

# Nuclear Physics

May 17, 2017 11:03 AM

Looking at the nucleus of atoms

- Protons }  
- Neutrons } Made of Quarks

Quarks: 3 per nucleon

Quarks have "spin"

up, charm, top	$+\frac{2}{3}$ electric charge
down, strange, bottom	$-\frac{1}{3}$ electric charge

Proton: up, up, down  
 $+\frac{2}{3} \quad +\frac{2}{3} \quad -\frac{1}{3} = \frac{3}{3} = +1e$

Neutron: up, down, down  
 $+\frac{2}{3} \quad -\frac{1}{3} \quad -\frac{1}{3} = 0 \text{ charge}$

## Isotopes:

Elements that can have different masses compared to an identical element.

Eg. Carbon-12      or      Carbon-13      or      Carbon-14

$P=6$	$P=6$	$P=6$
$n=6$	$n=7$	$n=8$

Ex. Co-62

$P=27$

$n=35$



## History

400 BCE - Democritus + Leucippus  
- "atomos" → indivisible

1600<sup>s</sup> - 1800<sup>s</sup> - Chemists were discovering elements

We still didn't know much about the atom.

Why?

→ too small!

→ Need a "mega-microscope"

The larger the lens, the less resolution is possible

- We need a new way to see.

1895 - Röntgen discovered X-rays


1896 - Becquerel discovered radioactivity of uranium

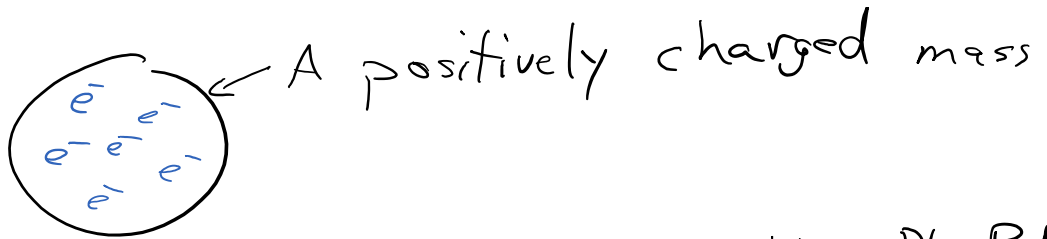
1897 - J.J. Thompson discovered the electron

- The atom is made of positive stuff and negative stuff (electrons)

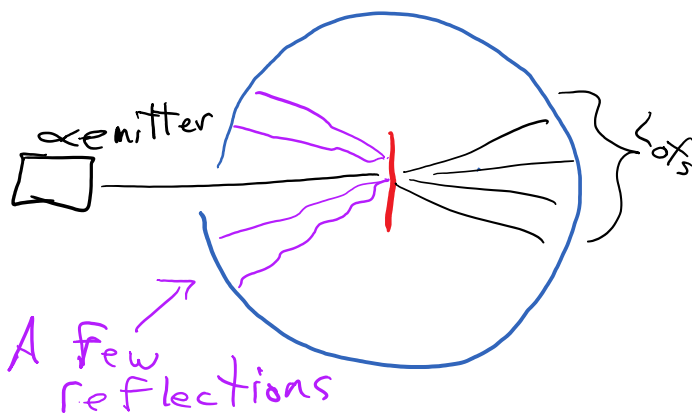
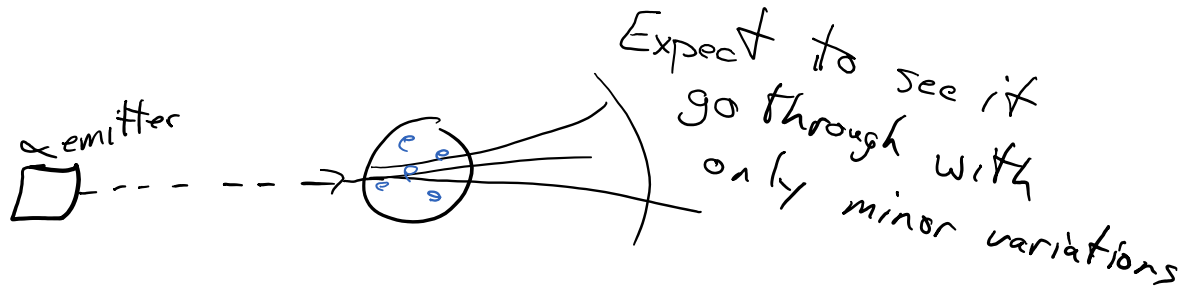
JJ Thompson's model

"Plum Pudding Model"

 A positively charged mass



1911 - Rutherford set out to prove the Plum Pudding Model,



↳ There has to be something hard and heavy to reflect the  $\alpha$  particles  
 ↳ Nucleus

1913 - Niels Bohr → electron orbitals of the hydrogen atom.

## Homework

Mass of  $p^+$  = 1.0072766 amu

Mass of  $n$  = 1.0086654 amu

$$\text{Pu-245} = 245.067825968 \text{ amu}$$

Find something weird.