

HISTORY OF ATOMIC STRUCTURE

Democritus

Small Particles

- When: ~600BC
- Where: Greece
- What: Democritus believed that matter was made up of **small particles** he named “atoms.”



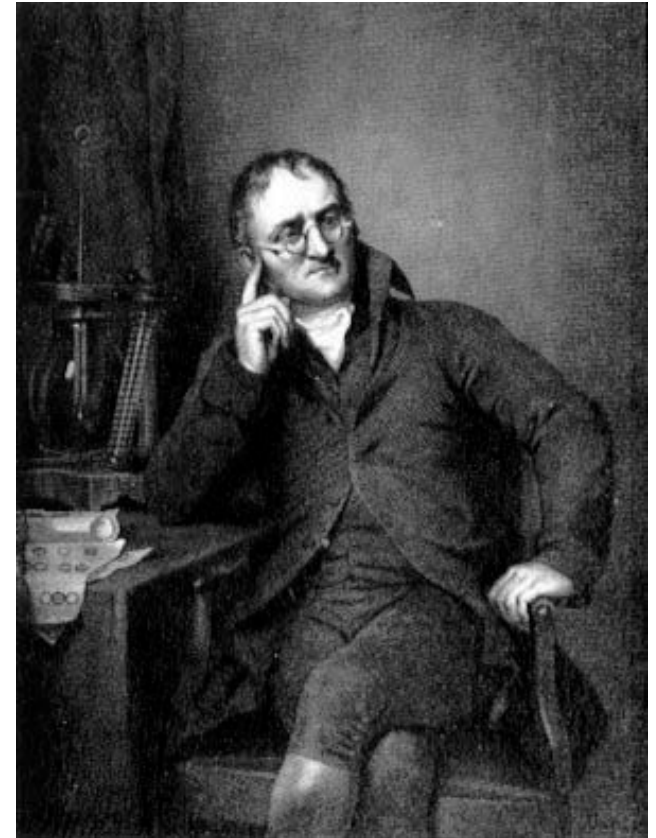
John Dalton

Atoms can't be divided

- When: 1808
- Where: England
- What: Atoms as tiny particles that could not be divided.

Like marbles!

Thought each element was made of its own kind of atom, and they combined to make compounds



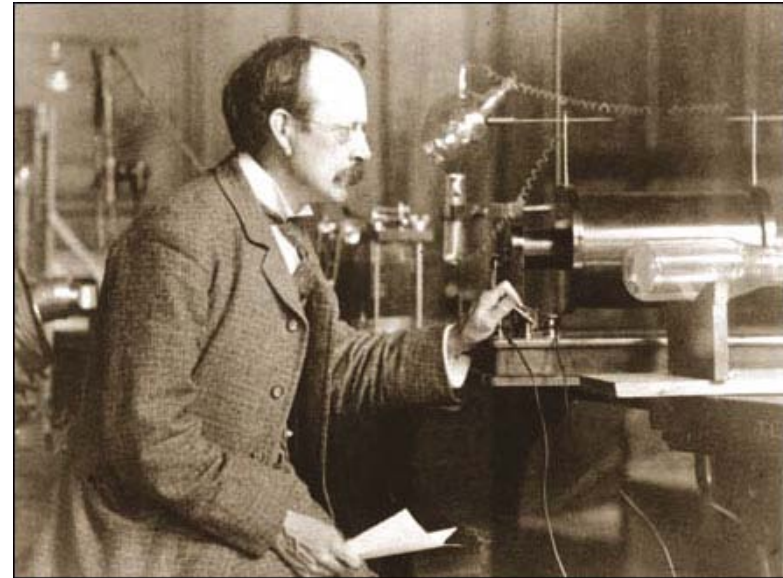
J.J. Thomson

The electron

- When: 1897
- Where: England
- What: **Discovered the electron and the electron charge!**

Cathode Ray Tube

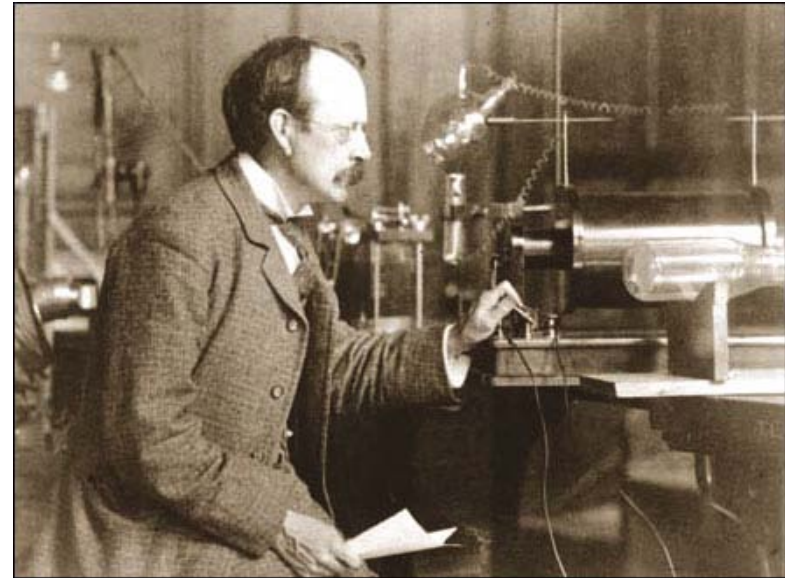
- Problem: Thomson knew atoms were neutrally charged, but couldn't find the positive particle!



J.J. Thomson

The electron

- Cookie model
 - Chips = e⁻
 - Rest of cookie = positive part



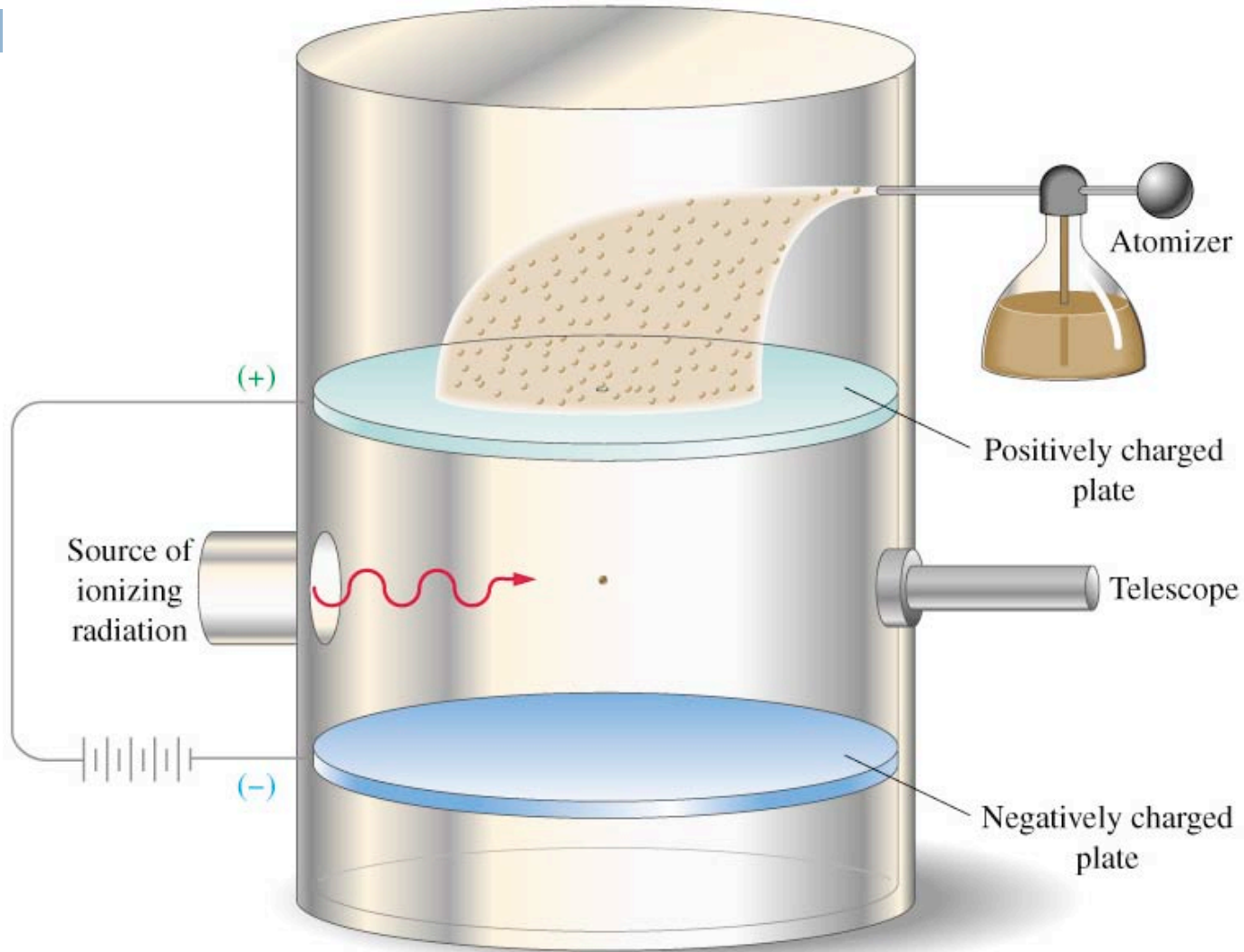
Robert Millikan

Mass of electron

- When: 1907
- Where: England
- What: **Mass of electron = small!!!**
- Problem: Electrons only weigh
 $9.109 \times 10^{-31} \text{ g}$
 - $1/1837^{\text{th}}$ the mass of a hydrogen atom!!!
 - Where is the rest of the mass???

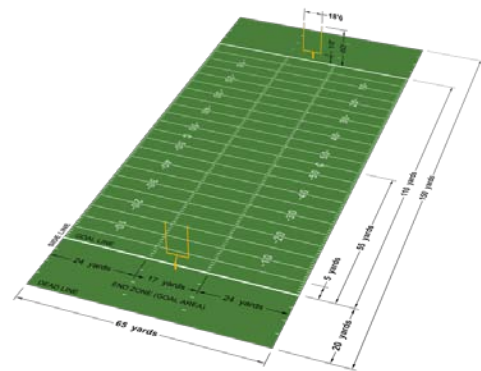
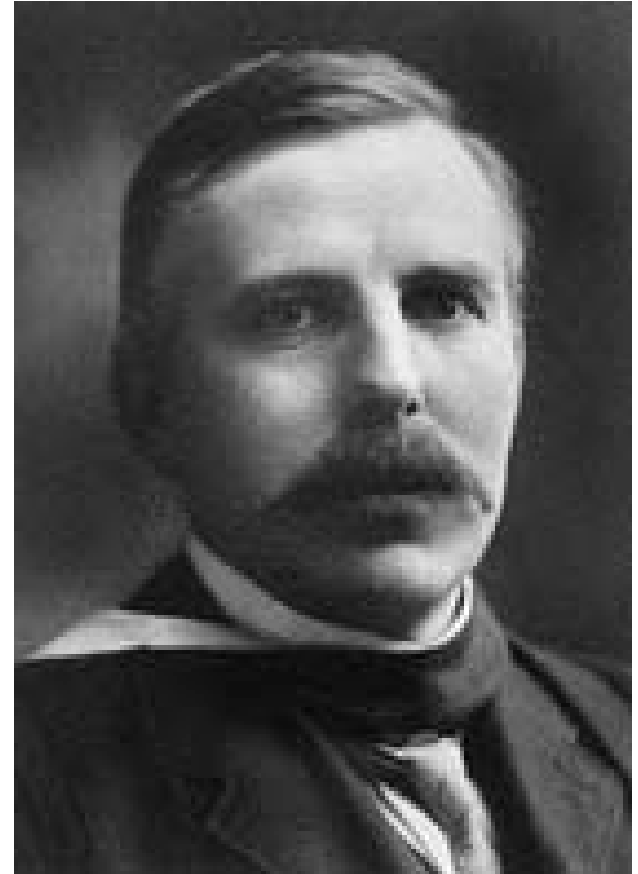


The Oil Drop Experiment

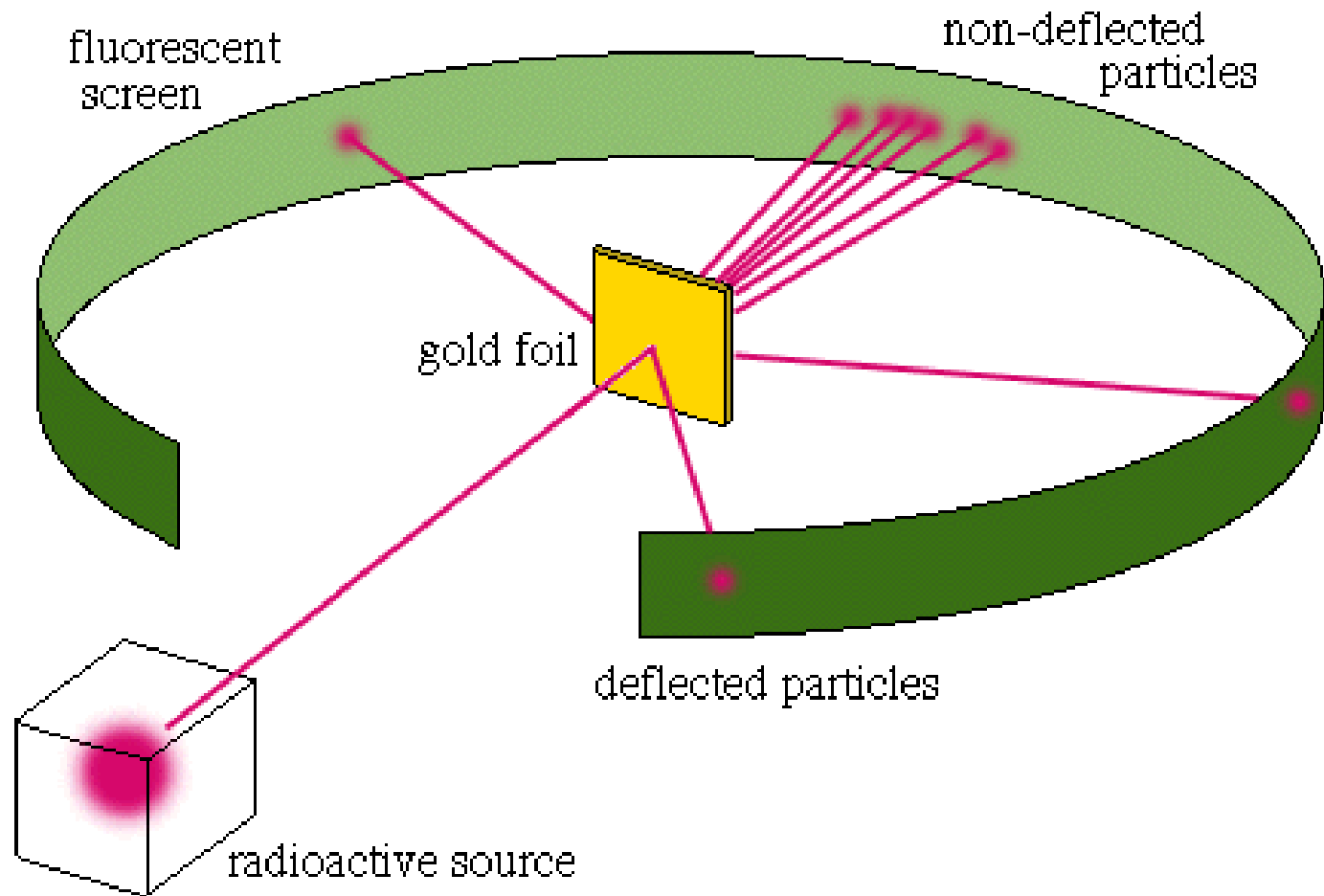


Ernest Rutherford

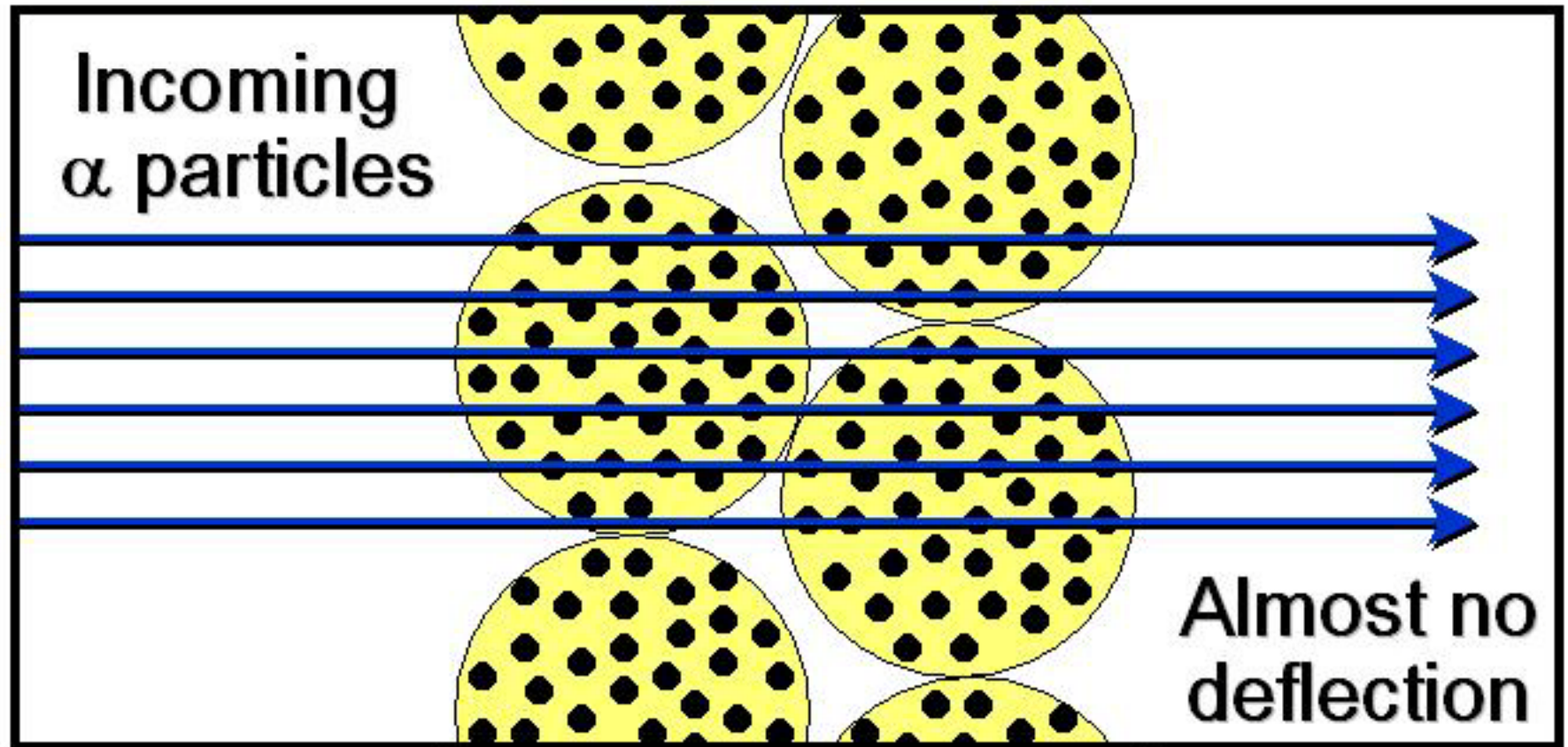
- When: 1911
- Where: England
- What: Discovered protons and the nucleus.
Decided that the atoms were **mostly empty space**, but had a **dense central core**.



The Gold Foil Experiment

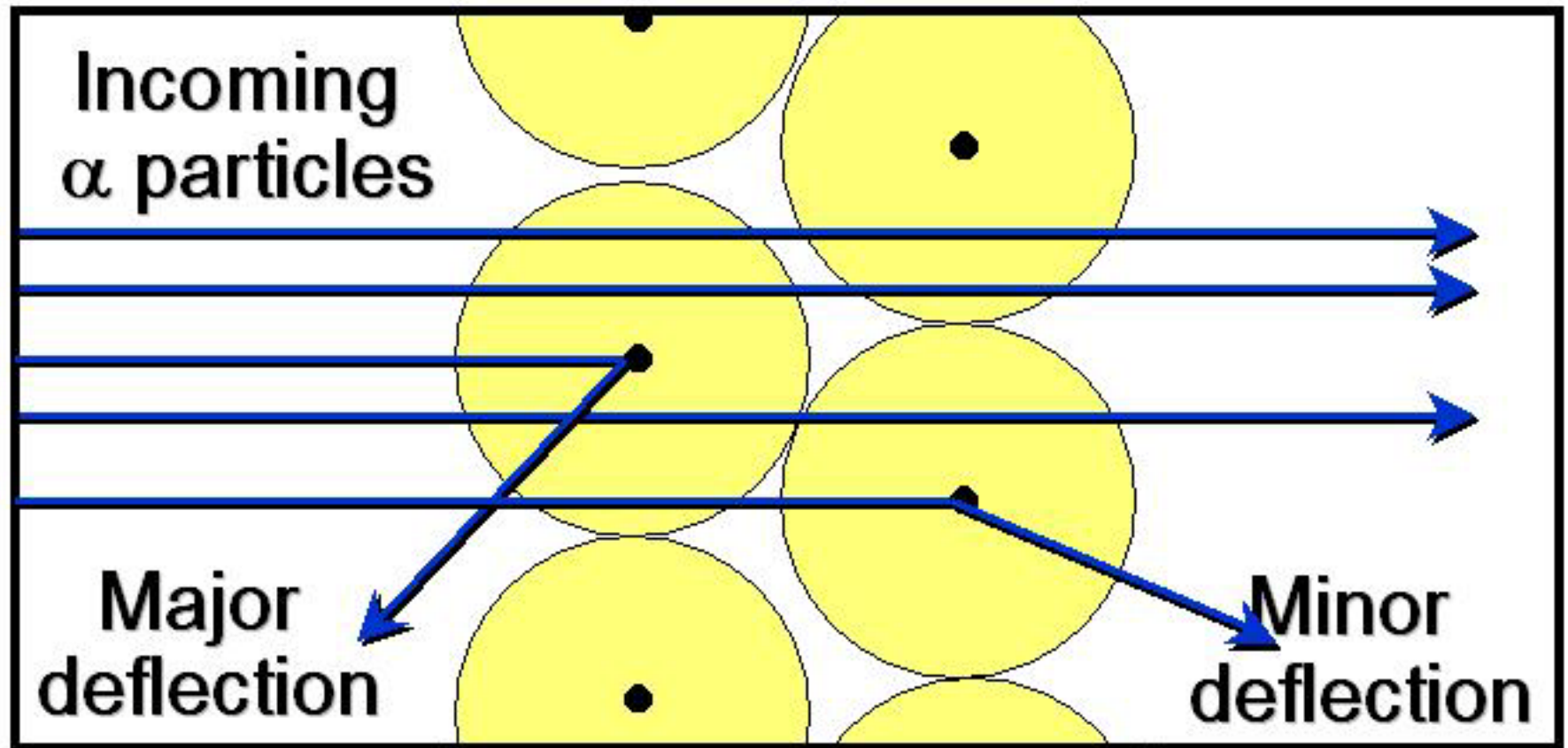


Hypothesis: expected result based on
“plum pudding” model



**Cross section of gold foil composed of plum
pudding atoms**

Actual result

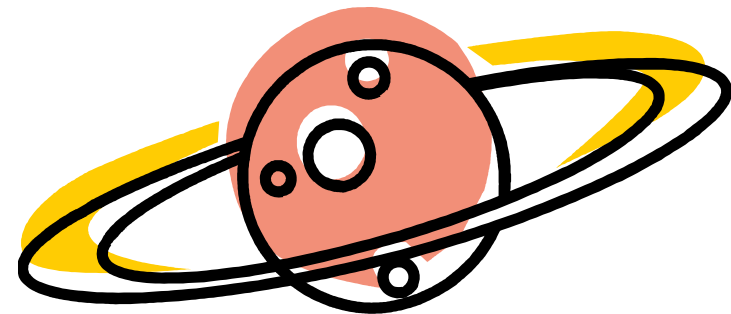


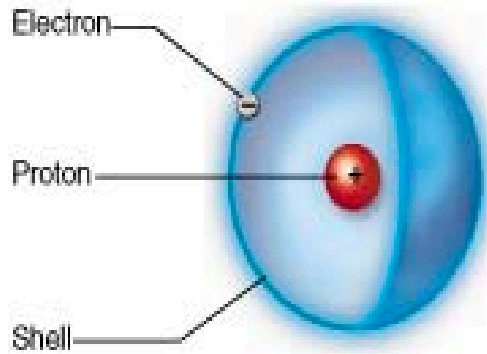
Cross section of gold foil composed of atoms with a tiny, massive, positive nucleus

Niels Bohr

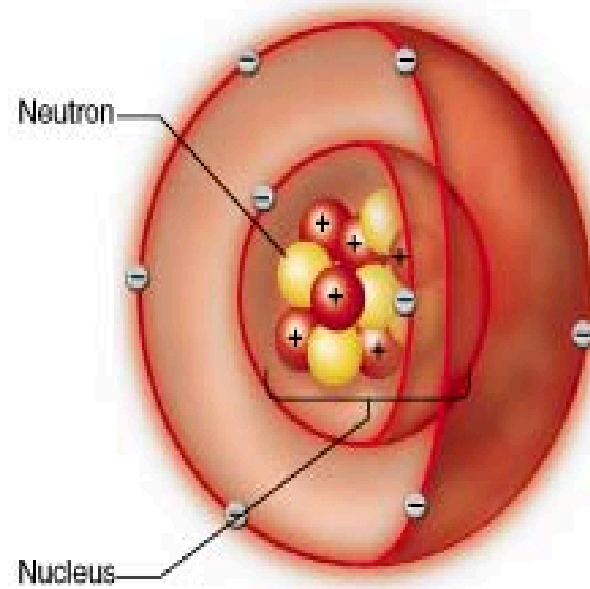
Electrons orbit nucleus

- When: 1913
- Where: England
- What: **Electrons “orbit” the nucleus** in “rings”
- Why: Bohr was trying to show why the negative electrons were not sucked into the nucleus of the atom.

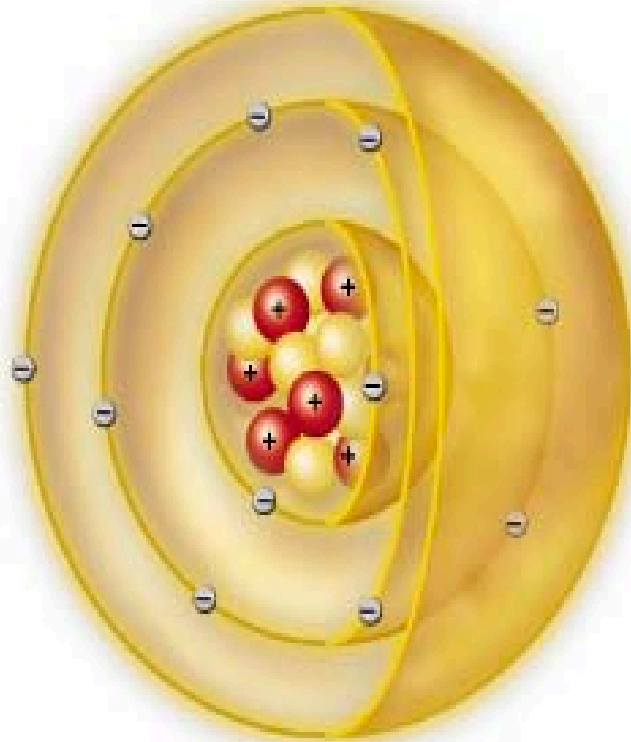




(a) Hydrogen
1 proton



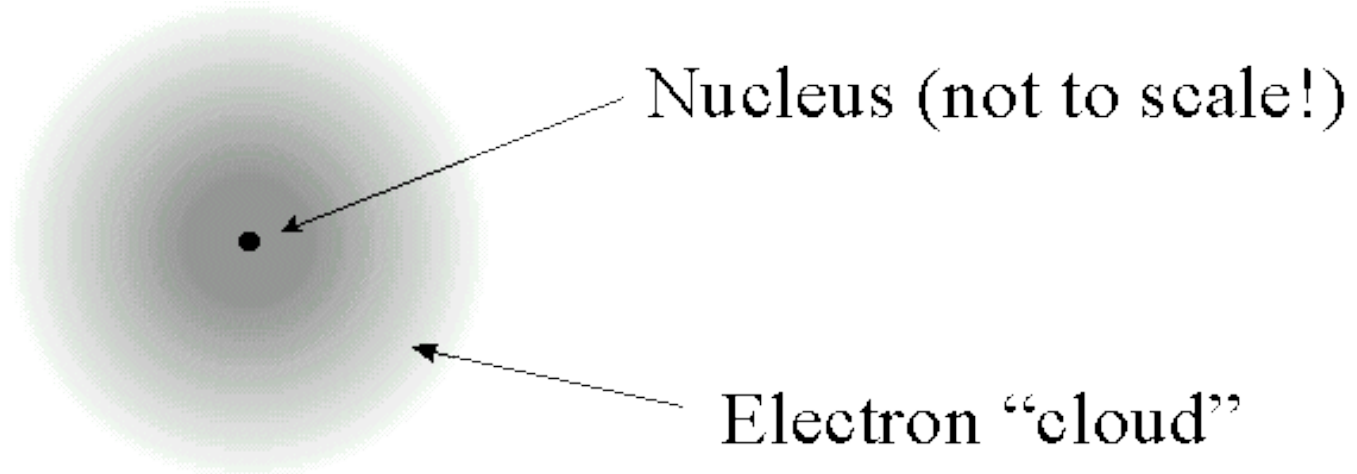
(b) Oxygen
8 protons
8 neutrons
8 electrons
in 2 shells



(c) Sodium
11 protons
11 neutrons
11 electrons
in 3 shells

Electron Cloud Model

- Electrons travel around the nucleus in **random** orbits.
- **Cannot predict exactly where** they will be at any given moment.
 - Can predict the **MOST LIKELY** place
 - **Orbitals – probability clouds**



SUMMARY OF CURRENT IDEAS

Particle	Symbol	Charge	Relative Mass	Actual Mass (Kg)
electron	e⁻	-1	0	9.11x10⁻²⁸
proton	p	+1	1	1.67x10⁻²⁴
neutron	n	0	1	1.67x10⁻²⁴