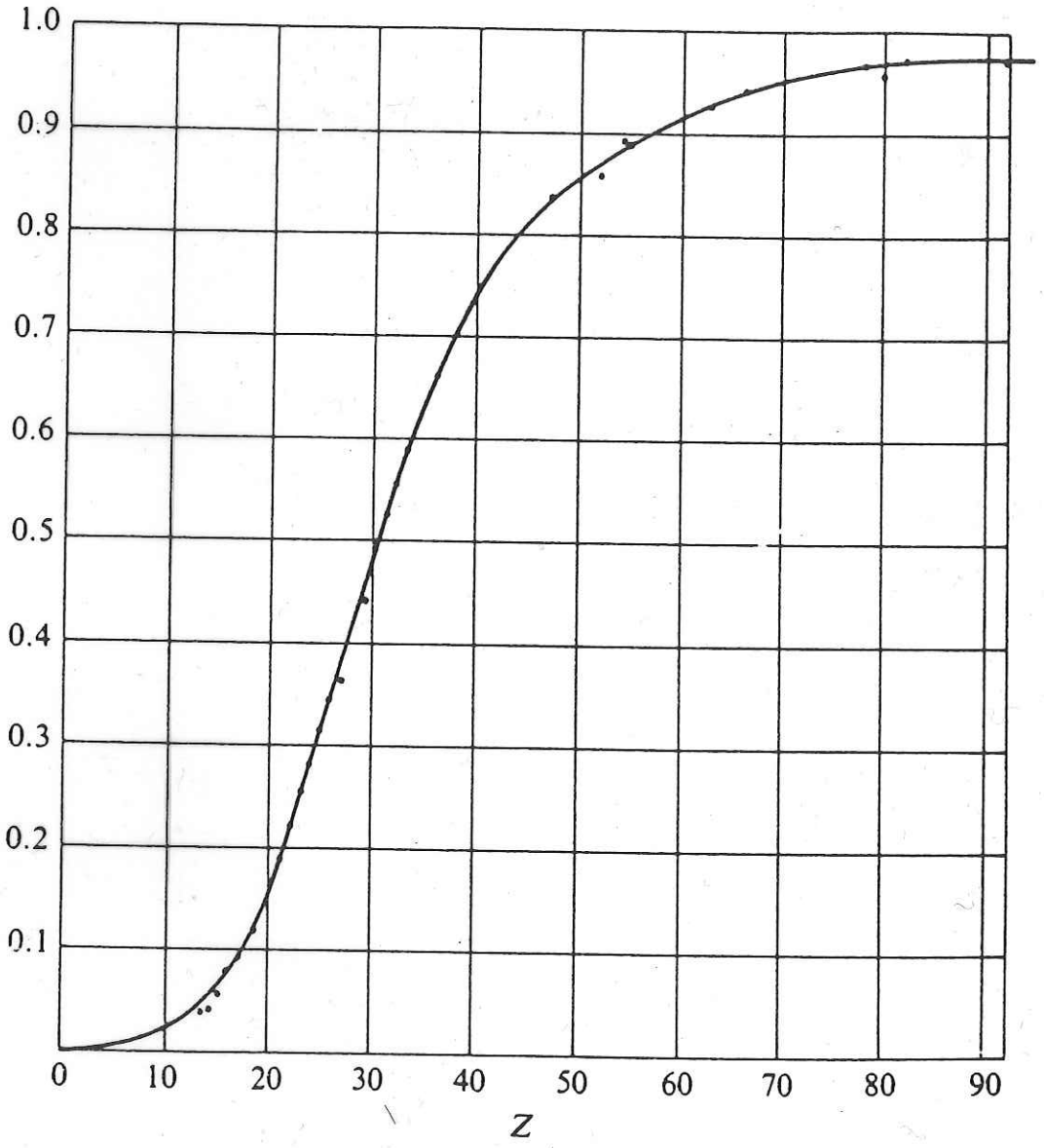


Fig. 3.8*a*. $K_{\alpha_2}:K_{\alpha_1}$ intensities (expressed as a ratio of numbers of photons) as a function of Z (after Rao *et al.*, 1972).

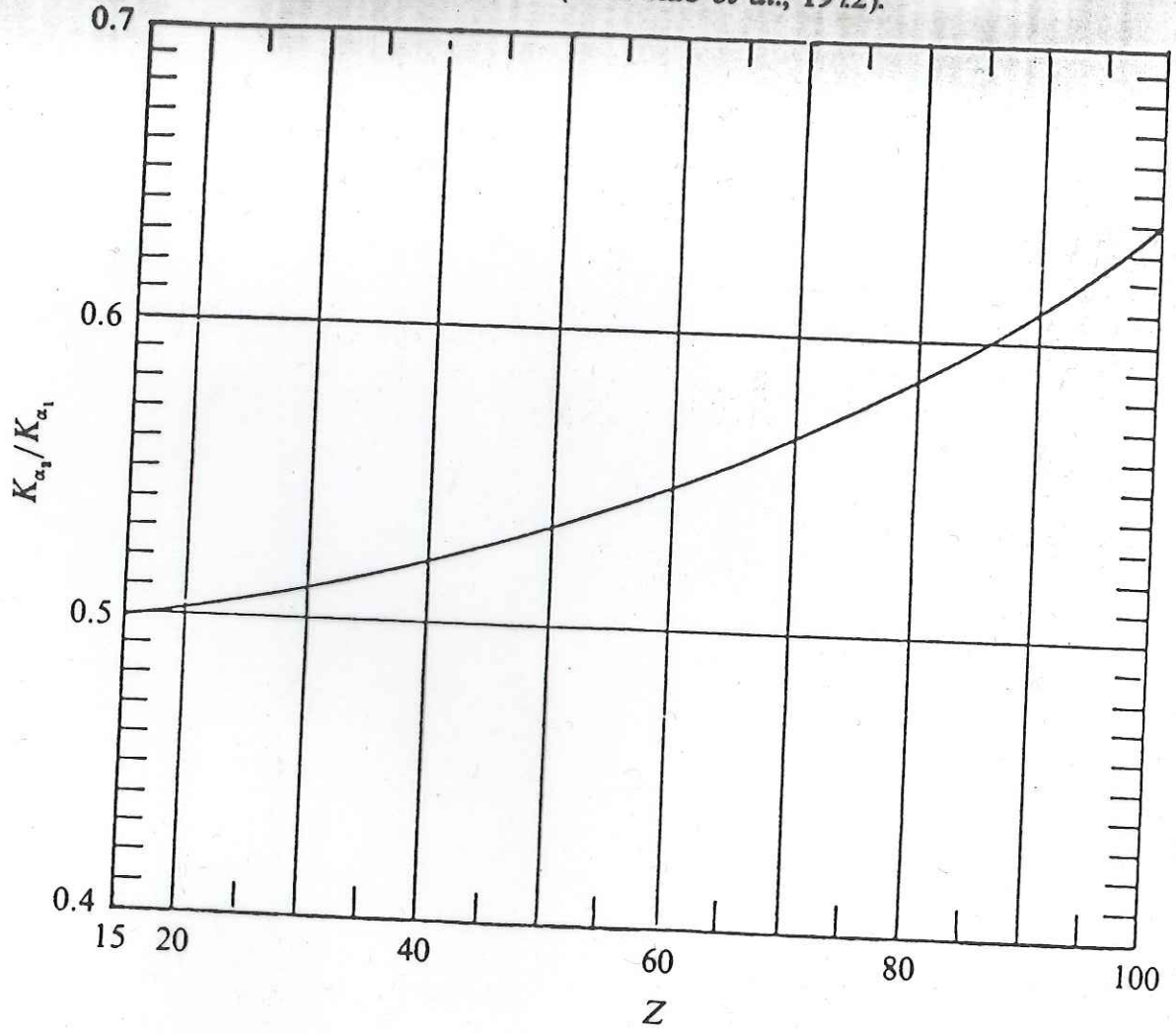
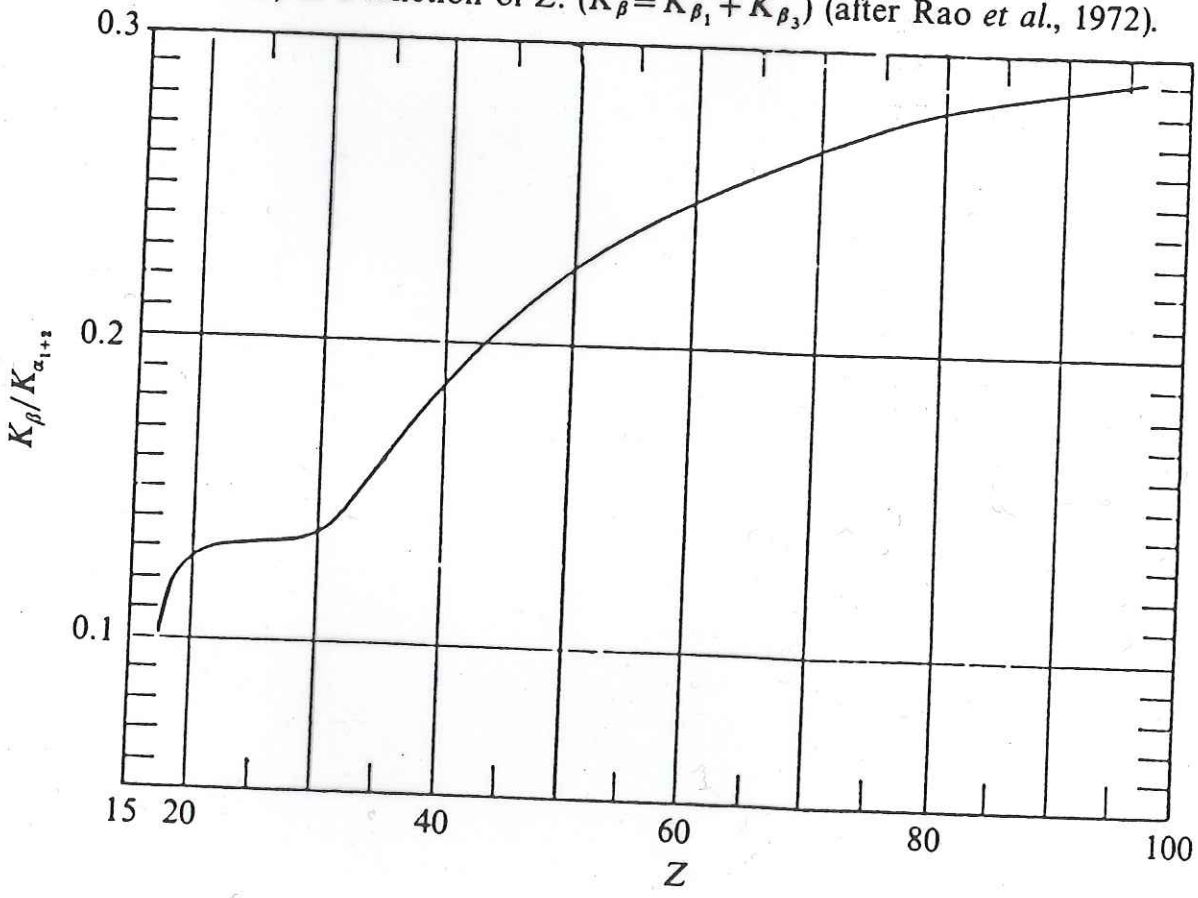


Fig. 3.8*b*. K_β: $K_{\alpha_{1+2}}$ intensities (expressed as a ratio of numbers of photons) as a function of Z. ($K_\beta = K_{\beta_1} + K_{\beta_3}$) (after Rao *et al.*, 1972).

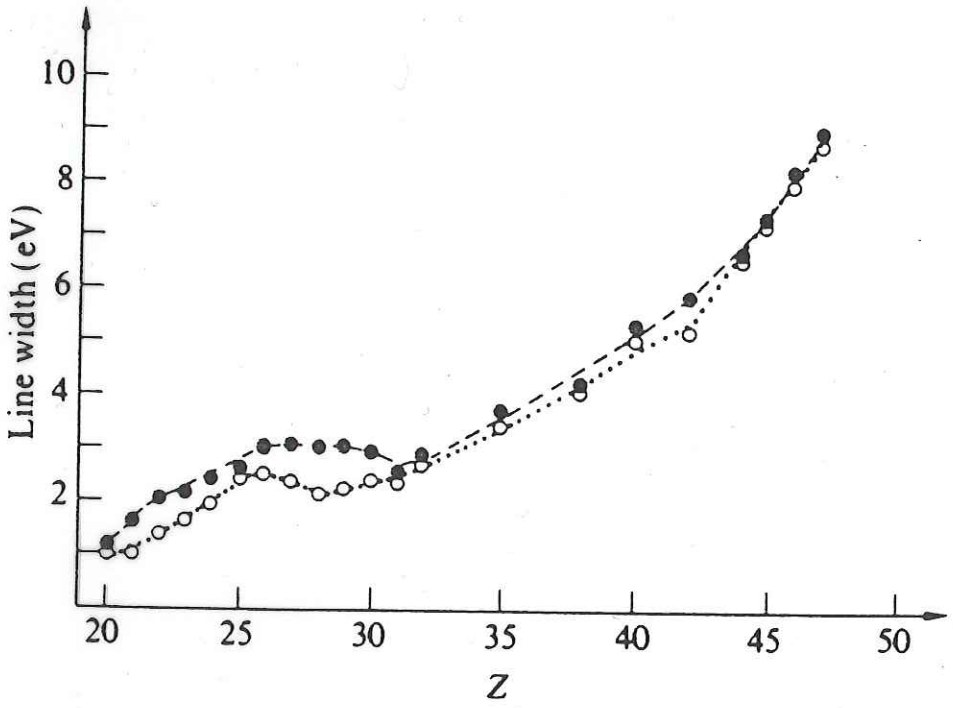


Note that $\delta(f-d_i)$ means a monochromatic line which is an approximation.

Atomic levels have an intrinsic width Γ due to the Heisenberg uncertainty principle

$$\Gamma = \hbar/\tau \leftarrow \text{mean life time of the state}$$

Fig. 3.35(*a*). Width of K_{α} lines as a function of Z (Brogren, 1963). ($\bullet = K_{\alpha_2}$ lines; $\circ = K_{\alpha_1}$ lines).



For a transition between two states i and f, the total width Γ is given by

$$\Gamma = \Gamma_i + \Gamma_f$$

The shape of the line is given by the probability density

$$p\,dE = \frac{\Gamma\,dE}{2\pi\left[(E-E_{if})^2 + \left(\frac{\Gamma}{2}\right)^2\right]}$$

(E_{if}: mean energy of the transition)

(Lorenzian distribution)

Table 3.13 *Level widths in gold (Ramberg and Richtmeyer, 1937)*

Level	K	L_1	L_2	L_3	M_1	M_2	M_3	N_1
Width (eV)	54	8.7	3.7	4.4	15.5	10.7	12.1	11.7
Lifetime (units of 10^{-18}s)	12.2	80	178	150	42.6	61.7	54.5	56.4

Fig. 3.35(*b*). *K*-level width as a function of atomic number (Bambynek *et al.*, 1972). (A full list of references is given in this review.)