# Lecture 2

## Units of Energy and Mass in EPP

Charged particles are accelerated by placing them in an electric field.

The increase in the kinetic energy of a charge $q$ crossing a potential difference of $\Delta V$ is $\Delta E = -q\Delta V$ (in Joules). So for an electron charge $-e$, accelerated across a potential difference of 1V, the change in $E$ is:

$$\begin{aligned}\Delta E &= -(-e) \times 1 \\ &= 1.6 \times 10^{-19}\text{J}\end{aligned}$$

This is the standard unit of energy in atomic physics.

$$1\text{eV} = 1.6 \times 10^{-19}\text{J} \tag{1}$$

We then have:

$$\begin{aligned}1\text{MeV} &= 1.6 \times 10^{-13}\text{J (nuclear physics)} \\ 1\text{GeV} &= 1.6 \times 10^{-10}\text{J (standard in particle physics)}\end{aligned}$$

For masses, Einstein taught us:

$$\begin{aligned}E &= mc^2 \\ \rightarrow m &= \frac{E}{c^2}\end{aligned}$$

So usual to use as the unit of mass:

$$\frac{1\text{eV}}{c^2}$$