Electricity

Nicolas Cognaux

26 novembre 2011

1 Electric field and electric charge

Two charges with the same sign are attracted. Two opposite charges are repeled.

1.1 Coulomb's law

The magnitude of the force between two charges is :

$$F = \frac{1}{4\pi\epsilon_0}\frac{|q_1 q_2|}{r^2}$$

$$\frac{1}{4\pi\epsilon_0} = k \cong 9.0x10^9 N.m^2/C^2$$

1.2 Electric Field and Electric Forces

The electric field is the electric Force per unit of charge

$$\vec{E} = \frac{\vec{F}}{q}$$

So $\vec{E}$ can be written as :

$$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}\hat{r}$$

1.3 Electric Field Lines

Electric field lines starts at positive charge and go to negative charge.
- They never intersect
- The number of field lines can give an idea of the magnitude of the Electric Field.
- The electric field is tangeant with the electric field lines.

1.4 Electric Dipole

If two opposit charges are linked, they can form an electric Dipole. There is a rotation and so a couple.

The magnitude of the torque can be written as :

$$\tau = pE\sin\theta$$

$$\vec{\tau} = \vec{P}x\vec{E}$$

The potential energy of an Electric Dipole is :

$$U = -\vec{p}.\vec{E}$$

2 Gauss's Law

2.1 Electric Flux

The Electric flux is the quantity of electric charges passing throug a defined surface.

$$\frac{dV}{dt} = vA\cos\theta = v \perp A = \vec{v}.\vec{A}$$