Atoms - the beginning of Quantum Mechanics

``Plumpudding’’ Model
(before 1910)

Rutherford Scattering Exp.

``Planetary Motion’’ Model

E.M. Radiation Spectroscopy

Bohr’s Model

Electrons change Orbit

\[ hf = E_{\text{Outer}} - E_{\text{Inner}} \]

Quantum Condition

\[ L = mv \ r_n = n \frac{h}{2\pi} \]

\( n=1, 2, 3... \)
Bohr’s Model can explain simple atoms such as hydrogen (atoms with a single electron)

**Ground State** = Lowest Energy State  
**Excited State** = not the ground state

### A) Force on an Electron

Coulomb Force = \( ma = \frac{mv^2}{r_n} \)

**Radius of nth Orbit**

\[ r_n = 0.529 \times 10^{-10} \text{ m} \left( \frac{n^2}{Z} \right) \]

\( Z = \# \text{ of protons} \)

### B) Energy of an Electron

\( E = KE + PE \)

**Energy of electron in nth orbit**

\[ E_n = -\left(2.18 \times 10^{-18} \text{J}\right) \frac{Z^2}{n^2} \] or \(-13.6 \text{ eV} \frac{Z^2}{n^2}\)

### C) Spectral Lines

\[ hf = E_{\text{Outer}} - E_{\text{Inner}} \]

Photon Emission ➔ outer → inner orbit

Photon Absorption ➔ inner → outer orbit