

Clase 10

26/02/2013

Lecturas 22.1 - 22.6

THE STANDARD MODEL

	Fermions			Bosons	
Quarks	u up	c charm	t top	γ photon	Force carriers
	d down	s strange	b bottom	Z Z boson	
Leptons	ν_e electron neutrino	ν_μ muon neutrino	ν_τ tau neutrino	W W boson	
	e electron	μ muon	τ tau	g gluon	

Higgs^{*}
boson

*Yet to be confirmed

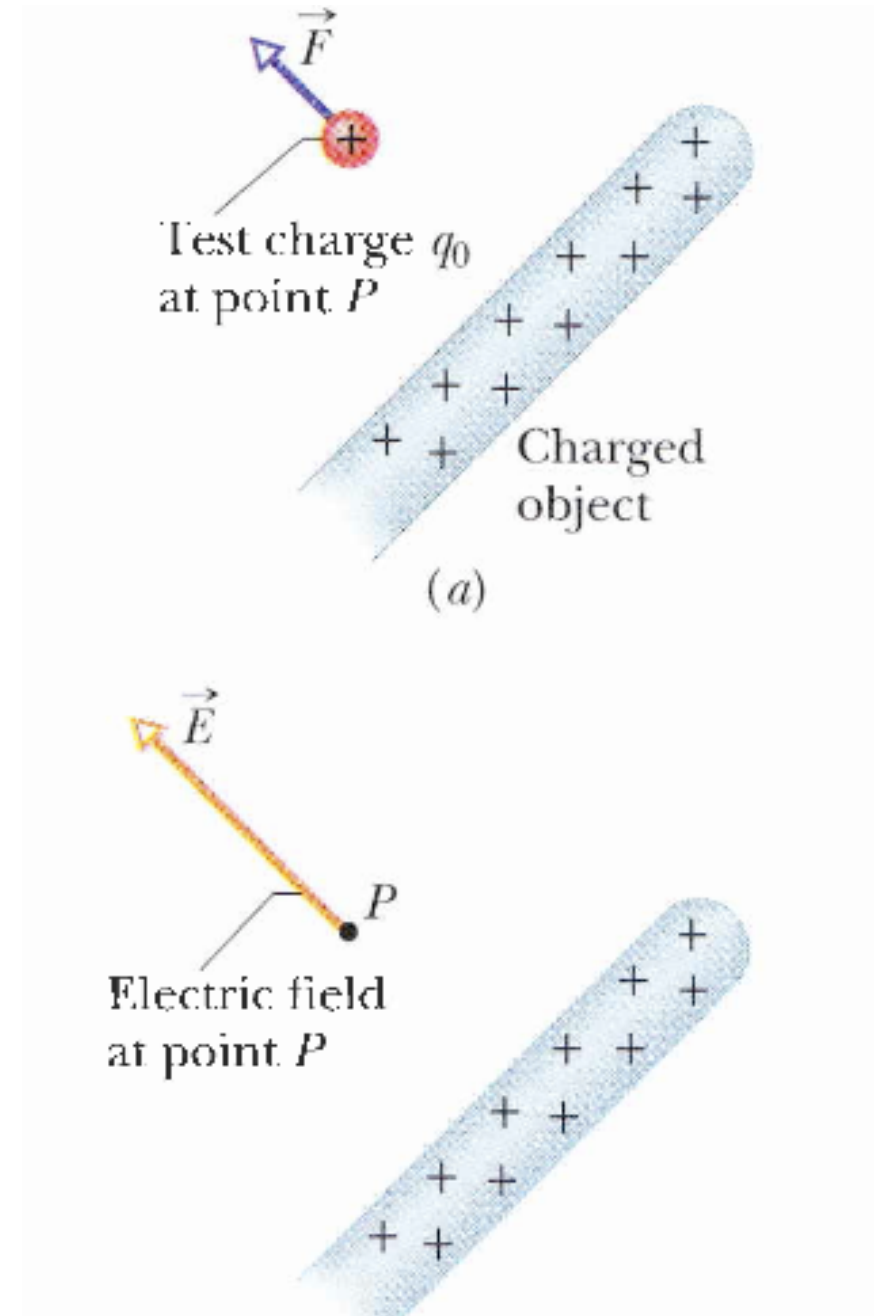
Source: AAAS

Campos eléctricos

Campo vectorial

$$\vec{E} = \frac{\vec{F}}{q_0}$$

[N/C]

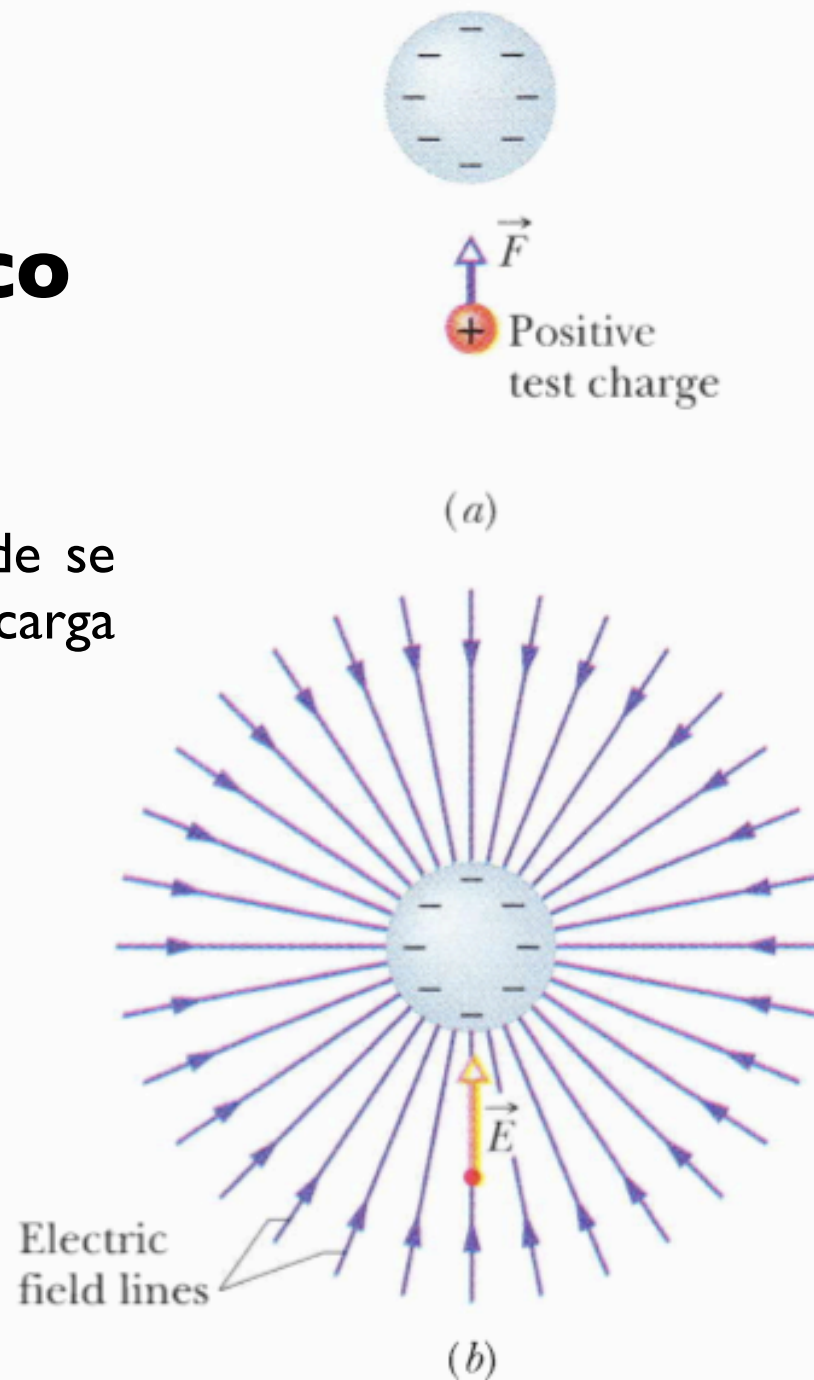


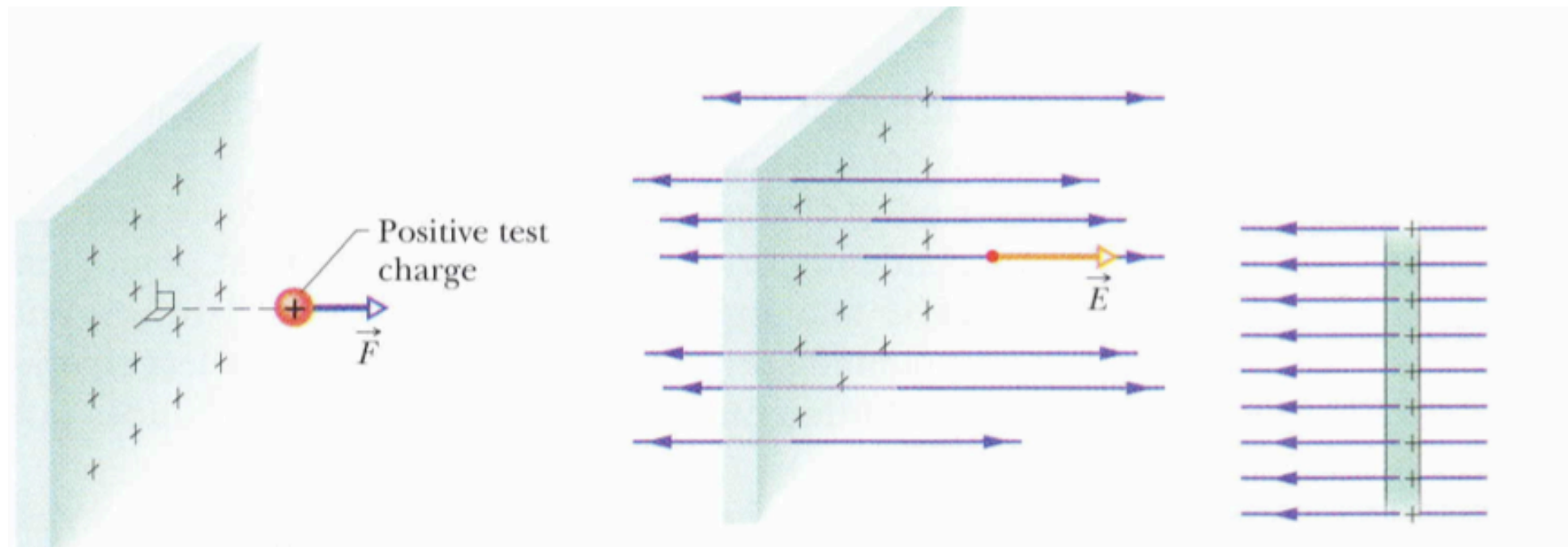
Some Electric Fields

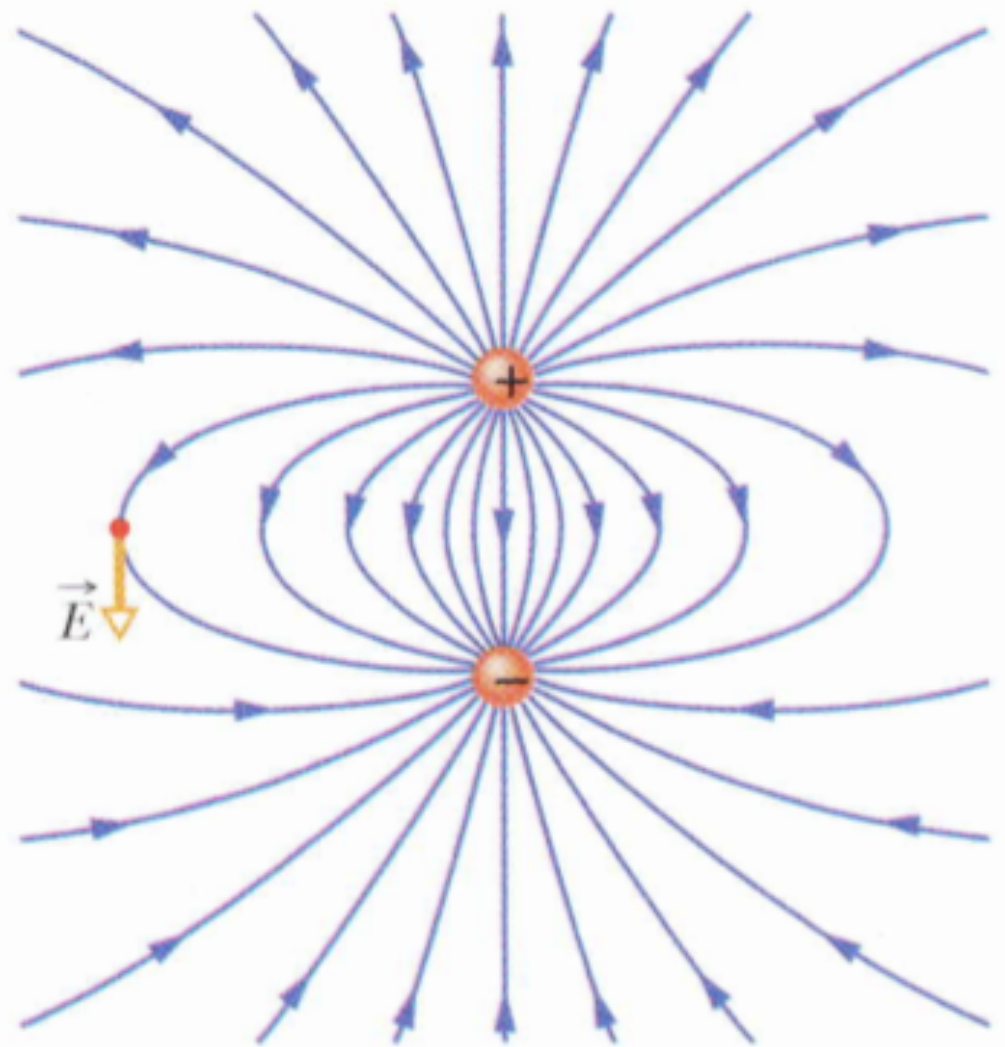
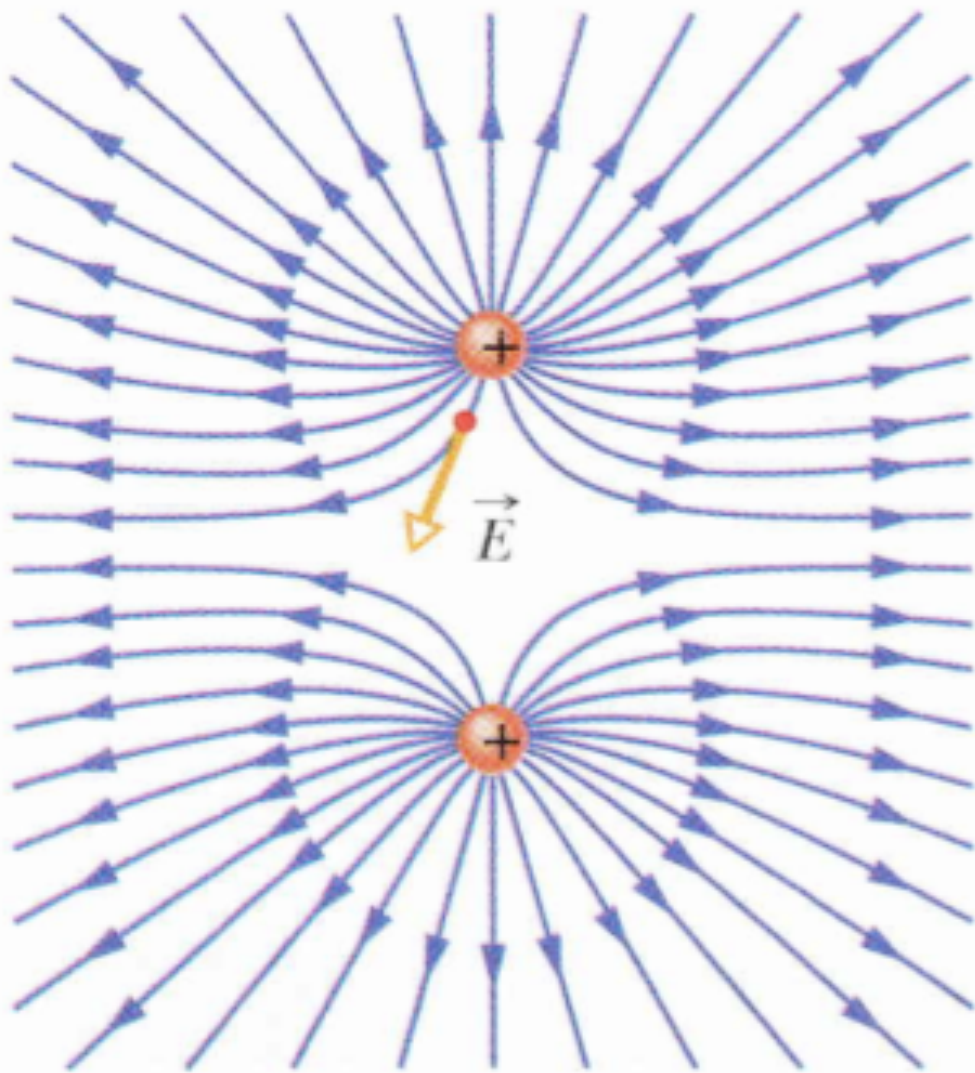
Field Location or Situation	Value (N/C)
At the surface of a uranium nucleus	3×10^{21}
Within a hydrogen atom, at a radius of 5.29×10^{-11} m	5×10^{11}
Electric breakdown occurs in air	3×10^6
Near the charged drum of a photo- copier	10^5
Near a charged comb	10^3
In the lower atmo- sphere	10^2
Inside the copper wire of household circuits	10^{-2}

Líneas de campo eléctrico

Se alejan de la carga positiva (donde se originan) y se dirigen hacia la carga negativa (donde terminan)



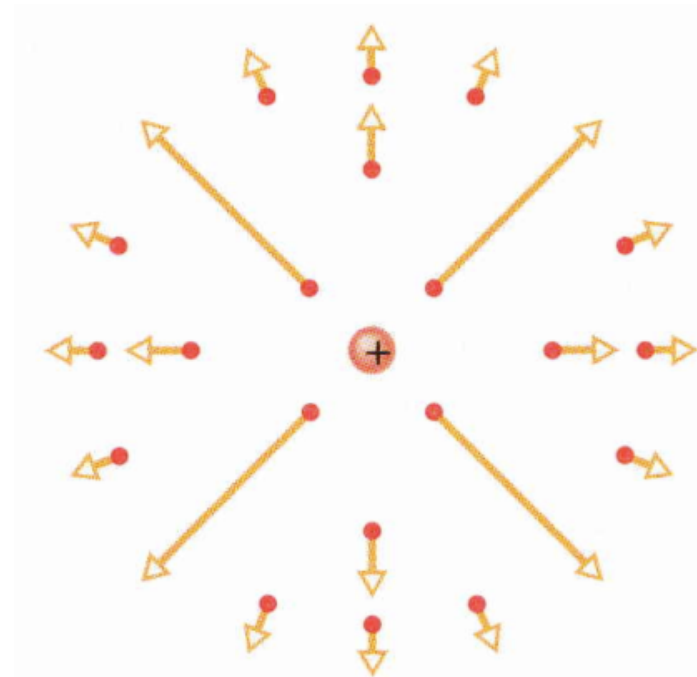




Campo eléctrico de una carga puntual

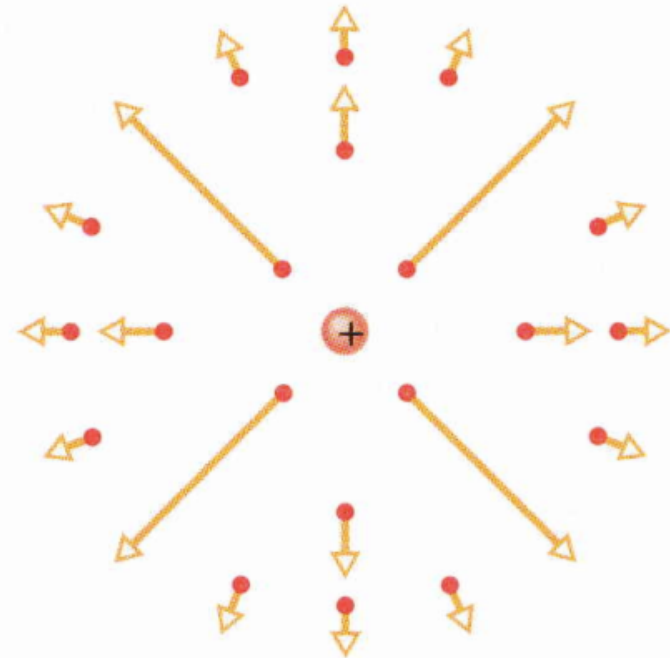
$$\vec{F} = \frac{1}{4\pi\epsilon_0} \frac{qq_0}{r^2} \hat{r}.$$

$$\vec{E} = \frac{\vec{F}}{q_0} = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \hat{r}$$

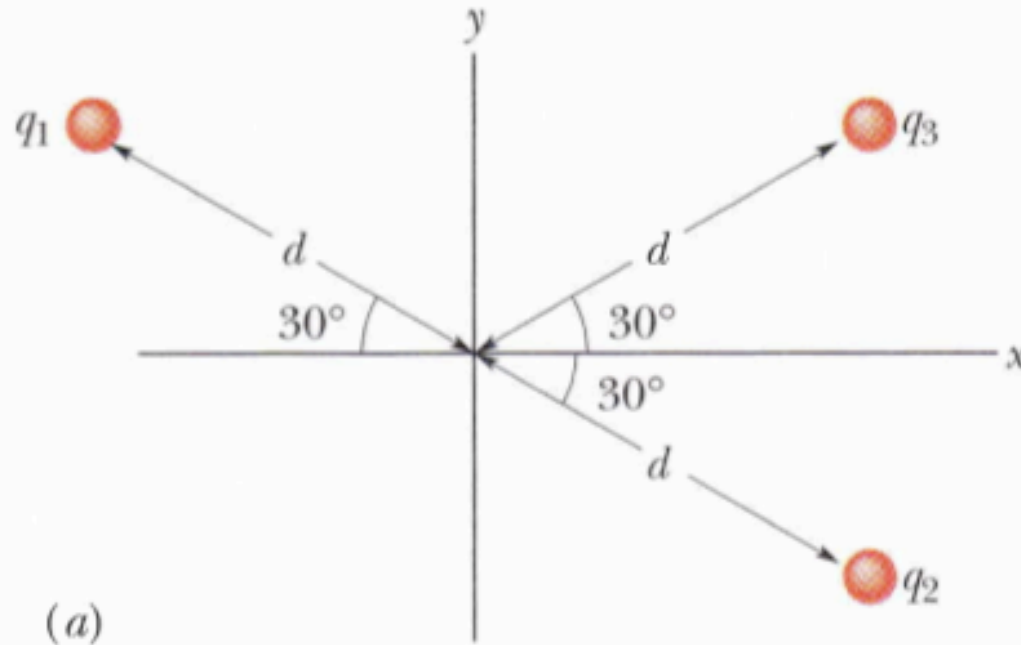


$$\vec{F}_0 = \vec{F}_{01} + \vec{F}_{02} + \cdots + \vec{F}_{0n}.$$

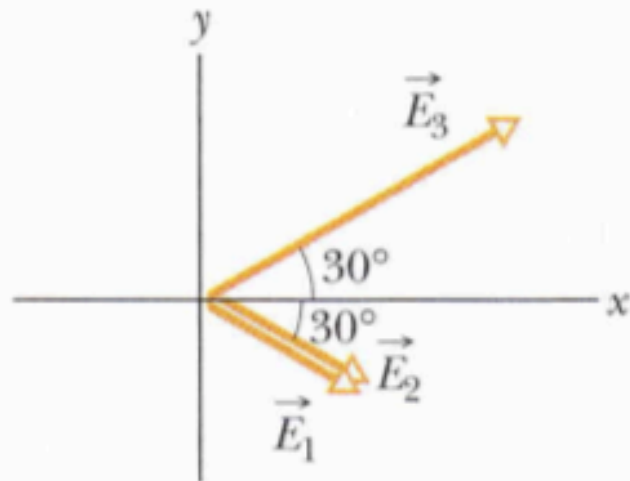
$$\begin{aligned}\vec{E} &= \frac{\vec{F}_0}{q_0} = \frac{\vec{F}_{01}}{q_0} + \frac{\vec{F}_{02}}{q_0} + \cdots + \frac{\vec{F}_{0n}}{q_0} \\ &= \vec{E}_1 + \vec{E}_2 + \cdots + \vec{E}_n.\end{aligned}$$



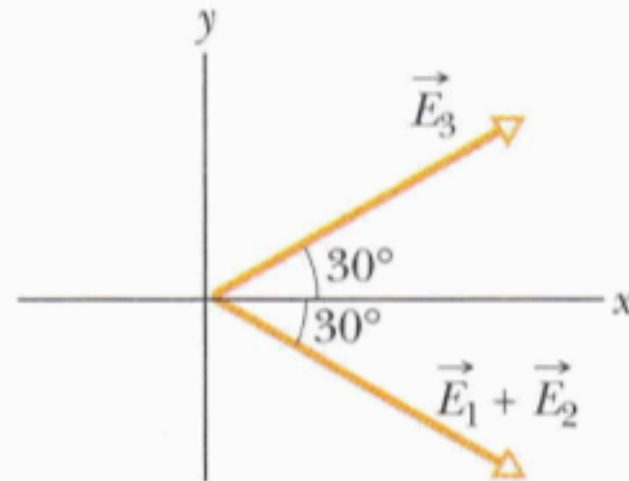
Ejercicio: La figura muestra 3 partículas con cargas $q_1=+2Q$, $q_2=-2Q$ y $q_3=-4Q$ cada una a distancia d del origen. Calcule el campo eléctrico neto en el origen.



(a)



(b)



(c)

$$E_2 = \frac{1}{4\pi\epsilon_0} \frac{2Q}{d^2}$$

$$E_3 = \frac{1}{4\pi\epsilon_0} \frac{4Q}{d^2}.$$

$$\begin{aligned} E_1 + E_2 &= \frac{1}{4\pi\epsilon_0} \frac{2Q}{d^2} + \frac{1}{4\pi\epsilon_0} \frac{2Q}{d^2} \\ &= \frac{1}{4\pi\epsilon_0} \frac{4Q}{d^2}, \end{aligned}$$

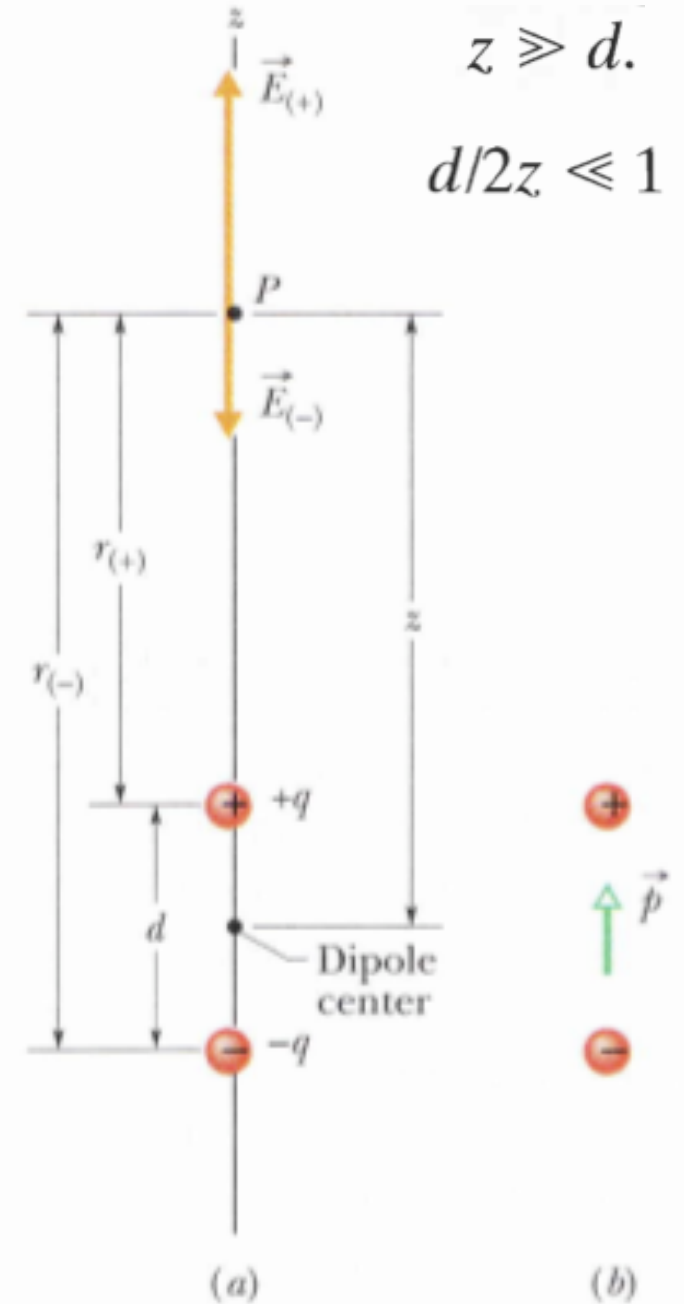
$$\begin{aligned} E &= 2E_{3x} = 2E_3 \cos 30^\circ \\ &= (2) \frac{1}{4\pi\epsilon_0} \frac{4Q}{d^2} (0.866) = \frac{6.93Q}{4\pi\epsilon_0 d^2}. \end{aligned}$$

Campo eléctrico de un dipolo

$$\begin{aligned}
 E &= E_{(+)} - E_{(-)} \\
 &= \frac{1}{4\pi\epsilon_0} \frac{q}{r_{(+)}^2} - \frac{1}{4\pi\epsilon_0} \frac{q}{r_{(-)}^2} \\
 &= \frac{q}{4\pi\epsilon_0(z - \frac{1}{2}d)^2} - \frac{q}{4\pi\epsilon_0(z + \frac{1}{2}d)^2}.
 \end{aligned}$$

$$E = \frac{q}{4\pi\epsilon_0 z^2} \left(\frac{1}{\left(1 - \frac{d}{2z}\right)^2} - \frac{1}{\left(1 + \frac{d}{2z}\right)^2} \right).$$

$$E = \frac{q}{4\pi\epsilon_0 z^2} \frac{2d/z}{\left(1 - \left(\frac{d}{2z}\right)^2\right)^2} = \frac{q}{2\pi\epsilon_0 z^3} \frac{d}{\left(1 - \left(\frac{d}{2z}\right)^2\right)^2}.$$



$$E = \frac{q}{4\pi\epsilon_0 z^2} \frac{2d/z}{\left(1 - \left(\frac{d}{2z}\right)^2\right)^2} = \frac{q}{2\pi\epsilon_0 z^3} \frac{d}{\left(1 - \left(\frac{d}{2z}\right)^2\right)^2}.$$

$$E = \frac{1}{2\pi\epsilon_0} \frac{qd}{z^3}.$$

$$E = \frac{1}{2\pi\epsilon_0} \frac{p}{z^3}$$

p : momento del dipolo

Campo eléctrico debido a una línea de carga

Name	Symbol	SI Unit
Charge	q	C
Linear charge density	λ	C/m
Surface charge density	σ	C/m ²
Volume charge density	ρ	C/m ³



Campo eléctrico debido a una línea de carga

$$dq = \lambda ds.$$

$$dE = \frac{1}{4\pi\epsilon_0} \frac{dq}{r^2} = \frac{1}{4\pi\epsilon_0} \frac{\lambda ds}{r^2}.$$

$$dE = \frac{1}{4\pi\epsilon_0} \frac{\lambda ds}{(z^2 + R^2)}.$$

$$\cos \theta = \frac{z}{r} = \frac{z}{(z^2 + R^2)^{1/2}}.$$

$$dE \cos \theta = \frac{z\lambda}{4\pi\epsilon_0(z^2 + R^2)^{3/2}} ds.$$



Campo eléctrico debido a una línea de carga

$$dE \cos \theta = \frac{z\lambda}{4\pi\epsilon_0(z^2 + R^2)^{3/2}} ds.$$

$$E = \int dE \cos \theta = \frac{z\lambda}{4\pi\epsilon_0(z^2 + R^2)^{3/2}} \int_0^{2\pi R} ds$$

$$= \frac{z\lambda(2\pi R)}{4\pi\epsilon_0(z^2 + R^2)^{3/2}}.$$

$$E = \frac{qz}{4\pi\epsilon_0(z^2 + R^2)^{3/2}}$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{q}{z^2}$$

anillo cargado a gran distancia

