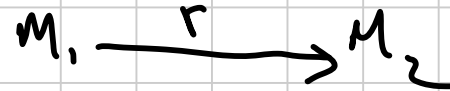


Physics 142 - September 2, 2010

Note Title

9/2/2008

$$\vec{F} = \frac{G m_1 m_2}{r^2} \hat{r}$$



EM

Repulsion + Attraction

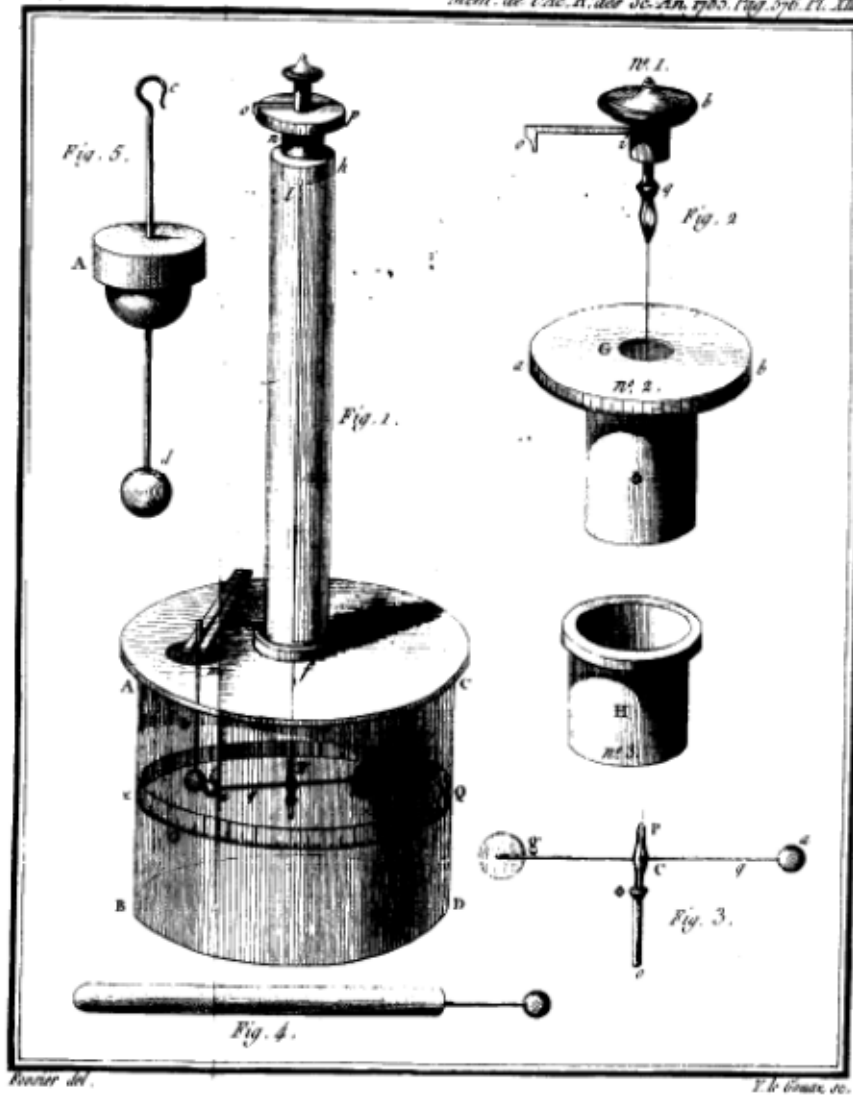
→ two types of charge



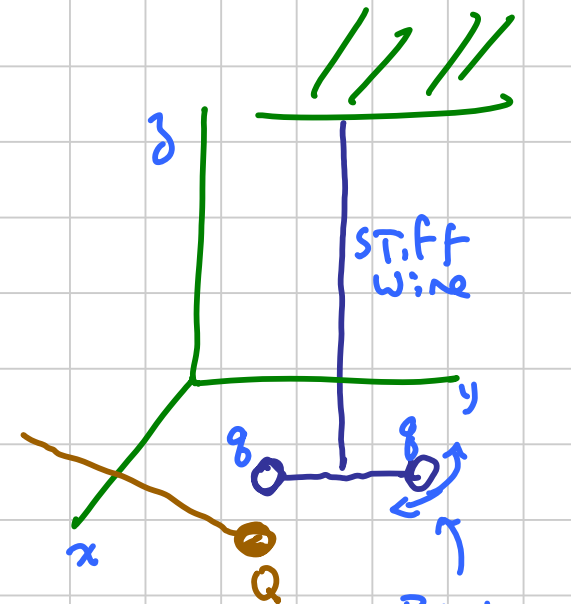
Charles
Augustin
Coulomb

(1736 - 1806)

Coulomb's Law ~ 1785



Torsion Balance



$$F \propto \frac{g_1 g_2}{r^2}$$

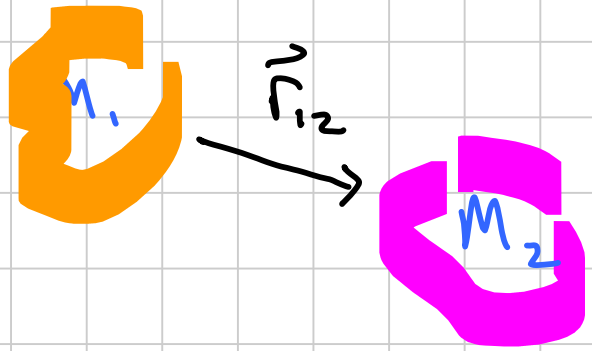
Period of oscillation depends on force

Rotates in x-y plane

Gravitation

$$F = - \frac{G M_1 M_2}{r_{12}^2} \hat{r}_{12}$$

Attractive Force



$$G = 6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$$

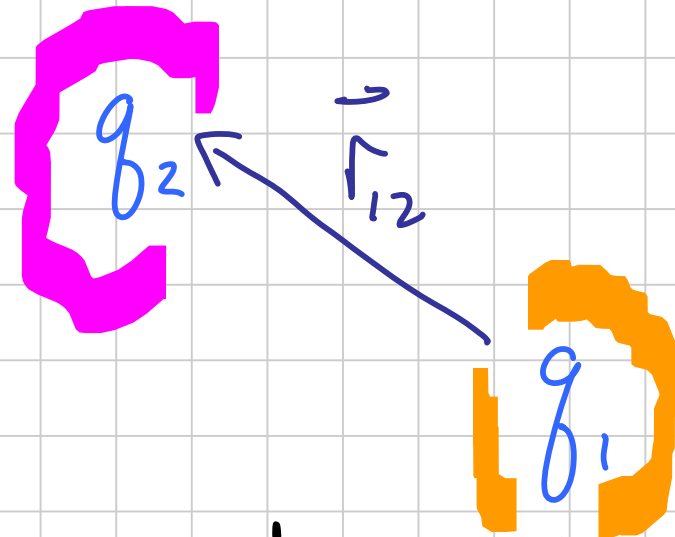
$$\hat{r}_{12} = \frac{r_{12}}{|r_{12}|}$$

r_{12}

Electromagnetism

$$F = k \frac{q_1 q_2}{r_{12}^2} \hat{r}_{12}$$

$8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$



Coulombs \rightarrow unit of charge

C

$$\vec{F} = k \frac{q_1 q_2}{r^2} \hat{r}$$

$$8.99 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$$

$$k = \frac{1}{4\pi \epsilon_0}$$

Permittivity of Free Space

$$\epsilon_0 = 8.85 \times 10^{-12} \frac{\text{C}^2}{\text{Nm}^2}$$

Electric charge is conserved

Electric charge is quantized

in units of

$$|e| = 1.6 \times 10^{-19} \text{ Coulomb}$$

Evidence for particles w/ fractional charge

quark

$$\pm \frac{2}{3} |e|$$

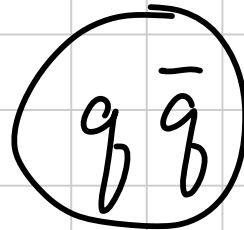
$$\text{or } \pm \frac{1}{3} |e|$$

Free quarks
NOT seen
due to nature
of
quark-quark
interaction.

Quantum
Chromodynamics

Hadrons

Baryon



meson