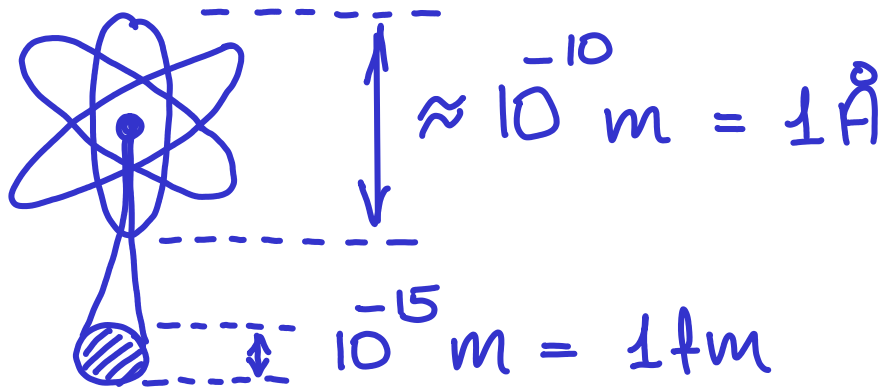


The Atomic Nucleus

Ernest Rutherford (1908, C. Nobel):



(fm: femtometer or fermi)

Nucleus: heavy but small.

Q: What is the nucleus made of?

→ Becquerel, Pierre and Marie Curie (1903, Nobel): α, β, γ radiations (from the nucleus).

→ Rutherford: the nucleus of atoms, proton: the nucleus of Hydrogen, α -particle: the nucleus of Helium, a heavy and neutral particle must exist beside the proton

→ James Chadwick, 1932 (1935, Nobel): the discovery of the neutron.

Notation



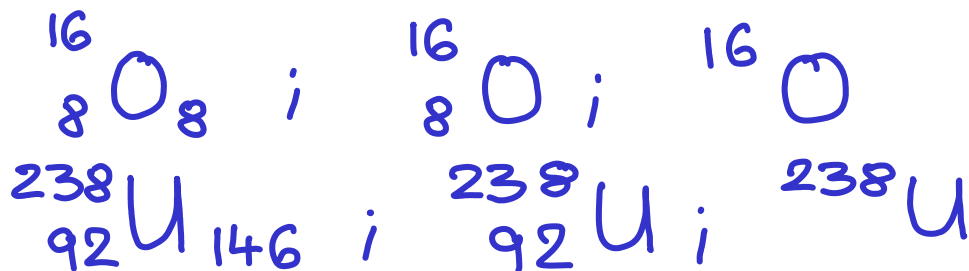
X: symbol of the element (H, He, Li...)

Z: atomic number = number of protons

N: neutron number

A: mass number: $A = Z + N$

Examples:



isotopes: same Z: ex: $\begin{matrix} 18 \\ 8 \end{matrix} O_{10}$; $\begin{matrix} 17 \\ 8 \end{matrix} O_9$; $\begin{matrix} 16 \\ 8 \end{matrix} O_8$

isotones: same N: ex: $\begin{matrix} 14 \\ 6 \end{matrix} C_8$; $\begin{matrix} 15 \\ 7 \end{matrix} N_8$; $\begin{matrix} 16 \\ 8 \end{matrix} O_8$

isobars: same A: ex: $\begin{matrix} 16 \\ 6 \end{matrix} C_{10}$; $\begin{matrix} 16 \\ 7 \end{matrix} N_9$; $\begin{matrix} 16 \\ 8 \end{matrix} O_8$

Electron, proton, neutron

	e	p	n
Charge :	$-e$	$+e$	0
spin :	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
rest energy (MeV):	0.511	938.27	939.57
mass (AMU):	$5.4858 \cdot 10^{-4}$	1.0073	1.0087
mass (kg):	$9.11 \cdot 10^{-31}$	$1.673 \cdot 10^{-27}$	$1.675 \cdot 10^{-27}$
magnetic moment :	$-1.001 \mu_B$	$2.79 \mu_N$	$-1.91 \mu_N$
relative mass (m/m_e):	1	1836.1	1838.7

Bohr magneton:

$$\mu_B = \frac{e\hbar}{2m_e}$$

nuclear magneton:

$$\mu_N = \frac{e\hbar}{2m_p}$$

$$1 \text{ AMU} = 1.6605 \cdot 10^{-27} \text{ kg} = 931.494 \text{ MeV}/c^2$$