8.022 - Class 1 - 9/6/2006

October 20, 2007

Coursework -

- 3 hour exams and one final
- Problem sets due in class on Tuesdays
- E/M- Electromagnetic Forces

Table 1: Table of Forces

Force	Interaction Particles	Exchange Particles	Strength	Range
Gravity	matter/energy	graviton	1	∞
Weak	most particles	w^+,w^- ,Z^0 bosons	10^{24}	$10^{-17}m$
E/M	charges	photons	10^{35}	∞
Strong	quarks , gluons	gluons	10^{37}	$10^{-15}m$

Note - Gluons in exchange and interaction categories , Law of Superposition invvalid, so strong force problems are complex.

1 Charge

- Something on which the e/m force acts
- Plus and minus signs
- Quantized (oil drop experiment)
- Conserved quantity
- Couloumb's Law:

$$\vec{F_2} = \frac{1}{4\pi\epsilon_0}\frac{q_1 \cdot q_2}{r_{12}^2}\hat{r_{12}}$$

where $\epsilon_0 = 8.85 \cdot 10^{-12} C^2/N \cdot m^2$

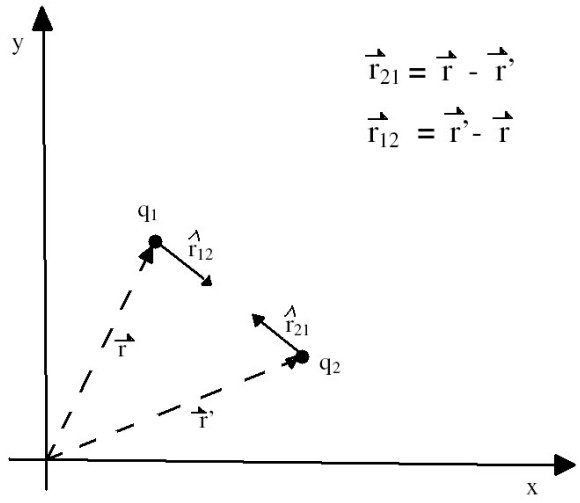

Figure 1: Two point charges and vectors; $\vec{r}$, $\vec{r'}$, $\vec{r_{12}}$, and $\vec{r_{21}}$.

- Superposition

$$\vec{F_2} = \vec{F_{12}} + \vec{F_{32}} = q_2 \frac{1}{4\pi\epsilon_0}\left(\frac{q_1}{r_{12}^2}\hat{r_{12}} + \frac{q_3}{r_{32}^2}\hat{r_{32}}\right)$$

- Electric Field

$$\vec{F_2} = q_2 \cdot \vec{E}(\{q_1\}, \{q_3\}, x, y)$$
$$\frac{\vec{F_2}}{q_2} = \vec{E}(\{q_1\}, \{q_3\}, x, y)$$

where $\vec{E}$ is the electric field.