Röntgen rays / Radioactivite radiation

Note nomenclature on "radiation" and "radio-active decay radiation": α , β , γ radiation, where γ is electromagnetic radiation (a form of "light").



Some "radiation" is bent in a magnetic field, so **charged**

Oppostie charges for α and β Radiation, So these are **particles** (with rest mass)

On Characteristic Röntgen rays

1. To the hydrogen atom and one-electron systems $E_n = -\frac{Z^2}{R_H}$



2. Application to X-ray or Röntgen spectra



Characteristic Röntgen rays; Moseleys analysis





Henry Moseley (1887-1915)

Moseleys K and L series of X-rays

$$Z_{eff} = \frac{\sqrt{v}}{\sqrt{cR(1/n_f^2 - 1/n_i^2)}} = Z - z_f$$

$$n_f = 1 \rightarrow \text{K-series (decay to lowest level)}$$

$$K\alpha \text{ series: } n_i = 2$$

$$K\beta \text{ series: } n_i = 3$$

$$n_f = 2 \rightarrow \text{L-series (decay to } n = 2 \text{ level})$$

$$L\alpha \text{ series: } n_i = 3$$

$$L\beta \text{ series: } n_i = 4$$

$$L\gamma \text{ series: } n_i = 5$$

$$\text{Emistry of } n_i = 5$$

 \sqrt{V} as a function of Atomic number \rightarrow Info on Periodic System

$$Z - z_{K\alpha} = \frac{\sqrt{\nu}}{\sqrt{cR(3/4)}}$$
$$Z - z_{K\beta} = \frac{\sqrt{\nu}}{\sqrt{cR(8/9)}}$$

$$Z - z_{L\alpha} = \frac{\sqrt{\nu}}{\sqrt{cR(5/36)}}$$



X-Ray Spectra and Atomic Number

Measurement of these spectra allows determination of inner energy levels, as well as Z, as the wavelength of the shortest Xrays is inversely proportional to Z^2 .



Bremsstrahlung



The continuous part of the X-ray spectrum comes from electrons that are decelerated by interactions within the material, and therefore emit photons. This radiation is called *bremsstrahlung* ("braking radiation").

Maximum energy transferred is the total amount of kinetic energy of the electron

 $hf_c = \Delta K = eV$ where V is the acceleration voltage on the discharge electrodes

$$\lambda_c = \frac{hc}{\rho V}$$

This means that all energy is transferred into an electromagnetic wave: No energy is transferred into rest mass: So bremsstrahlung is of EM origin ! (As are chracteristic Röntgens)