Fys3520 – 5.04.

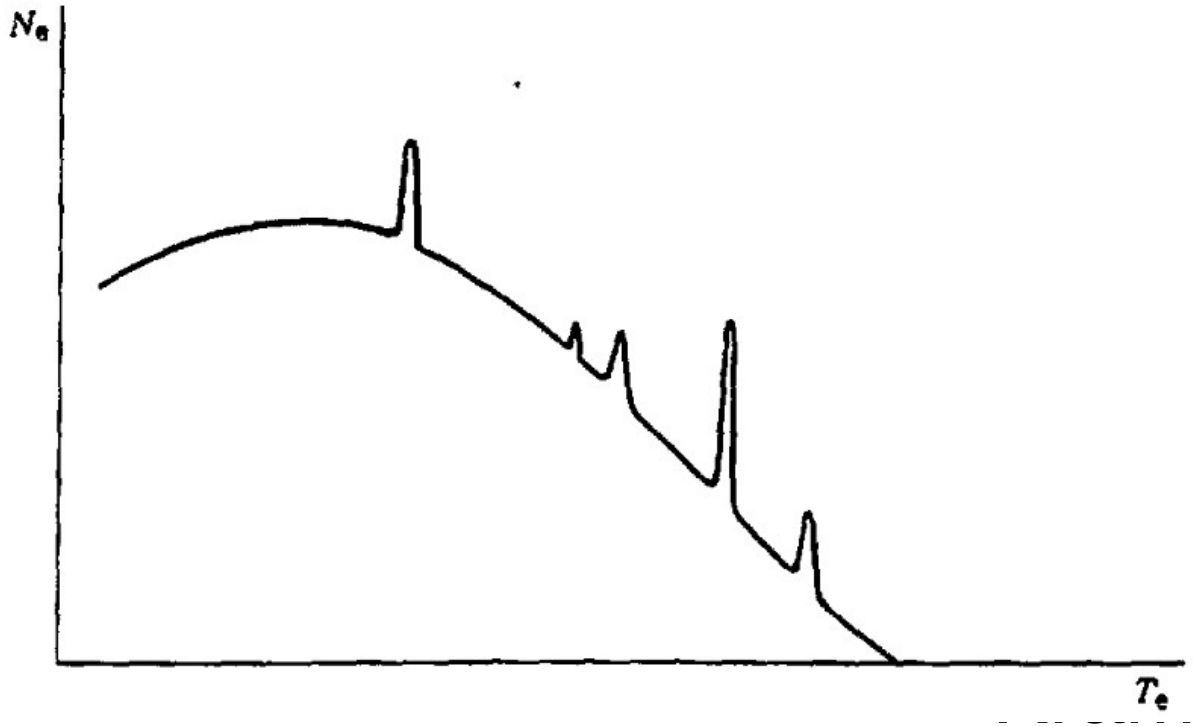
1. **Gamma Decay** (continuation)

2. Interaction of radiation with matter

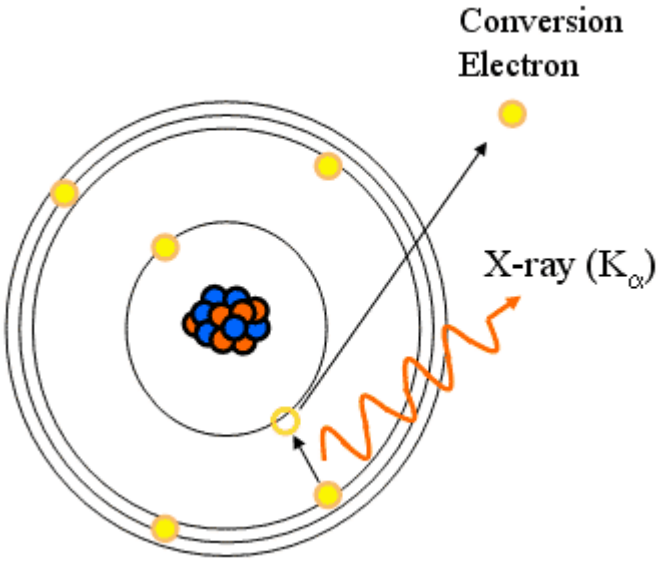
3. Problem session

Gamma Decay – so far

- Energetics of gamma decay
  - Incl. recoil
- Multipoles & Weiskopf units
- Selection Rules & transition rates
- (Angular Distribution & Polarization)
  - → next time

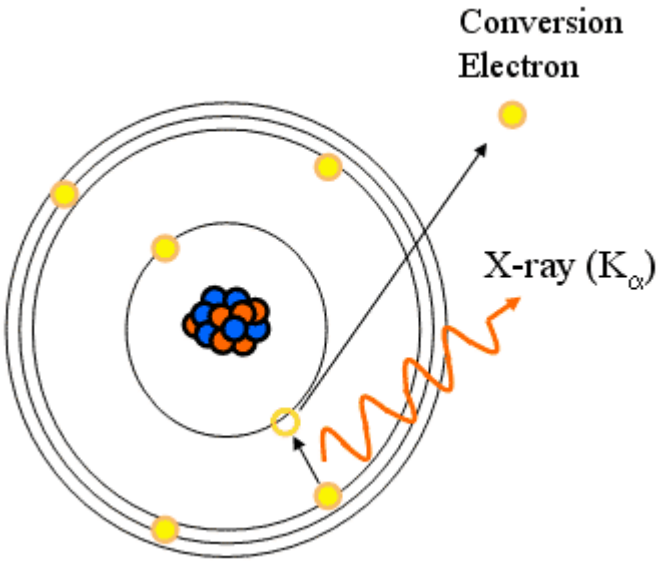


Krane, ch10



https://courses.ecampus.oregonstate.edu/ne581/three/index2.htm

Internal conversion



- Competes with γ-emission
  - Not (!) two-step process
- $T_e = \Delta E - B$
- $\lambda_t = \lambda_\gamma + \lambda_e$

$$\alpha = \frac{\lambda_e}{\lambda_\gamma}$$

$$\lambda_t = \lambda_\gamma(1 + \alpha)$$

$$\alpha = \alpha_K + \alpha_L + \alpha_M + \cdots$$

: subshells, we could break

$$\alpha_L = \alpha_{L_I} + \alpha_{L_{II}} + \alpha_{L_{III}}$$

Internal conversion

Energy difference between state
carried away by atomic electron:

$E_e = E_\gamma - B_e \quad (K, L_I, L_{II}, L_{III}, \ldots)$

B_e binding energy of the shell

Overlap of electron and nuclear wave functions, not a two-step process.

Internal conversion coefficients:

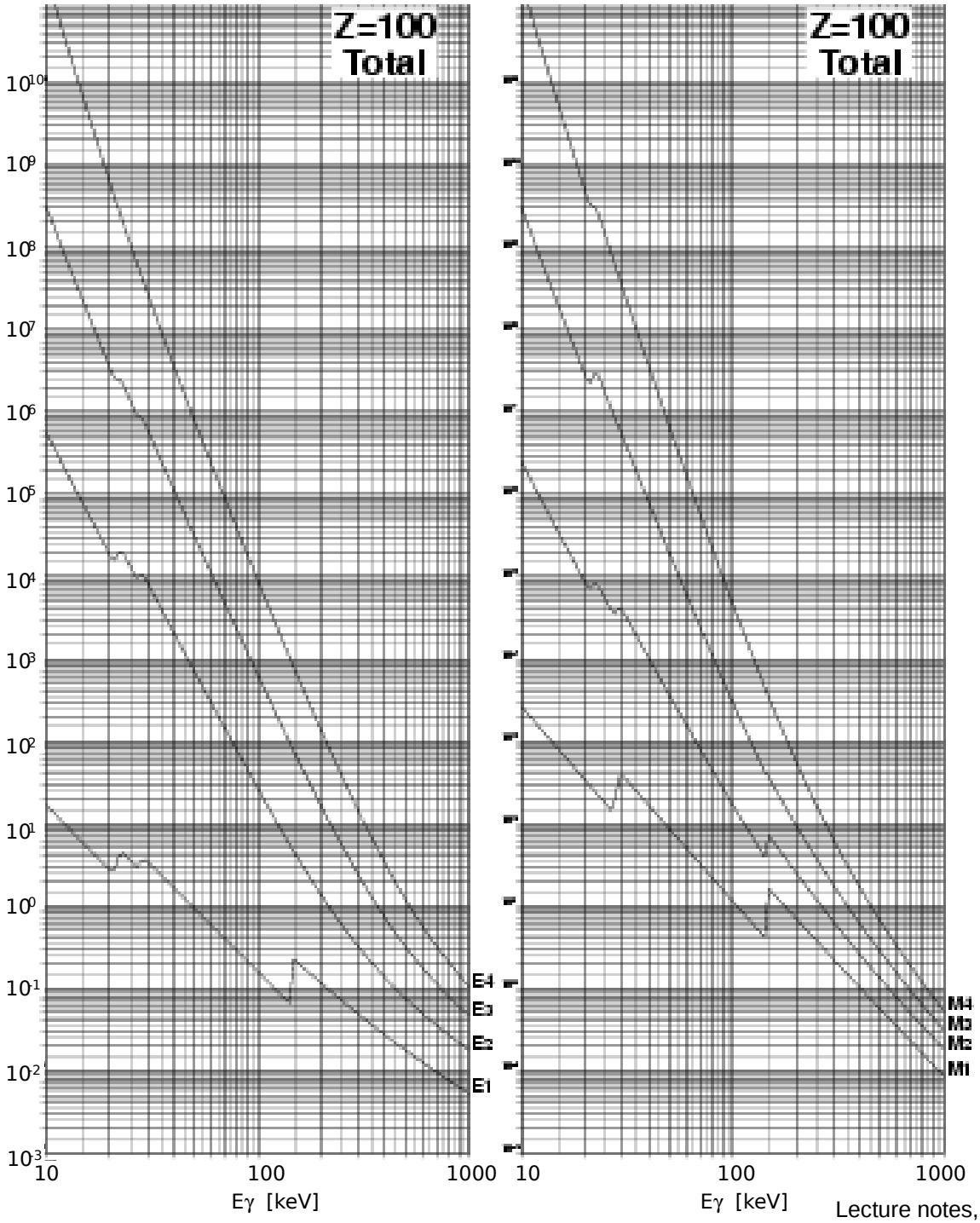
$$\alpha_{tot} = \frac{N_e}{N_\gamma} = \alpha_{K0} + \alpha_L + \ldots$$

$$N_{tot} = N_e + N_\gamma = (1 + \alpha_{tot}) N_\gamma$$

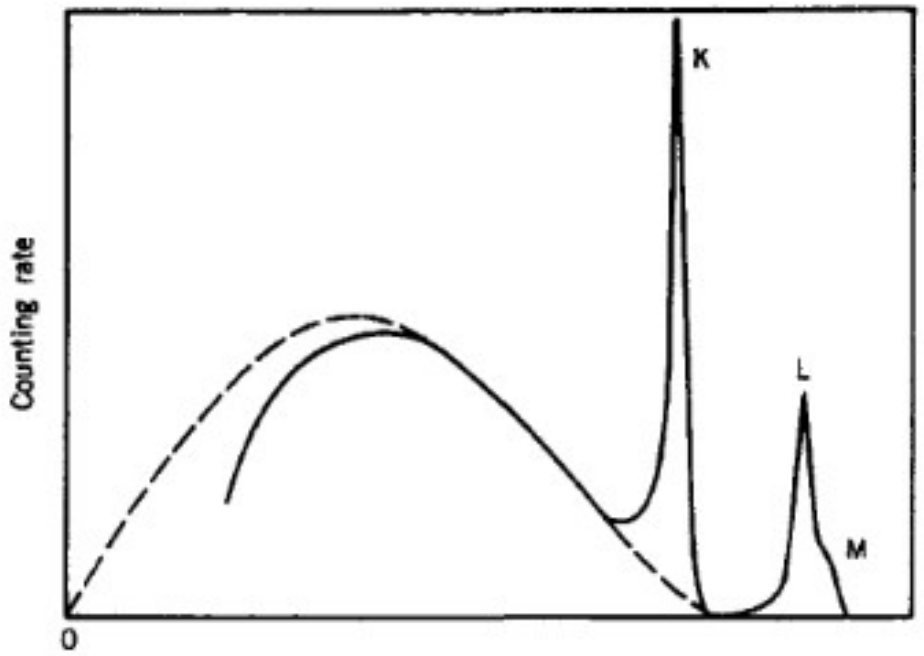
Strong dependence on

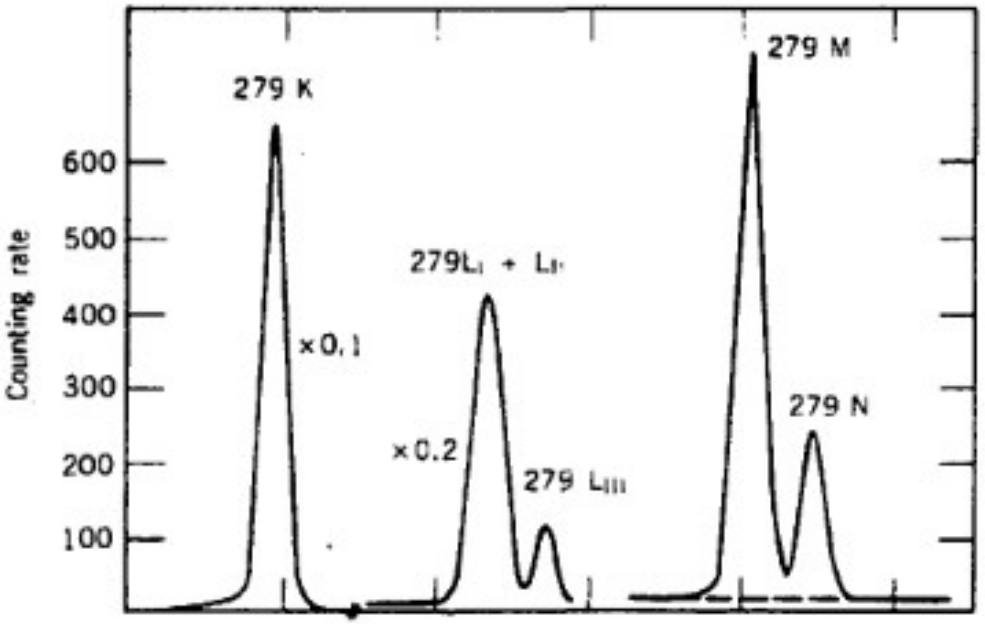
- ▼ transition energy
- ▲ multipolarity; *EL or ML*
- ▲ atomic number *Z*

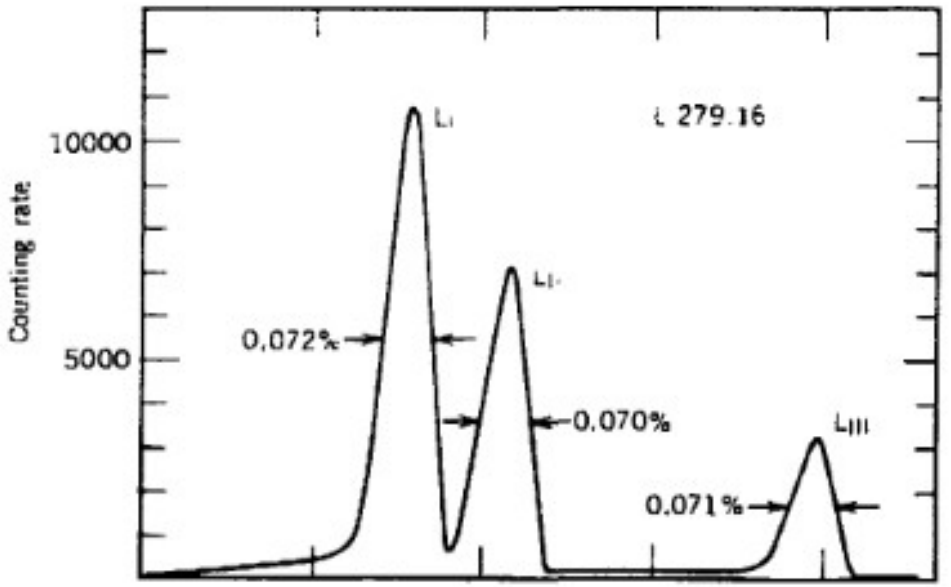
By measuring the internal conversion coefficient, it is possible to determine the multipolarity of a transition.



Hg-203 (Krane p.344 / Ref. therein)







1. Gamma Decay

2. **Interaction of radiation with matter**
   (need to check if/how much is pensum)

3. Problem session

Remind yourself:

The difference between how **gammas** and **charged particles interact** with matter is?