Structure of atoms

BIOPHYSICS 1 — LECTURE

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The Rutherford experiment

**Conclusions**

1. Most particles went through straight.
2. Some were deflected at low angles.
3. Very few were reflected.

- Atoms are mostly made of empty space.
- Charge of atom has to be concentrated.

**Diagram**: A schematic showing the paths of alpha particles (\( \alpha \)) through a gold foil. The diagram illustrates the angles at which particles are deflected.
Rutherford's model

\[ r_{\text{atom}} \approx 10^{-10} \text{ m} = 1 \text{ Å} = 0.1 \text{ nm} \]

\[ r_{\text{nucleus}} \approx 10^{-15} \text{ m} \]

100 000 x smaller

like a small solar system
spectra of atoms

emission spectrum

hydrogen

discharge tube

absorption spectrum

hydrogen

white lamp

atoms have LINE SPECTRA

400 500 600 700 nm
Atomic spectra
Spectrum of the Sun

- Ionised Calcium 3933 & 3968 Å
- CH Band 4300 Å
- Hβ 4861 Å
- Neutral iron 5270 Å
- Neutral sodium D1 & D2 5890 & 5896 Å
- Hα 6563 Å
- Terrestrial O₂ 6867 Å
- Terrestrial water vapour
- Terrestrial O₂ 7594 Å
Bohr's model

2 postulates

1. Electrons rotate on given orbitals only; here they do not radiate.

Angular momentum

\[ L = m \cdot v \cdot r = n \frac{h}{2\pi} \]

Integer

1, 2, 3, 4, ...

K, L, M, N, ...

Principal quantum number

2. \( 2\pi r = n \frac{h}{mv} \)

3. \( 2\pi r = n \lambda \)

Standing wave

\[ n = 3 \]

M
2. Postulate by Bohr: electrons can jump between orbitals.

Hydrogen atom

\[ E_1 = -13.6 \text{ eV} \]

Bound state

\[ E_2 = \frac{E_1}{4} \]

\[ E_3 = \frac{E_1}{9} \]

\[ E_4 = \frac{E_1}{16} \]

\[ hf = E_2 - E_1 \]