

Radioactive Decay



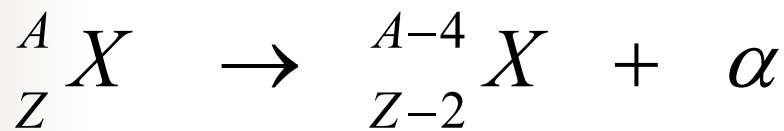
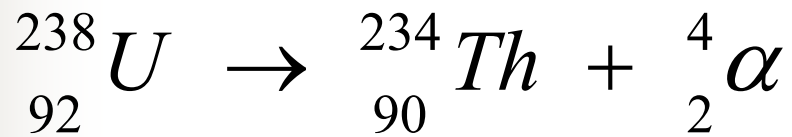
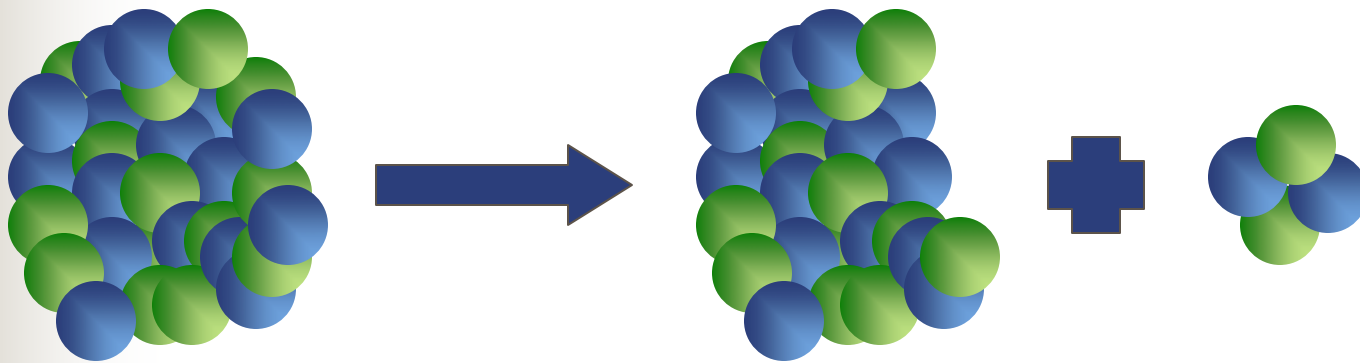
Spontaneous Processes



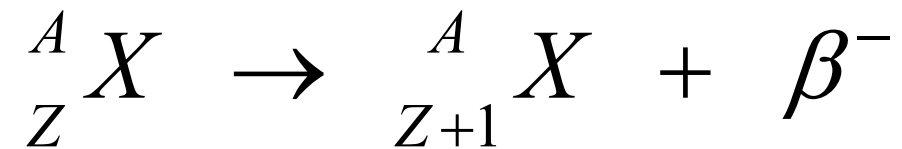
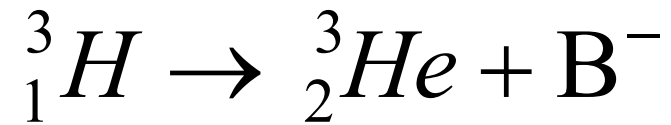
Types of Emissions

- Alpha (α)
- Beta (B)
- Gamma (γ)
- There are others
 - Not important in reactor operation

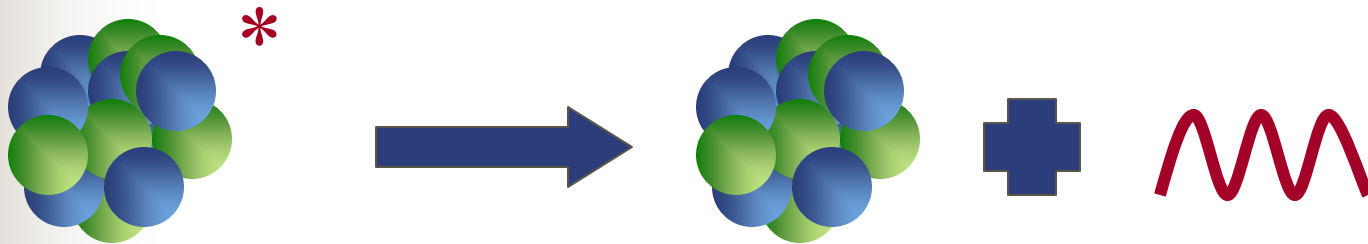
Alpha



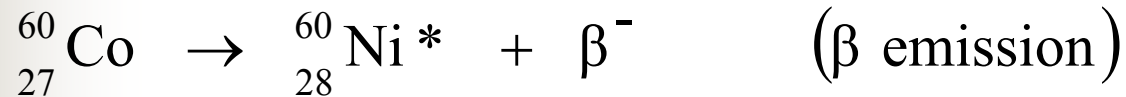
Beta



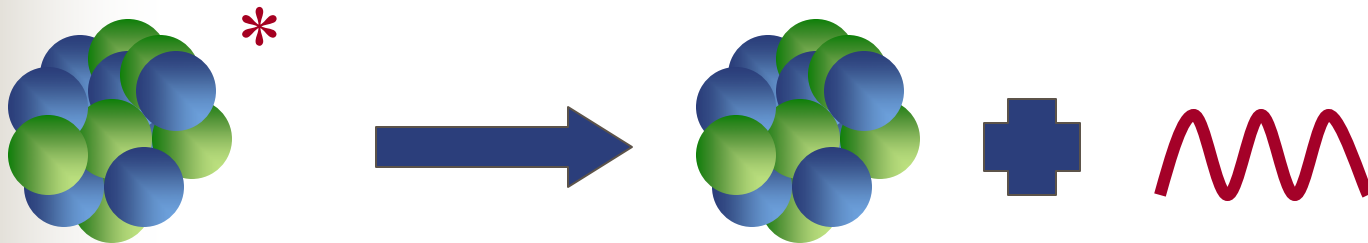
Gamma



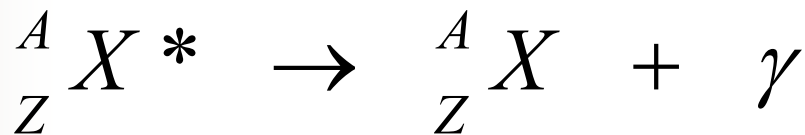
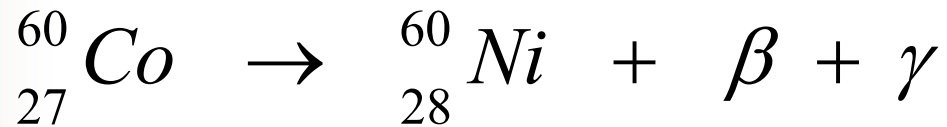
Happens after an alpha or Beta decay!



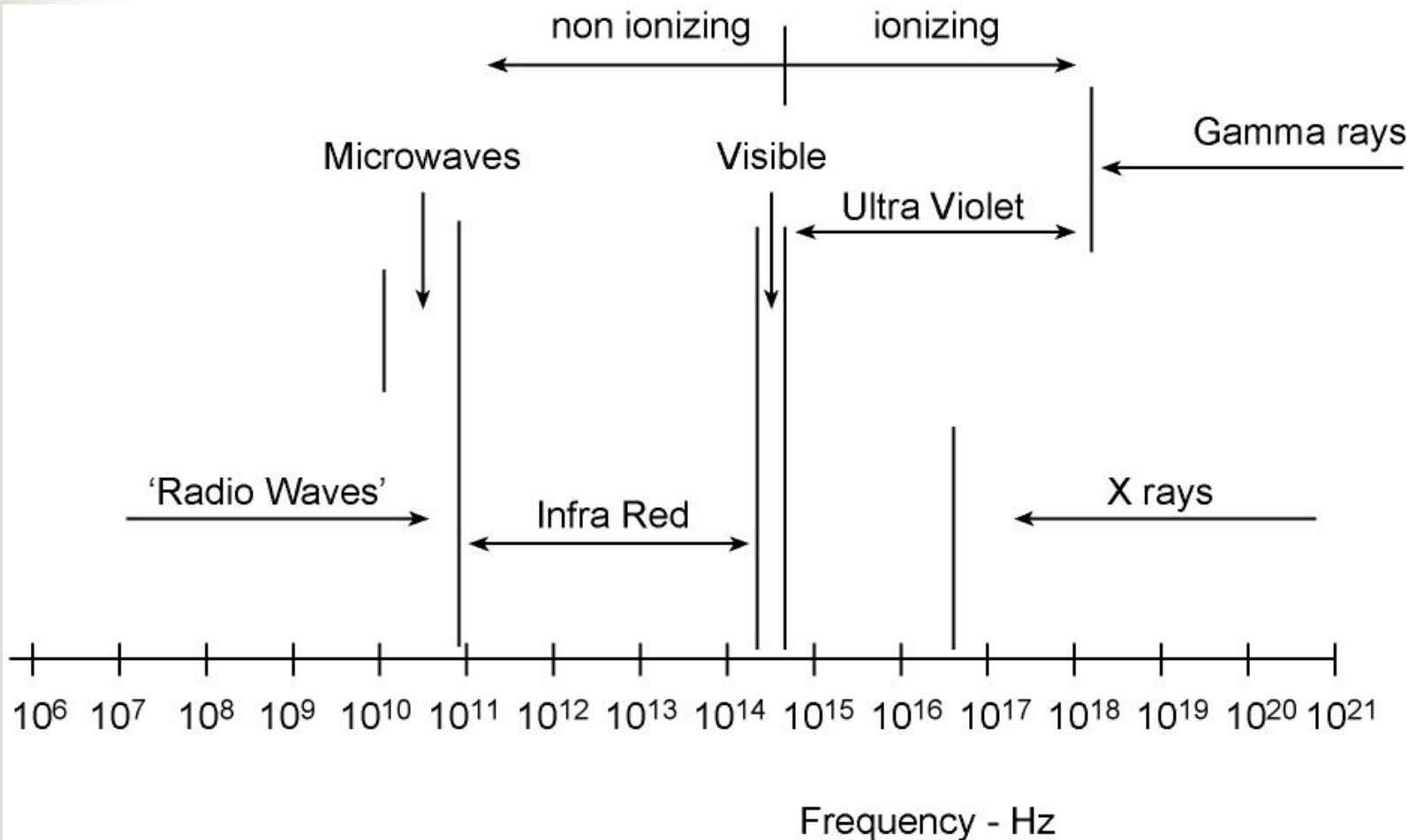
More Gamma



Gamma emission is usually so fast that the two emissions are considered simultaneous



Electro-Magnetic Spectrum





Interaction of α and Matter

- Charge +2, mass 4u
- Intensely ionizing
- 50,000 ion pairs/inch of travel in air
- 34 eV per ionization
- 4 MeV dissipates in about 2.5 cm of travel



Interaction of B^- and Matter

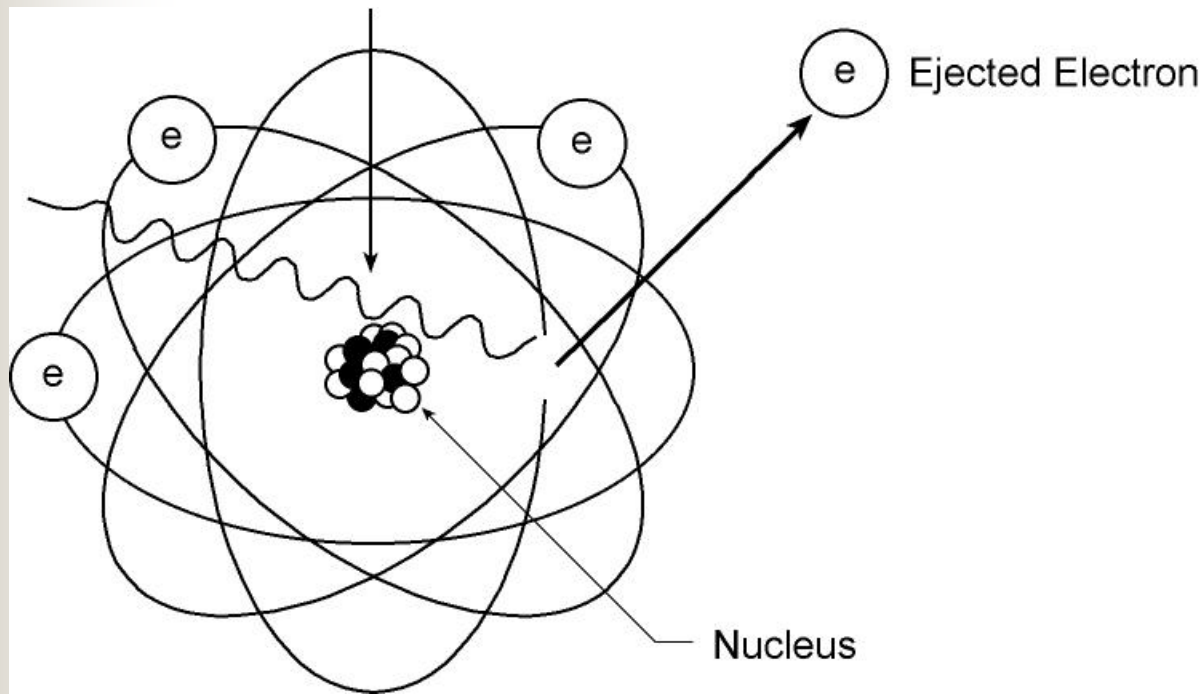
- Charge -1 , mass $0.000,584$ u
- Travel very fast ($90-99\%$ c)
- 100-300 ion pairs per cm in air
- Lose their energy in 20 m in air.
- Create x-rays from bremsstrahlung

Interactions of γ and Matter

- Photoelectric
- Compton
- Pair Production

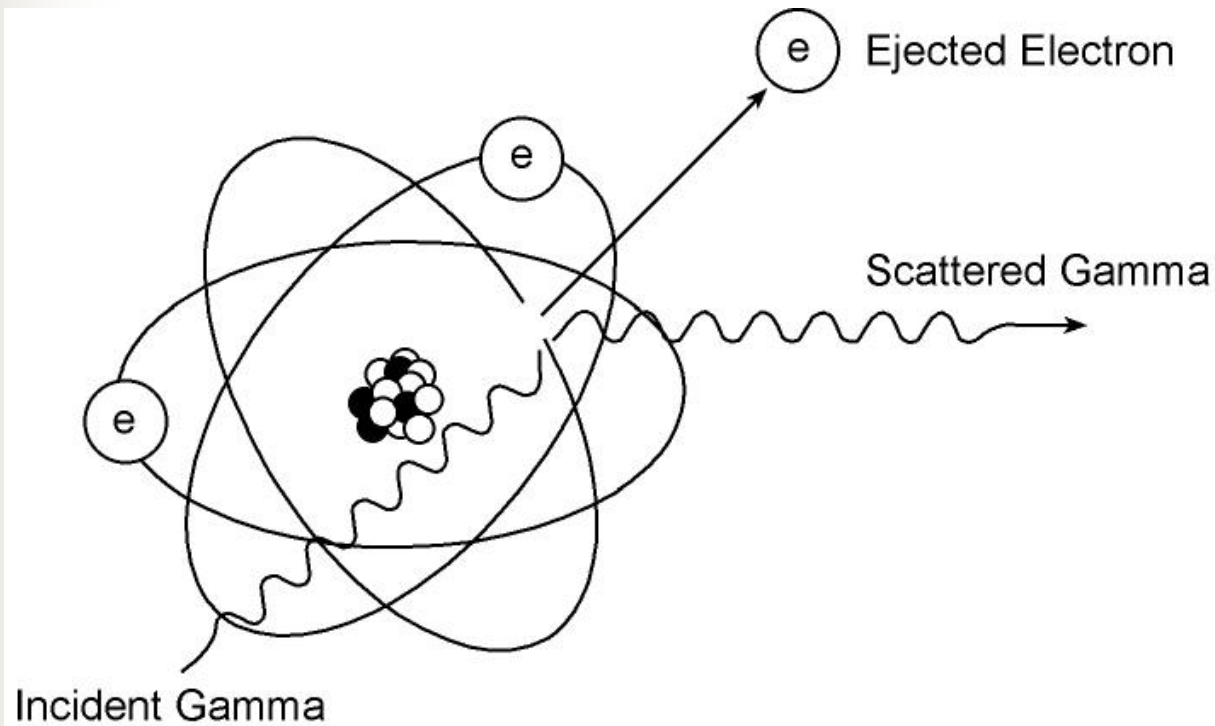


Photoelectric



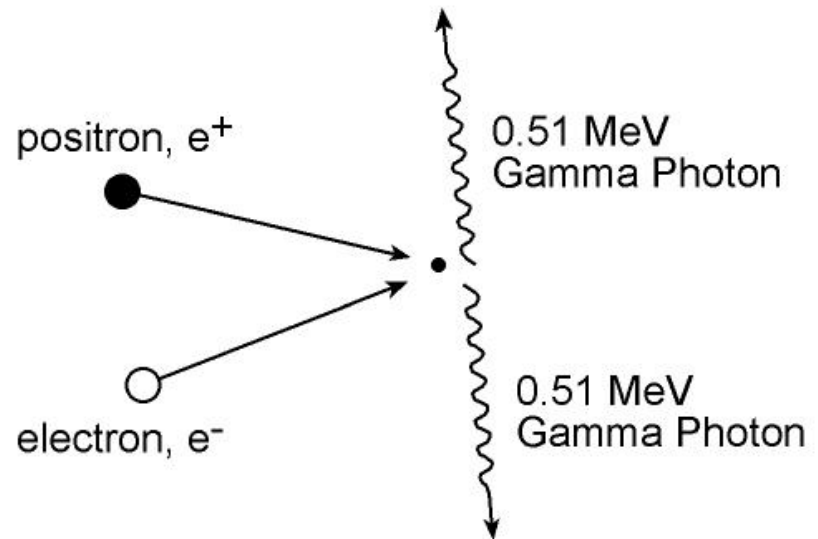
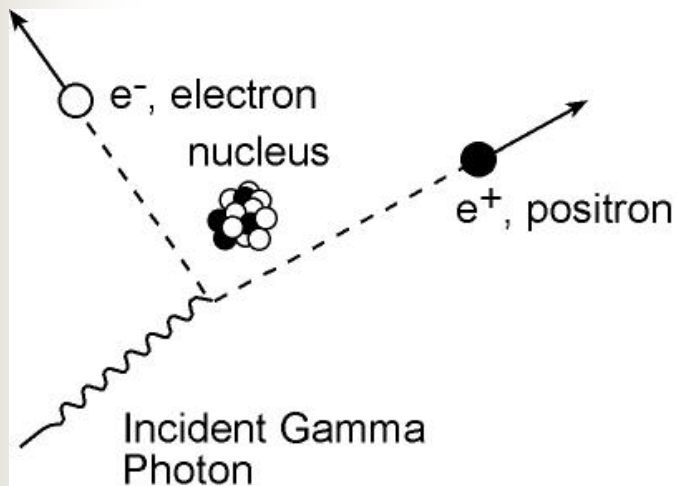
Not important above .1 MeV

Compton



Important for 0.1 to 10 MeV gamma

Pair Production



Minimum γ energy = 1.02 MeV
Usually higher





Other Stuff

- Indirect & direct ionization
- Shielding
- Half-value layers for γ