PHY1024

# Radioactivity and Nuclear Physics

Read chapter 31 <https://openstax.org/books/college-physics/pages/31-introduction-to-radioactivity-and-nuclear-physics>

Some nuclei are **radioactive**—they spontaneously decay destroying some part of their mass and emitting energetic rays, a process called **nuclear radioactivity**.

**Nuclear radiation**, like x rays, **is ionizing radiation**, because energy sufficient to ionize matter is emitted in each decay.

**Radiation detectors** are based directly or indirectly upon the ionization created by radiation, as are the effects of radiation on living and inert materials.

# Substructure of the Nucleus

Two particles, both called **nucleons**, are found inside nuclei.

The two types of nucleons are **protons** and **neutrons**.

They are very similar, except that the proton is positively charged while the neutron is neutral.

**The charge of proton** is equal to the charge of electron, but it is positive:

$q\_{p}=1.6×10^{-19}$ C

**A charge-to-mass ratio for proton**

$\frac{q\_{p}}{m\_{p}}=9.57 ×10^{7}$ C/kg

**Mass of proton**

$m\_{p}=1.67×10^{27}$ kg

**The unified atomic mass unit (u)**

$1 u=1.6605 ×10^{-27}$ kg

A **nuclide** is a specific combination of protons and neutrons, denoted by

$$N ,

Z is the number of protons or atomic number, X is the symbol for the element, N is the number of neutrons, and A is the mass number or the total number of protons and neutrons,

$$A=N+Z$$

**The radius of a nucleus**

$r=r\_{0}A^{1/3}$,

$r\_{0}=1.2 $fm (femtometer, $10^{-15}$ m).