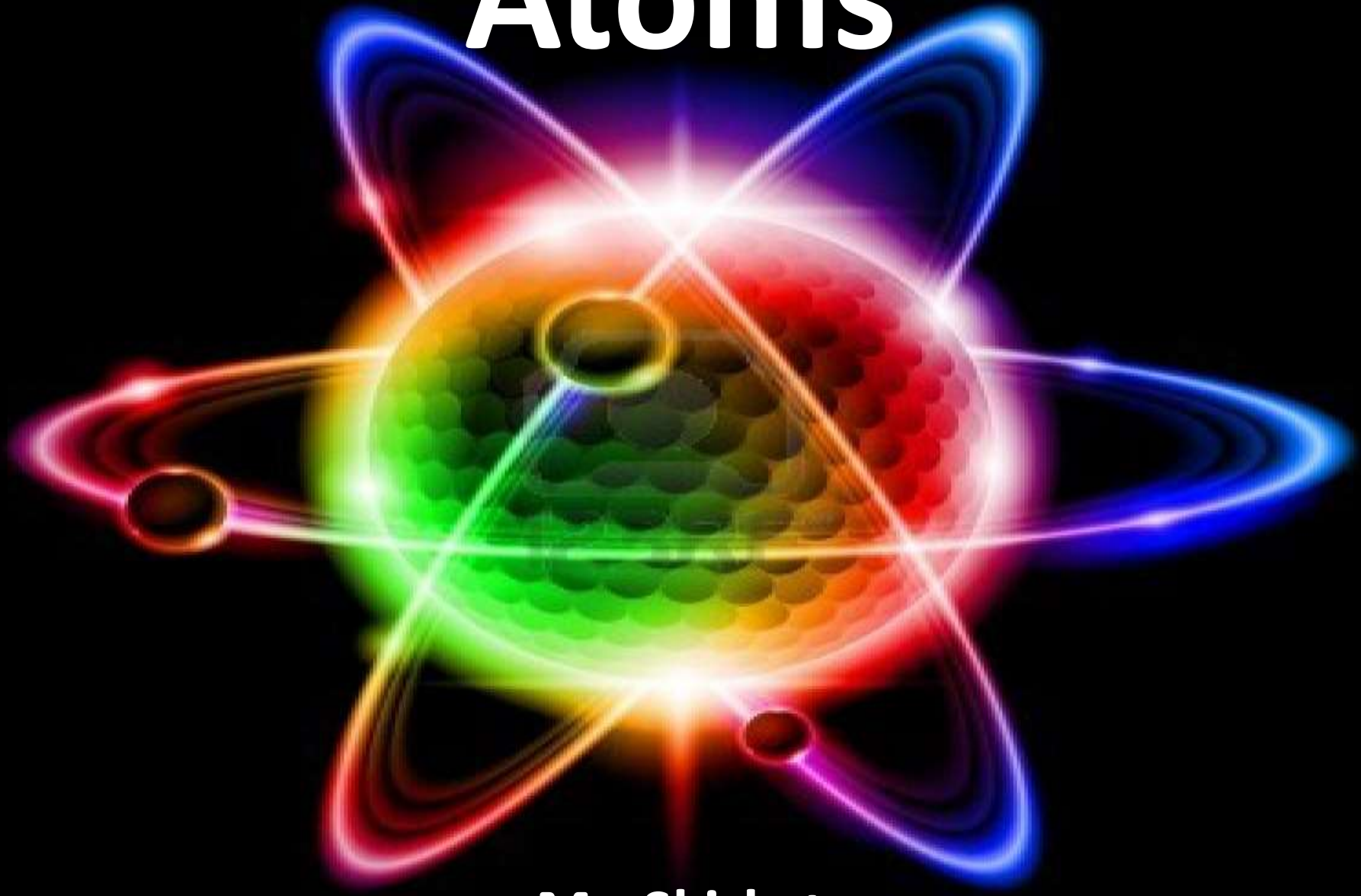
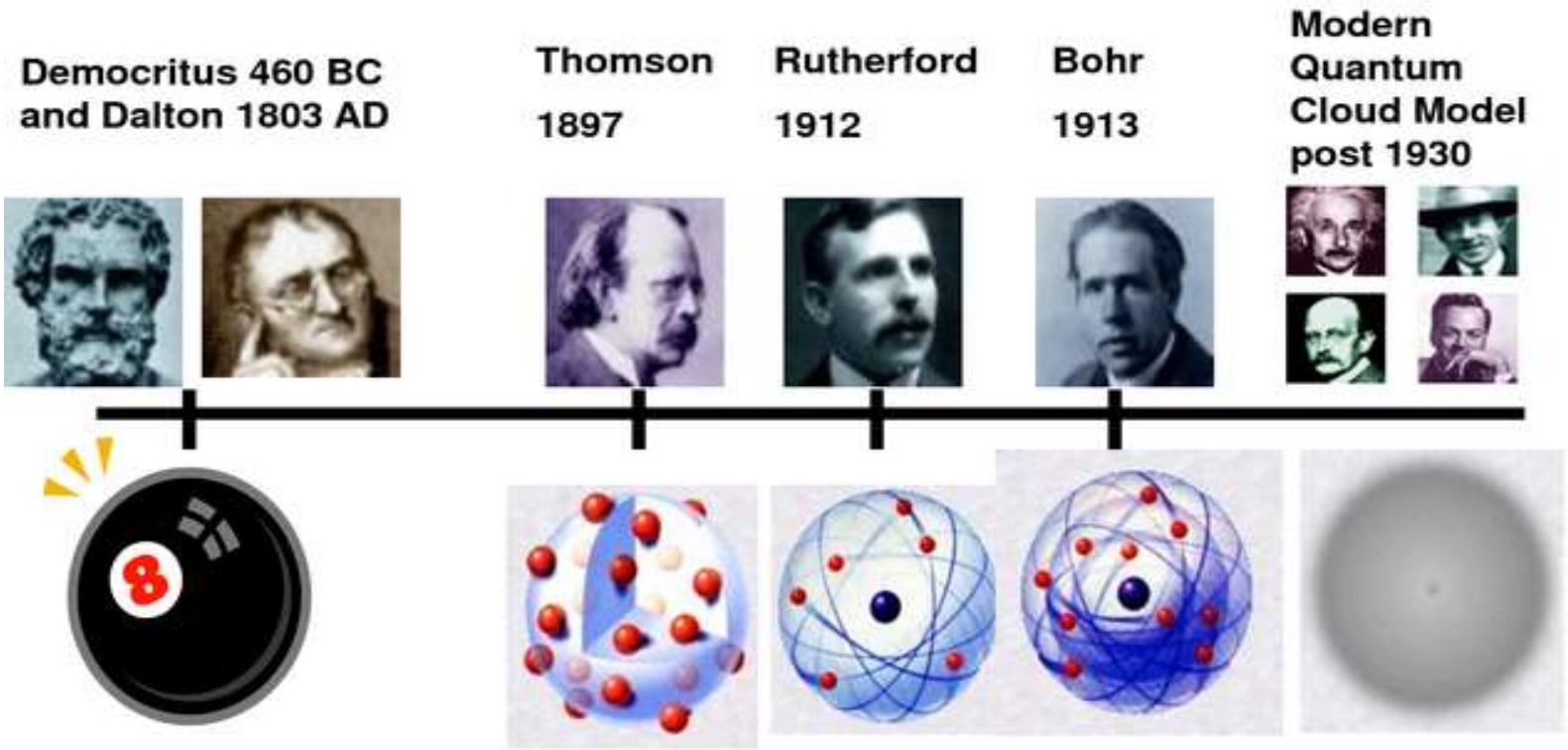
# Atoms



Mr. Skirbst

# Atomic Models

## History of the Atom Timeline



# Atomic Models

1. **Democritus** – Ancient Greek Philosopher
   - "atomos" indivisible

# Atomic Models

**2. John Dalton** – 1803, Eng. Chemist

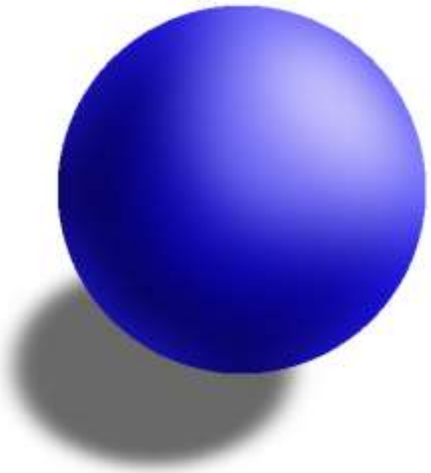
***Atomic Theory Of Matter (ATOM):***

# Atomic Models

**2. John Dalton** – 1803, Eng. Chemist

***Atomic Theory Of Matter (ATOM):***

* All elements made of indivisible atoms



# Atomic Models

**2. John Dalton** – 1803, Eng. Chemist

***Atomic Theory Of Matter (ATOM):***

* All elements made of indivisible atoms
* Atoms of an element are alike

# Atomic Models

**2. John Dalton** – 1803, Eng. Chemist

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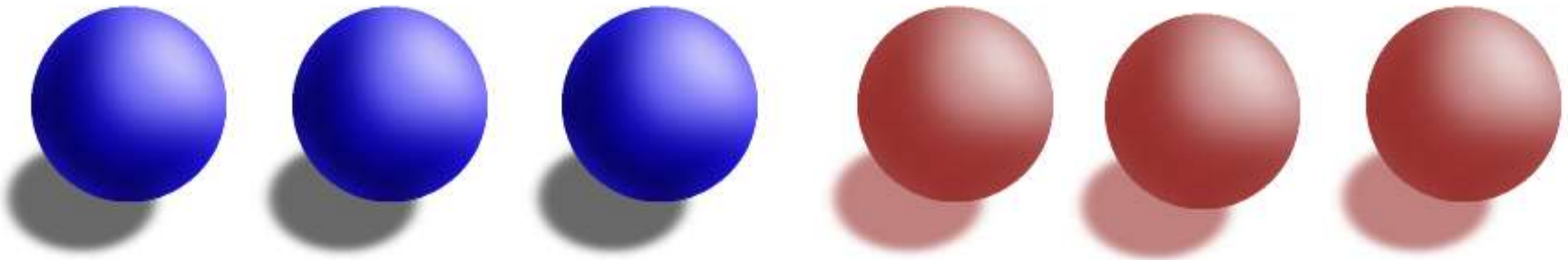
* All elements made of indivisible atoms
* Atoms of an element are alike
* Different elements have different atoms

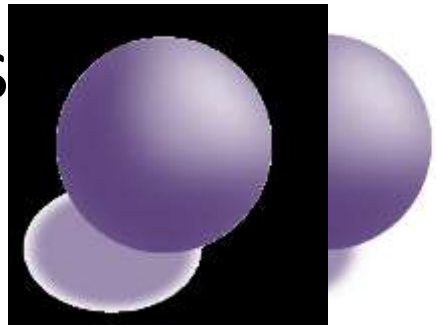


# Atomic Models

## 2. **John Dalton** – 1803, Eng. Chemist

***Atomic Theory Of Matter (ATOM):***

* All elements made of indivisible atoms
* Atoms of an element are alike
* Different elements have different atoms
* Atoms join to form compounds

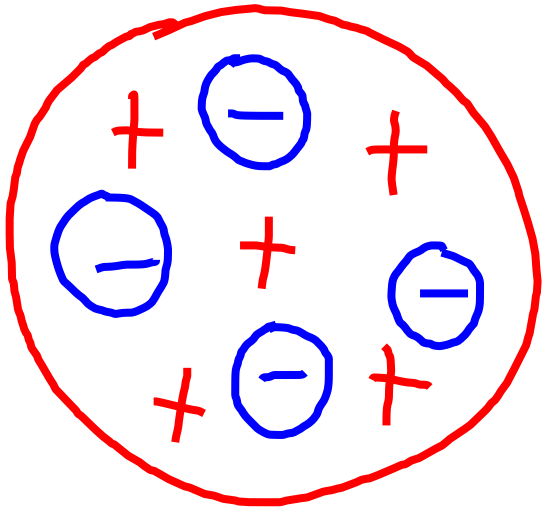


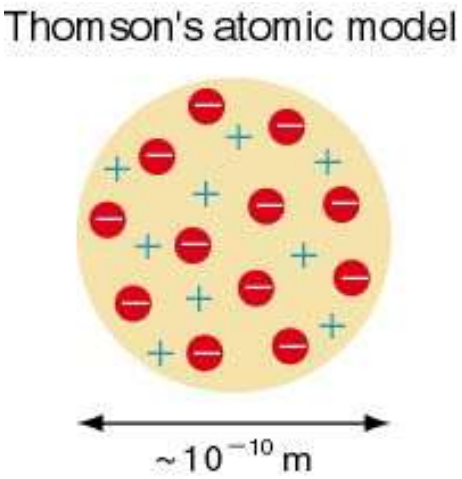
# Atomic Models

## 3. **J.J. Thomson** - 1897, Eng. Scientist

***Plum Pudding Model:***

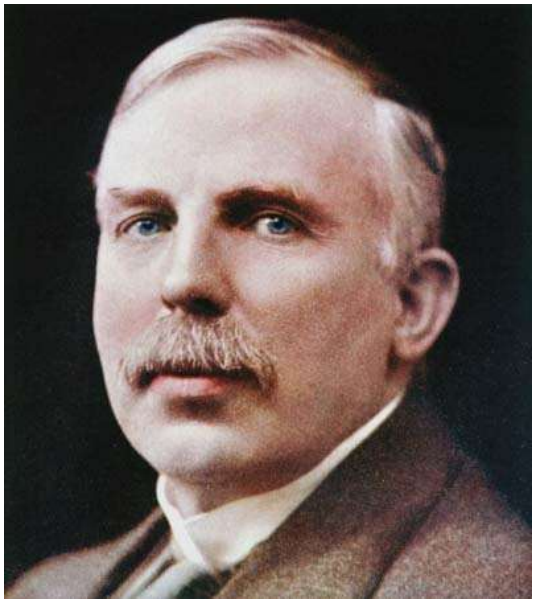
* Atoms made of (+) “pudding”
* (-) “corpuscles” throughout





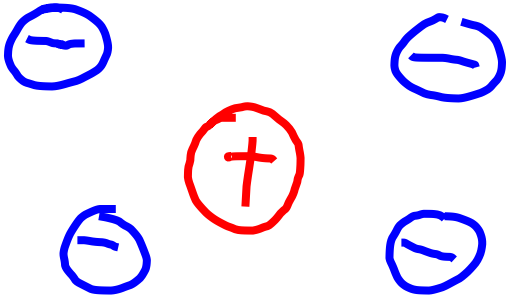

# Atomic Models

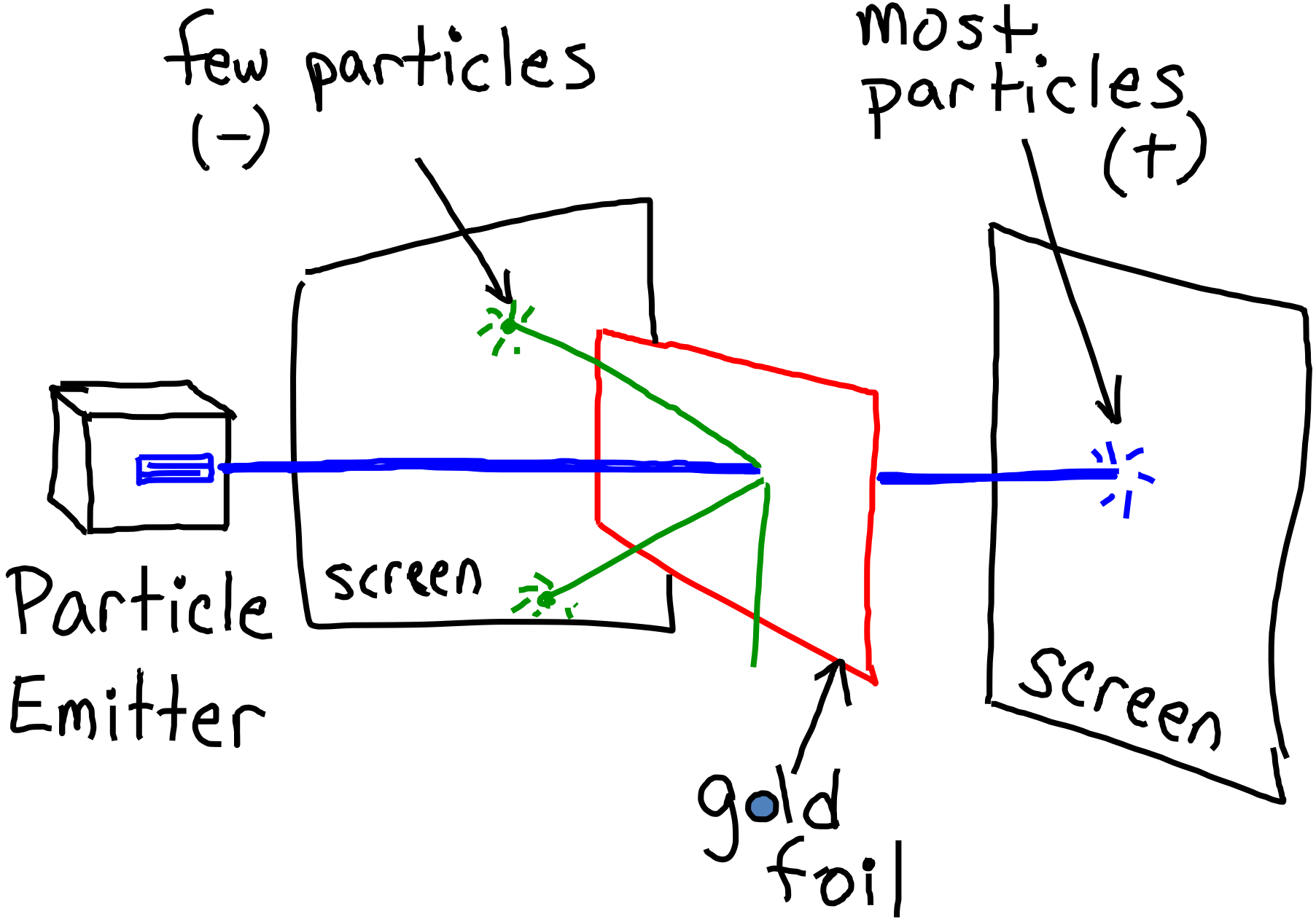
## 4. **Ernest Rutherford** - 1908, Eng. Physicist



***"Gold Foil" Experiment:***

* Dense, central nucleus
* Nucleus has (+) particles
* (-) particles outside nucleus




few particles
(-)
most particles
(+)
Particle Emitter
screen
gold foil
screen

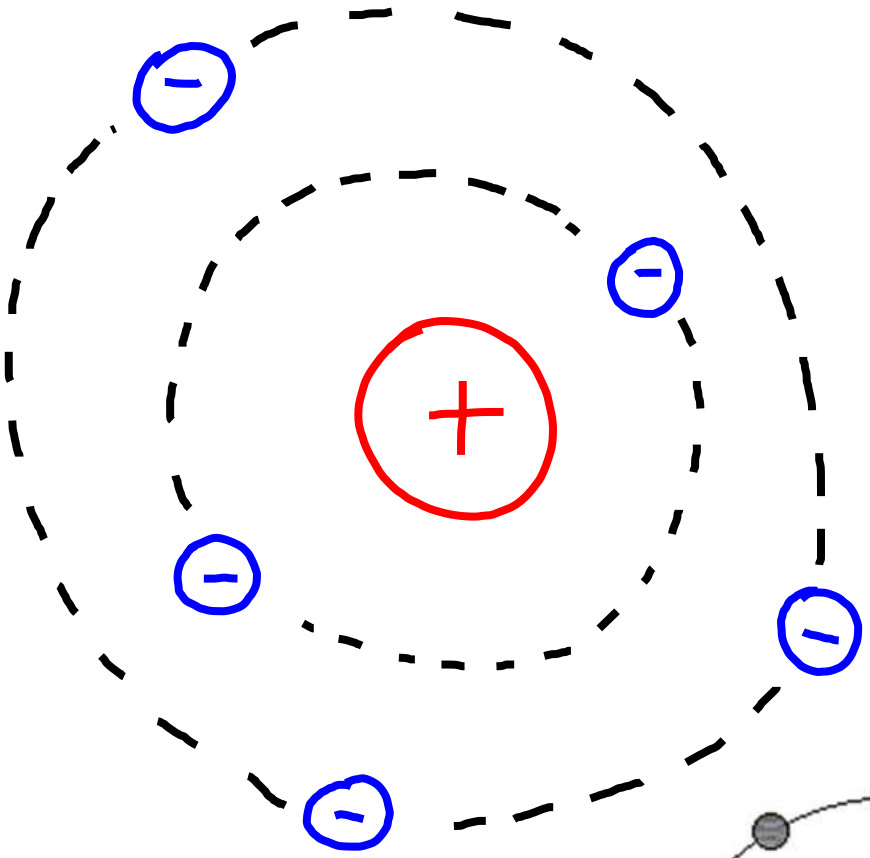
# Atomic Models

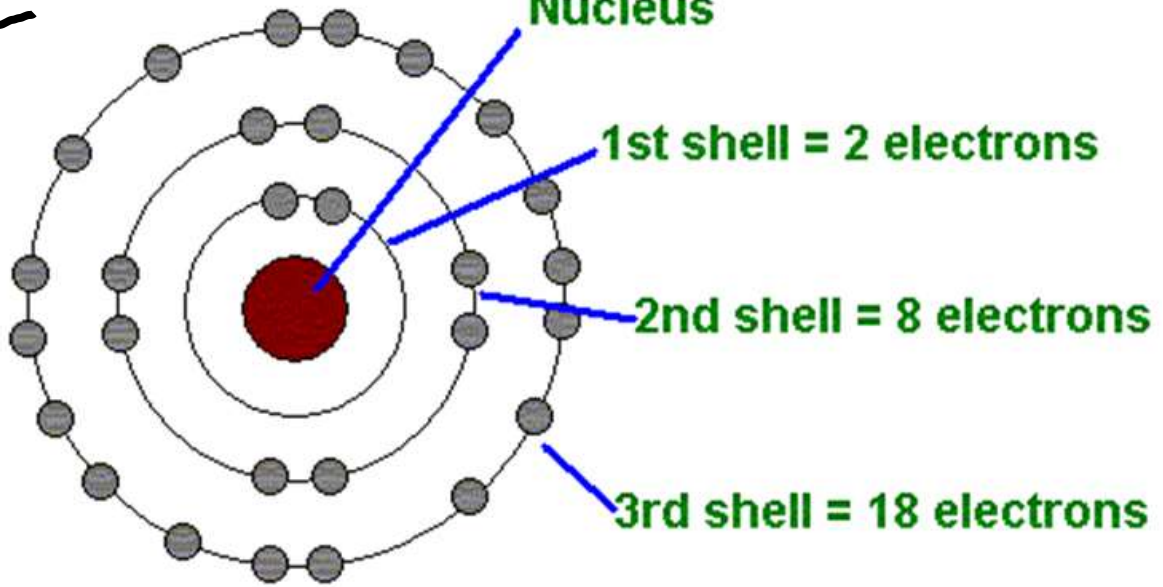
## 5. **Niels Bohr** - 1913, Danish Physicist

***Electron-Orbital Model:***

Electrons move in definite "orbits" around nucleus in energy levels

# Bohr Model



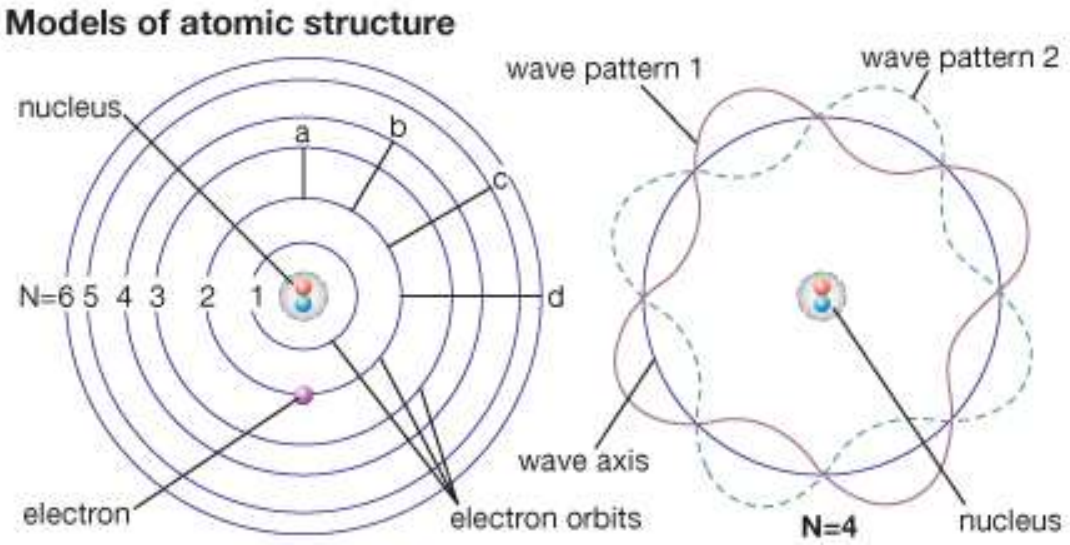

Nucleus
1st shell = 2 electrons
2nd shell = 8 electrons
3rd shell = 18 electrons

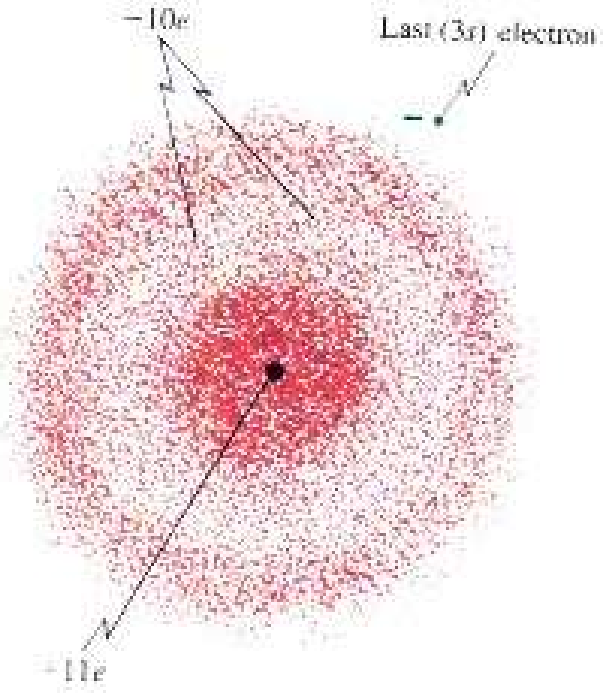
# Atomic Models

## 6. **Wave Model** - today, many

***Electron Cloud:***

*Electrons found in "electron cloud" around nucleus



# Atomic Models

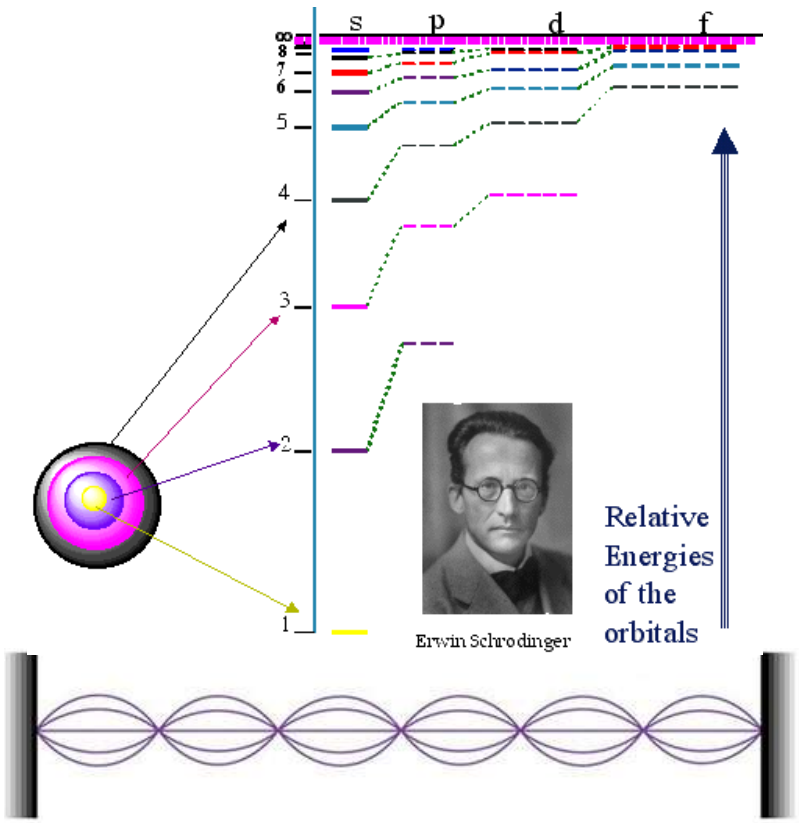
**6. Wave Model** - today, many

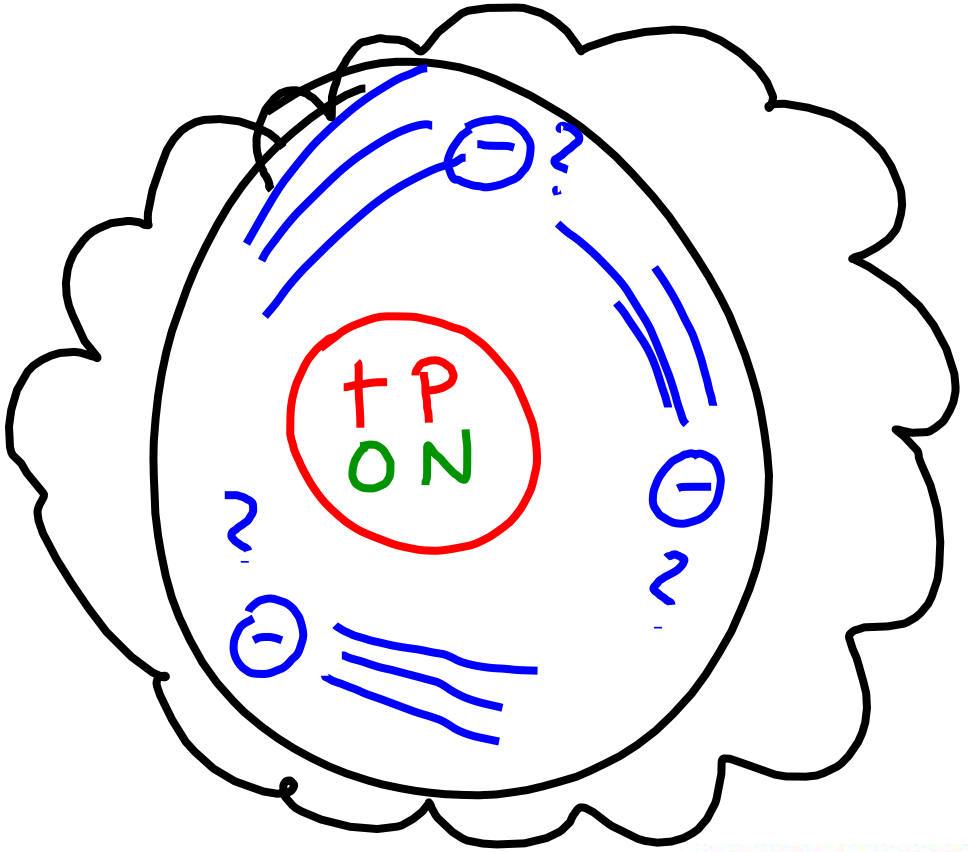
***Electron Cloud:***

*Electrons found in "electron cloud" around nucleus

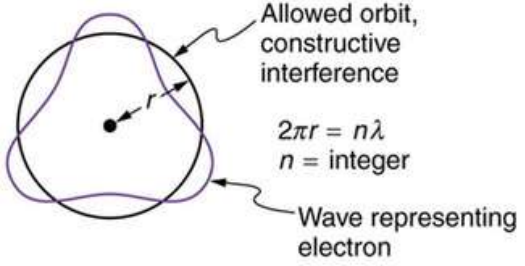
* Both ENERGY and POSITION of electron CANNOT be known at same time

# Wave Model

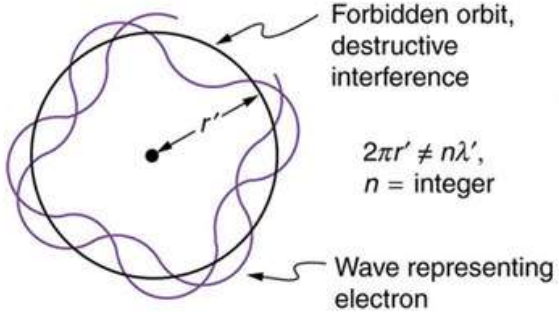


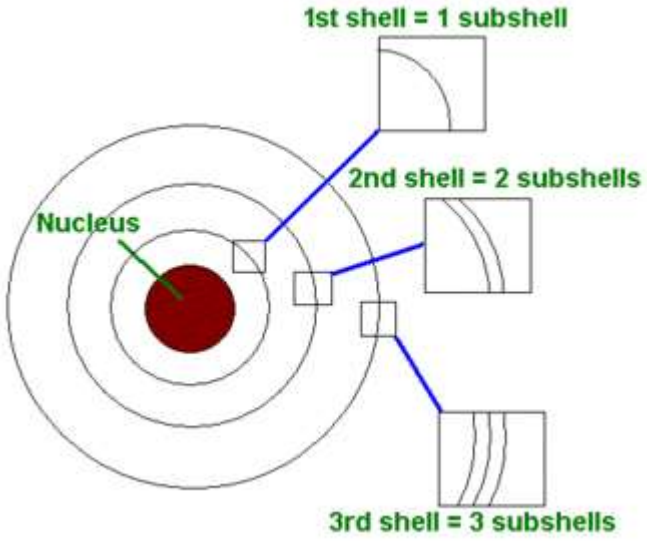

(a)




(b)




(c)



# Atomic Structure

## Sub-Atomic Particles

* Parts smaller than the atom itself

PROTON – (+) charge, in nucleus

Proton = Positive

# Atomic Structure

## Sub-Atomic Particles

* Parts smaller than the atom itself

PROTON – (+) charge, in nucleus

Proton = Positive

NEUTRON – (0) charge, in nucleus

Neutron = Neutral

# Atomic Structure

## Sub-Atomic Particles

* Parts smaller than the atom itself

PROTON – (+) charge, in nucleus

Proton = Positive

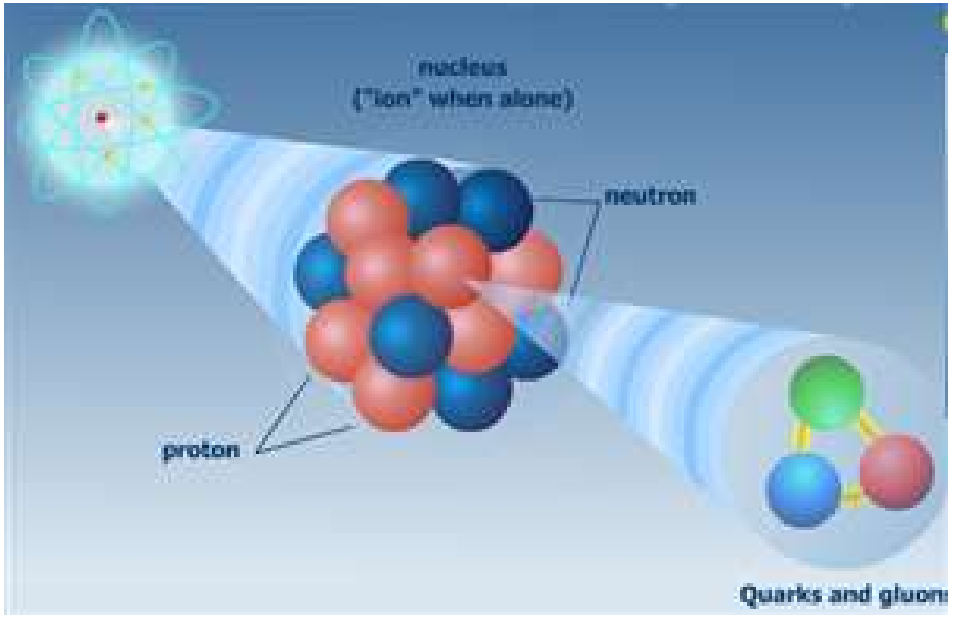
NEUTRON – (0) charge, in nucleus

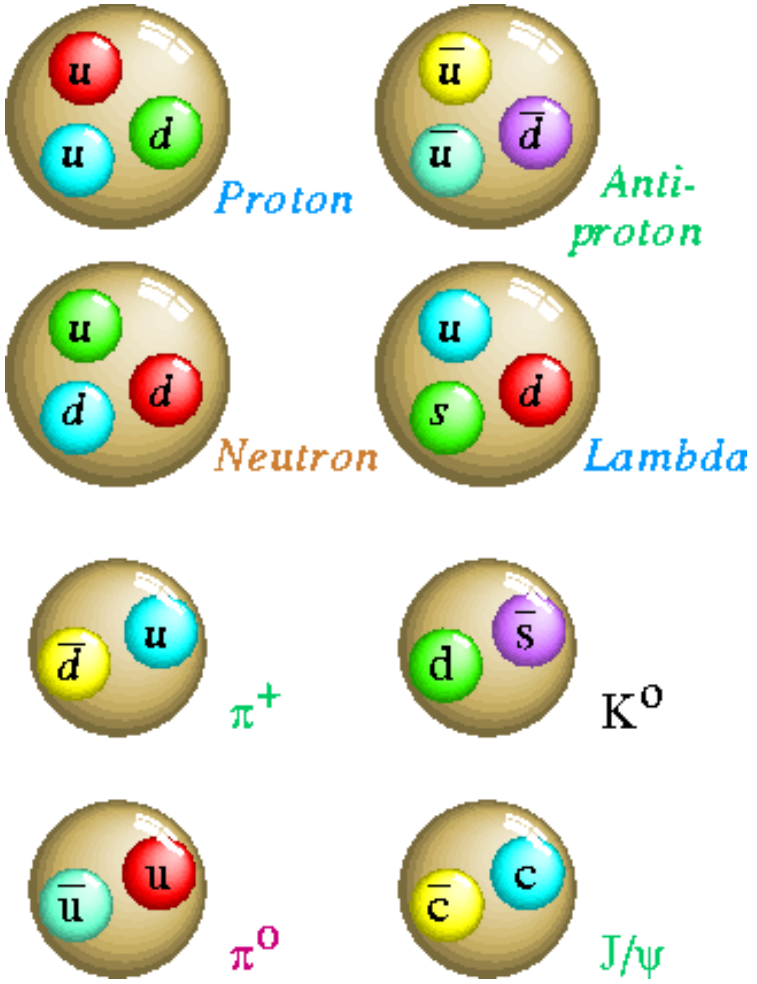
Neutron = Neutral

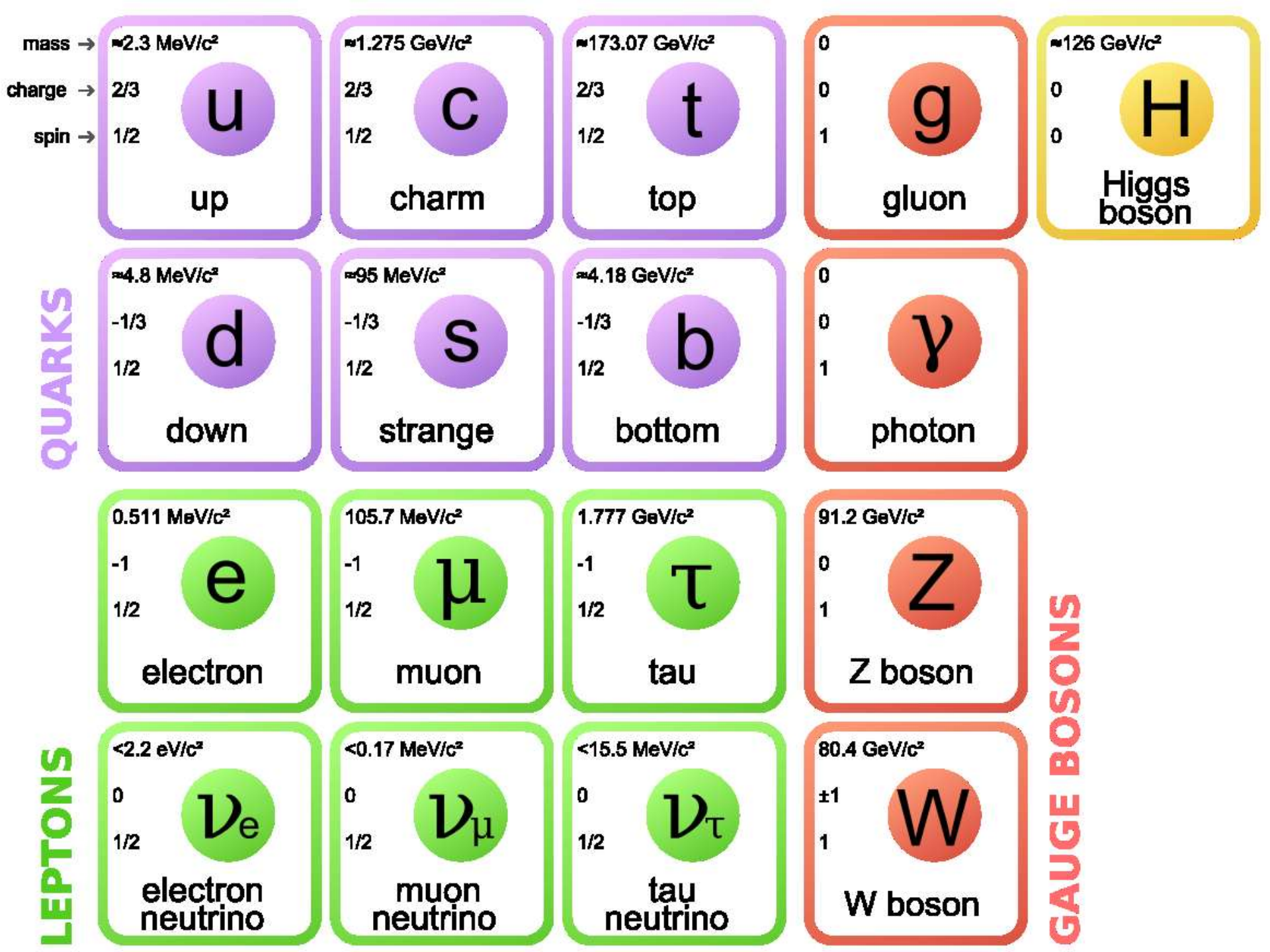
ELECTRON – (-) charge, around nucleus

# Atomic Structure

QUARKS – particles that make up sub-atomic particles

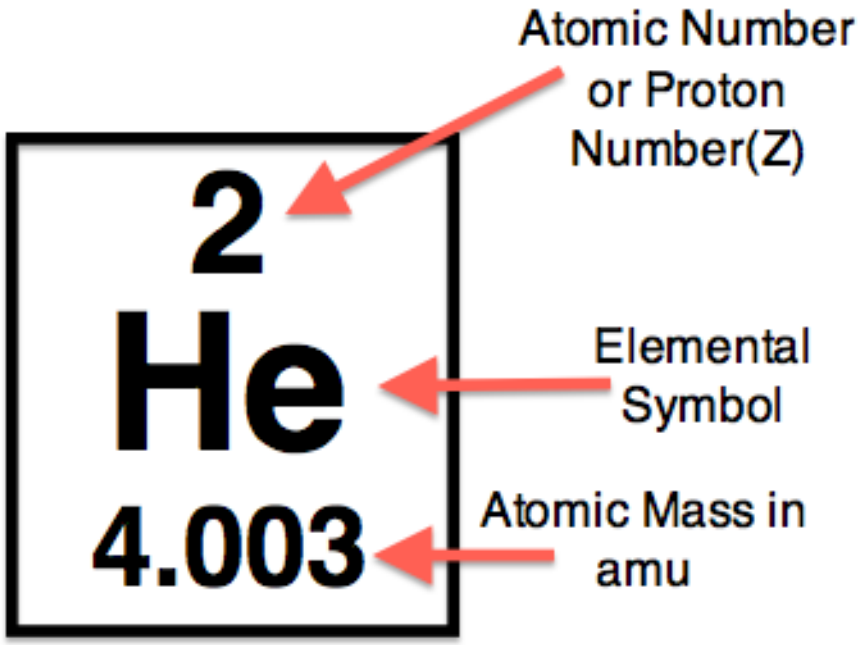


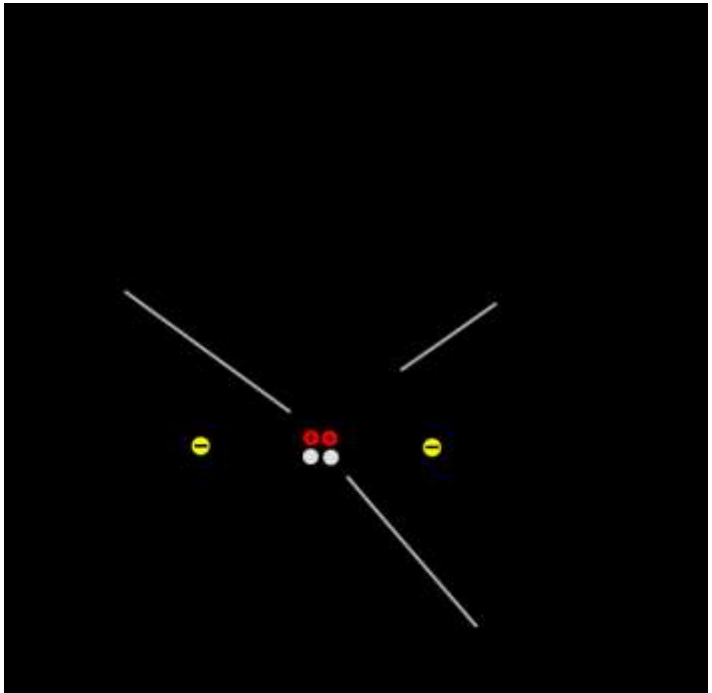




mass →
charge →
spin →
≈2.3 MeV/c²
2/3
1/2
u
up
≈1.275 GeV/c²
2/3
1/2
c
charm
≈173.07 GeV/c²
2/3
1/2
t
top
0
0
1
g
gluon
≈126 GeV/c²
0
0
H
Higgs boson
QUARKS
≈4.8 MeV/c²
-1/3
1/2
d
down
≈95 MeV/c²
-1/3
1/2
s
strange
≈4.18 GeV/c²
-1/3
1/2
b
bottom
0
0
1
γ
photon
0.511 MeV/c²
-1
1/2
e
electron
105.7 MeV/c²
-1
1/2
μ
muon
1.777 GeV/c²
-1
1/2
τ
tau
91.2 GeV/c²
0
1
Z
Z boson
LEPTONS
<2.2 eV/c²
0
1/2
νe
electron neutrino
<0.17 MeV/c²
0
1/2
νμ
muon neutrino
<15.5 MeV/c²
0
1/2
ντ
tau neutrino
80.4 GeV/c²
±1
1
W
W boson
GAUGE BOSONS

# Atomic Structure

ATOMIC ***NUMBER*** = the # of protons

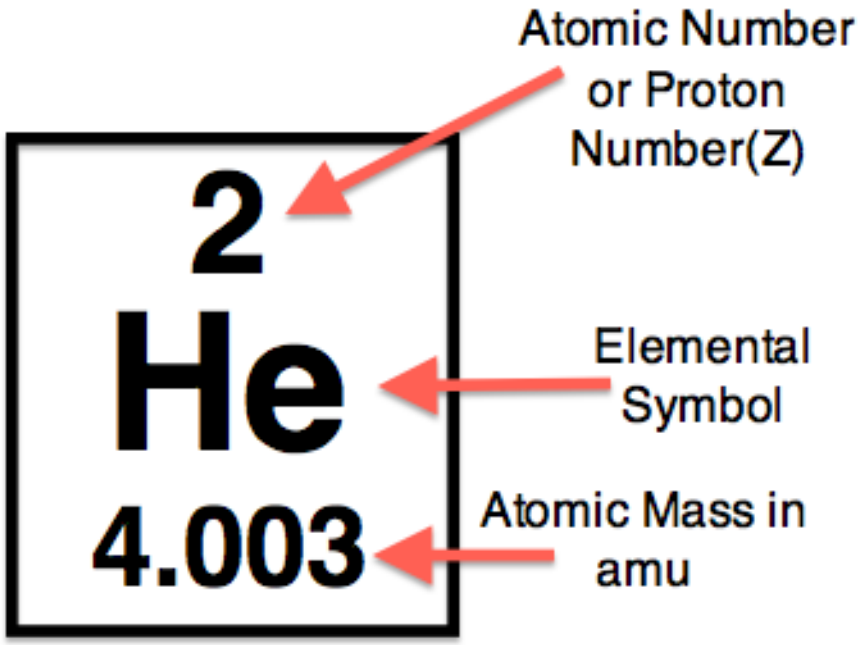


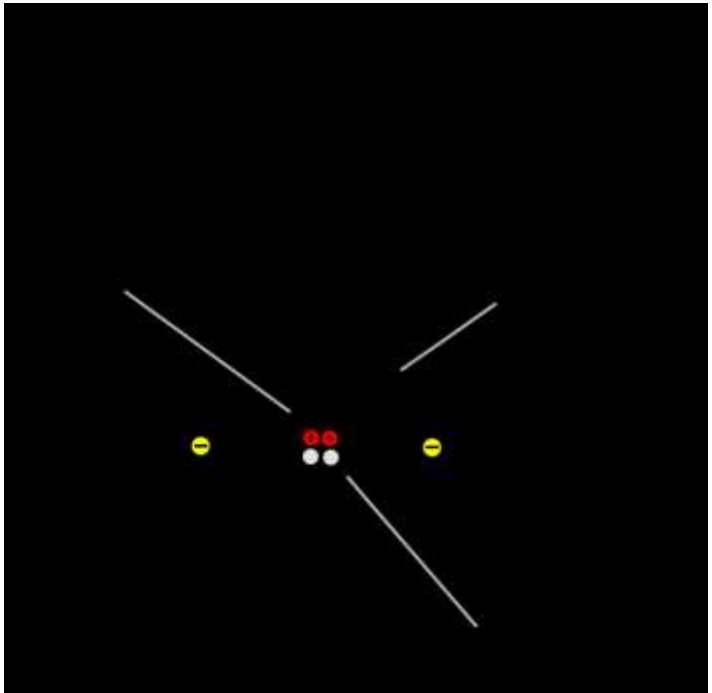



# Atomic Structure

ATOMIC ***NUMBER*** = the # of protons

ATOMIC ***MASS*** = # protons + # neutrons



# Atomic Structure

ATOMIC ***NUMBER*** = the # of protons

ATOMIC ***MASS*** = # protons + # neutrons

ISOTOPE – atom with different # neutrons

The Nuclei of the Three Isotopes of Hydrogen