

How do we
learn *what*
is inside?



See what “comes out”!

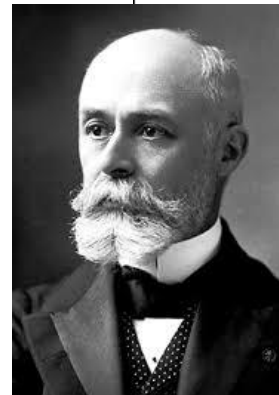
How can we study *the inside* of atom?

See what “comes out”!

- Electric current – originates within matter; can flow through matter but also...in **vacuum**!
 - Cathode rays, 1869: streams of **something travelling in straight lines** observed in vacuum tubes when voltage is applied across the evacuated tube equipped with two electrodes.
- Radioactivity (alpha, beta, gamma)
 - Henri Becquerel, 1896:
 - radioactivity was **first discovered** in uranium salts during his work on phosphorescence.
- Light (later!)



10 - 11 - 96. Sulfide Double Phosphor of the Potassium
Phosphor salt - Geiger's counter tubes -
Exposed on March 27. at the same distance to the
Nucleon' & 15 mm.



Discovery of Electron

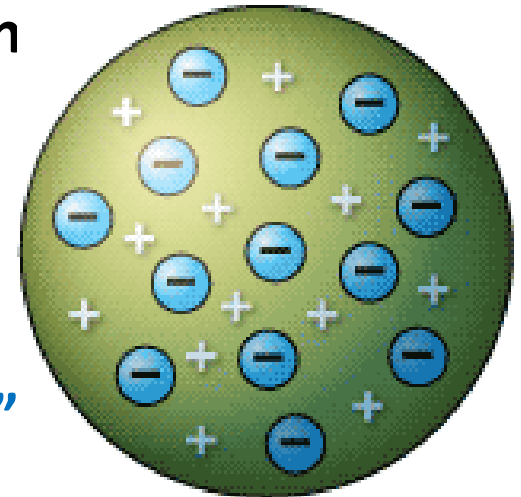


Joseph
John
Thomson



1897: Studying cathode rays, Thomson detected **charged particles** that were around **1800 times lighter than the lightest atom**, hydrogen. Therefore they were **not atoms, but a new particle**, the first subatomic particle to be discovered. Originally it was called "corpuscle" but was later named **electron**.

- many elements were shown to emit electrons...
- ...all atoms must contain **electrons as universal building blocks**
- atoms are neutral, so there must be a **balancing "cloud" of opposite charge**



Plum Pudding Model, 1904

1906 Nobel prize in Physics

Radioactivity

- Marie Sklodowska-Curie and Pierre Curie, 1898:

- conducted a **systematic study** to determine which elements and compounds emitted “mysterious radiation” that they called “radioactivity”

- isolated a new radioactive element, polonium (named in honor of Marie's home country),

- 4 years later, discovered an even more intensely radioactive substance, radium.

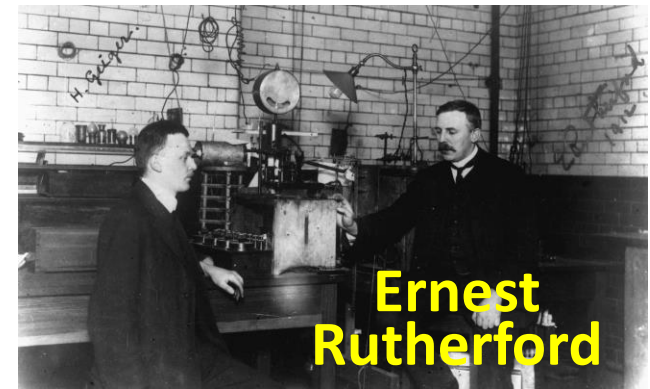


- Ernest Rutherford and Frederick Soddy, 1899-1903:

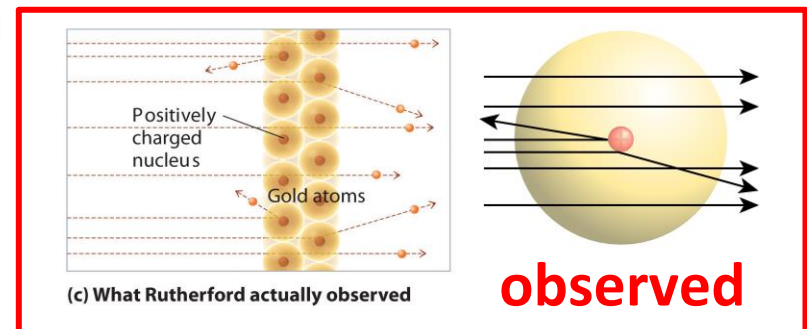
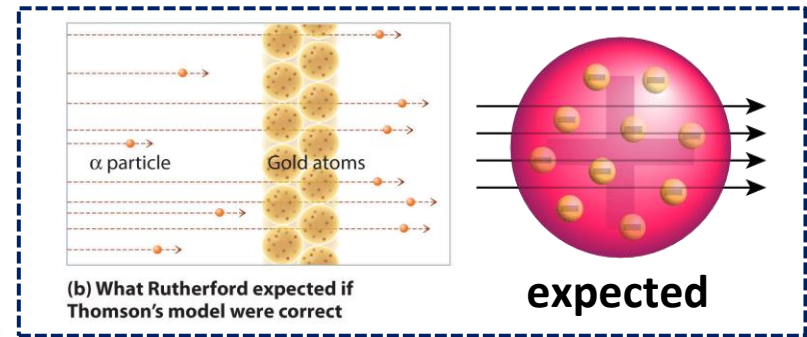
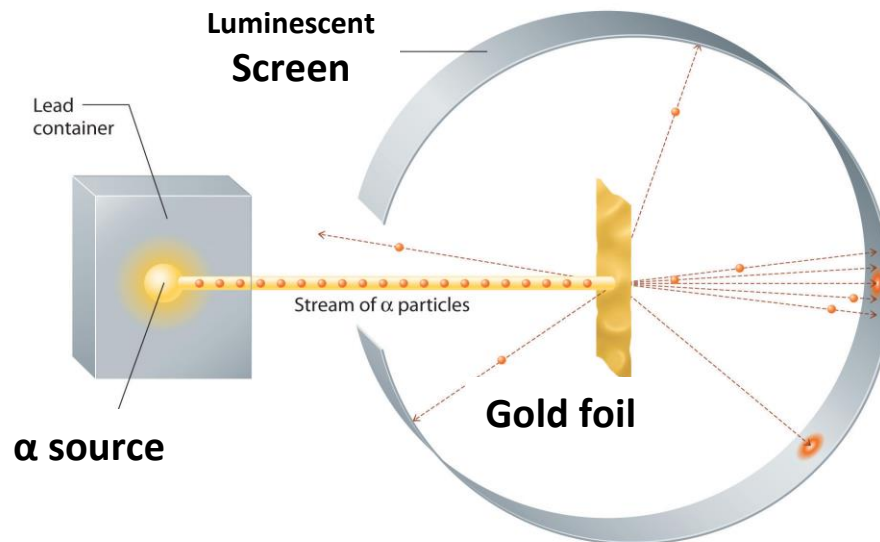
- discovered **three different types** (named α , β , γ) of radiation "rays" with very different properties and **proposed that atoms were not conserved in radioactive emissions.**

Discovery of the Nucleus

Rutherford (Geiger–Marsden),
1908-1913: Gold Foil Experiment



- “Father of nuclear physics”
- Bombarded a thin metal foil with alpha particles. A majority of the particles passed through the sheet, but a **small percentage were deflected**.



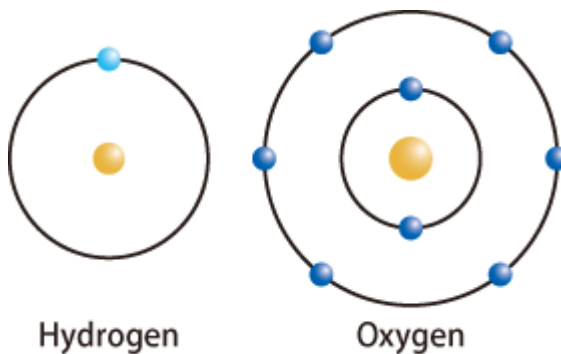
- Rutherford's conclusion: “the **greater part of the mass** of the atom was concentrated **in a minute nucleus**... carrying a charge”.

Planetary Model

Niels Bohr, 1913

Electrons move in definite orbits around the nucleus, **much like planets circle the Sun.**

- These circular orbits, or **energy levels**, are located at certain distances from the nucleus.



- Electrons can jump between levels emitting (or absorbing) energy...

...here comes Quantum Theory!

