Electricity and Magnetism

- Physics 259 – L02
- Lecture 7

UNIVERSITY OF CALGARY

Section 21.1-3

Last time

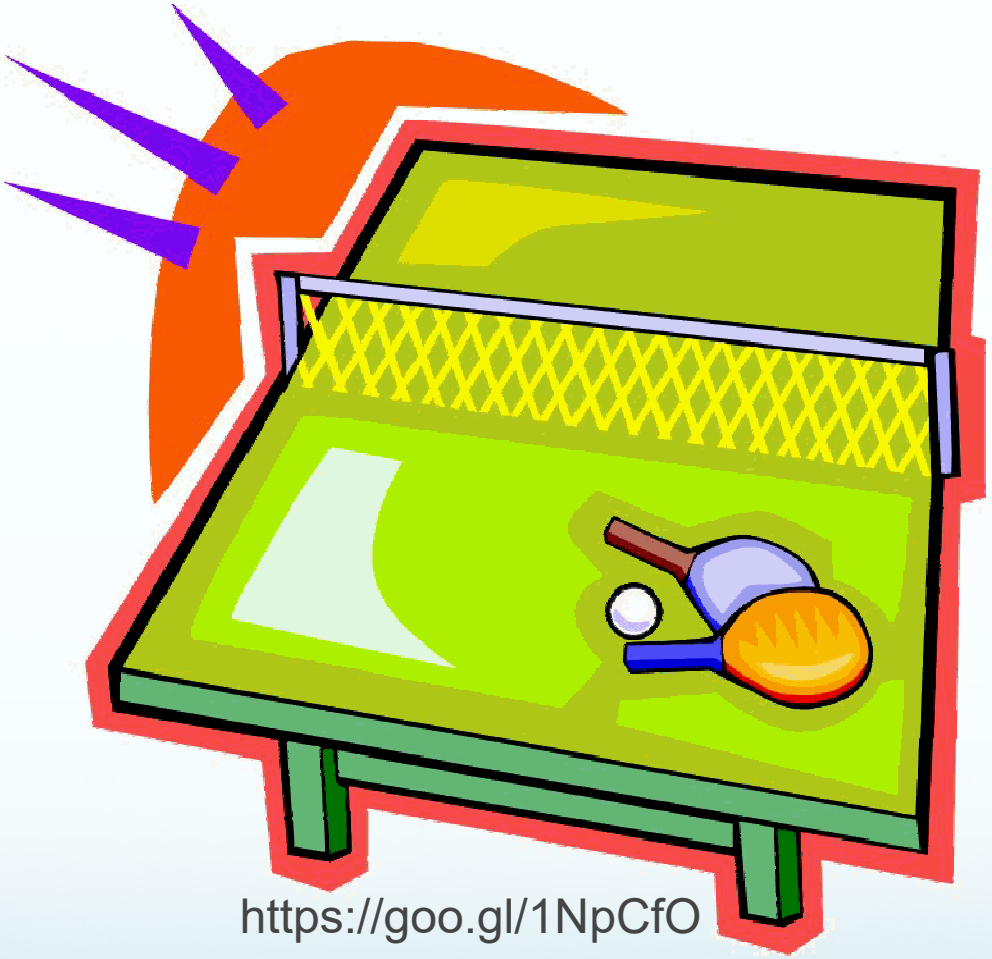
- Charges and Force Between Charges
- Conductors and Insulators
- Van De Graaff Generator Experiment

- Solve Class Activity Question
- Coulomb's Law

This time

- Examples for Coulomb's law

Let’s play Ping Pong



https://goo.gl/1NpCfO

Let’s play electric ping pong

Coulomb's Law

$$F_{1\,on\,2} = F_{2\,on\,1} = K\frac{|q_1||q_2|}{r^2}$$

K = electrostatic constant

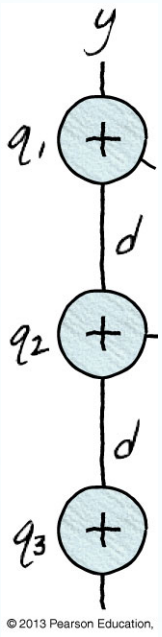
$$K = 8.99\times10^9\,\frac{N\cdot m^2}{C^2}$$

$$F_{1\,on\,2} = F_{2\,on\,1} = \frac{1}{4\pi\varepsilon_0}\frac{|q_1||q_2|}{r^2}$$

ε_0 = permittivity of free space

$$\varepsilon_0 = \frac{1}{4\pi K} = 8.85\times10^{12}\,\frac{C^2}{N\cdot m^2}$$

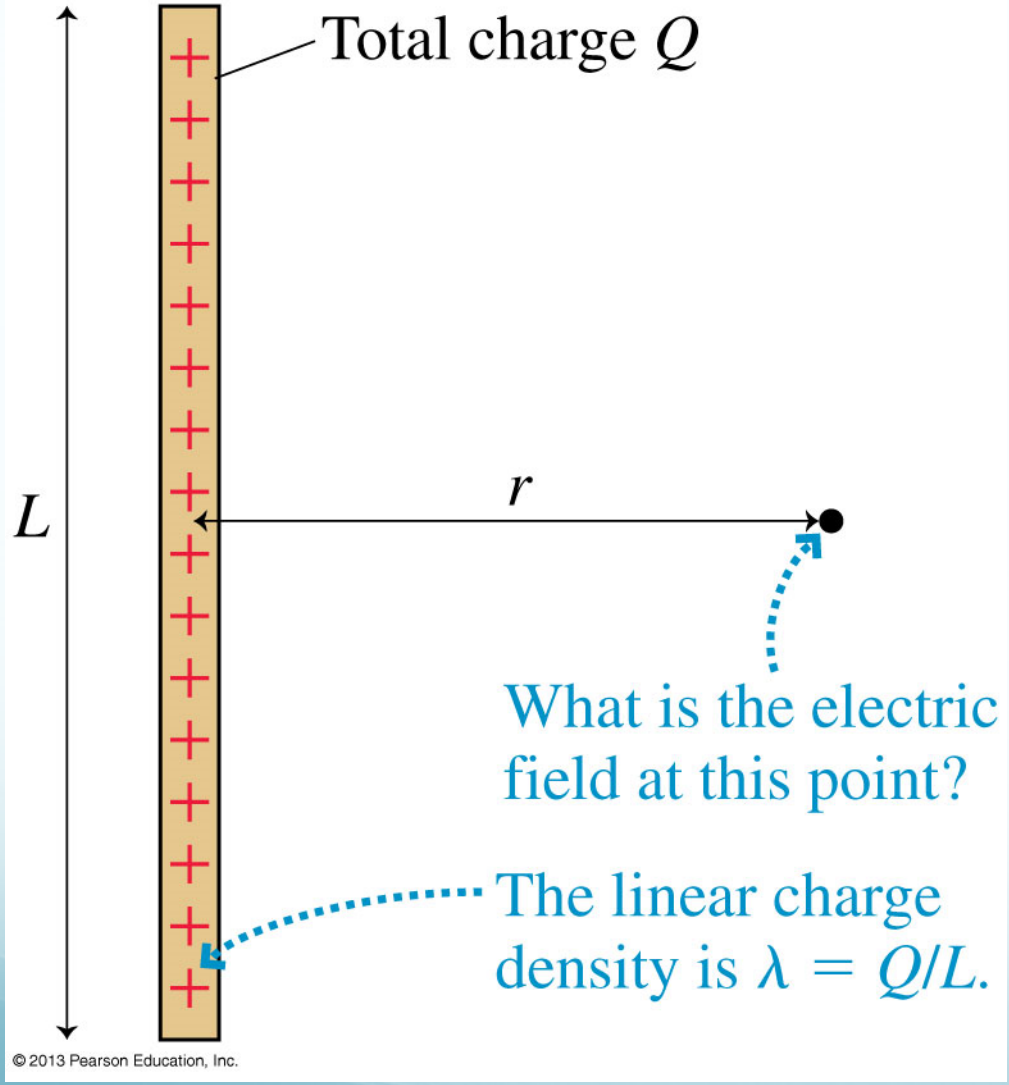
Example #1: Three point charges

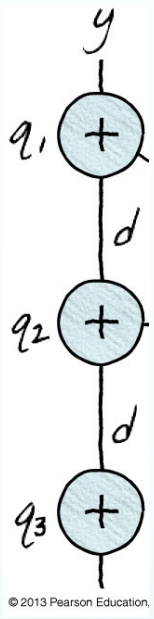


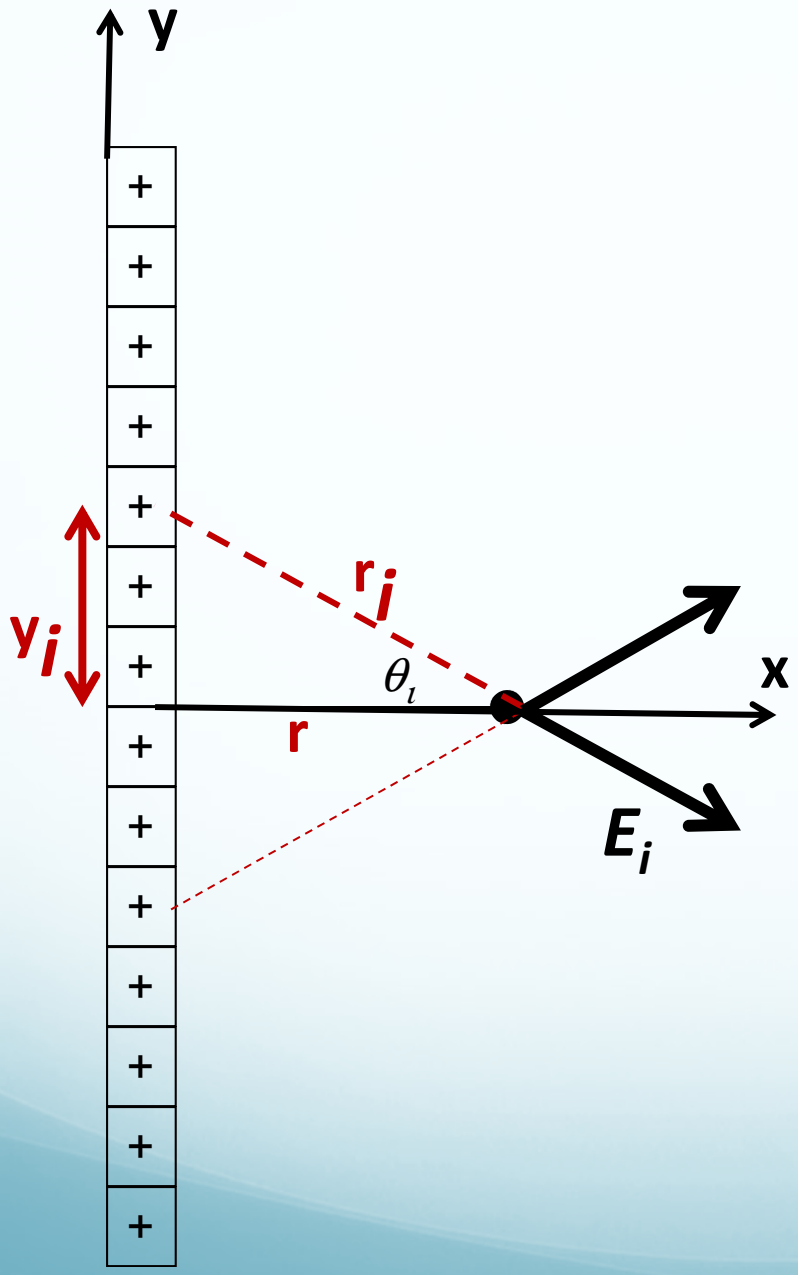
$$(F_{net})_x = 2(F_1)_x + (F_2)_x = \frac{qQ}{4\pi\varepsilon_o}\left[\frac{1}{x^2} + \frac{2x}{(x^2+d^2)^{3/2}}\right]$$

$$\vec{F}_{net} = \frac{qQ}{4\pi\varepsilon_o}\left[\frac{1}{x^2} + \frac{2x}{(x^2+d^2)^{3/2}}\right]\hat{i}$$

Example #2: Force from a line of charge



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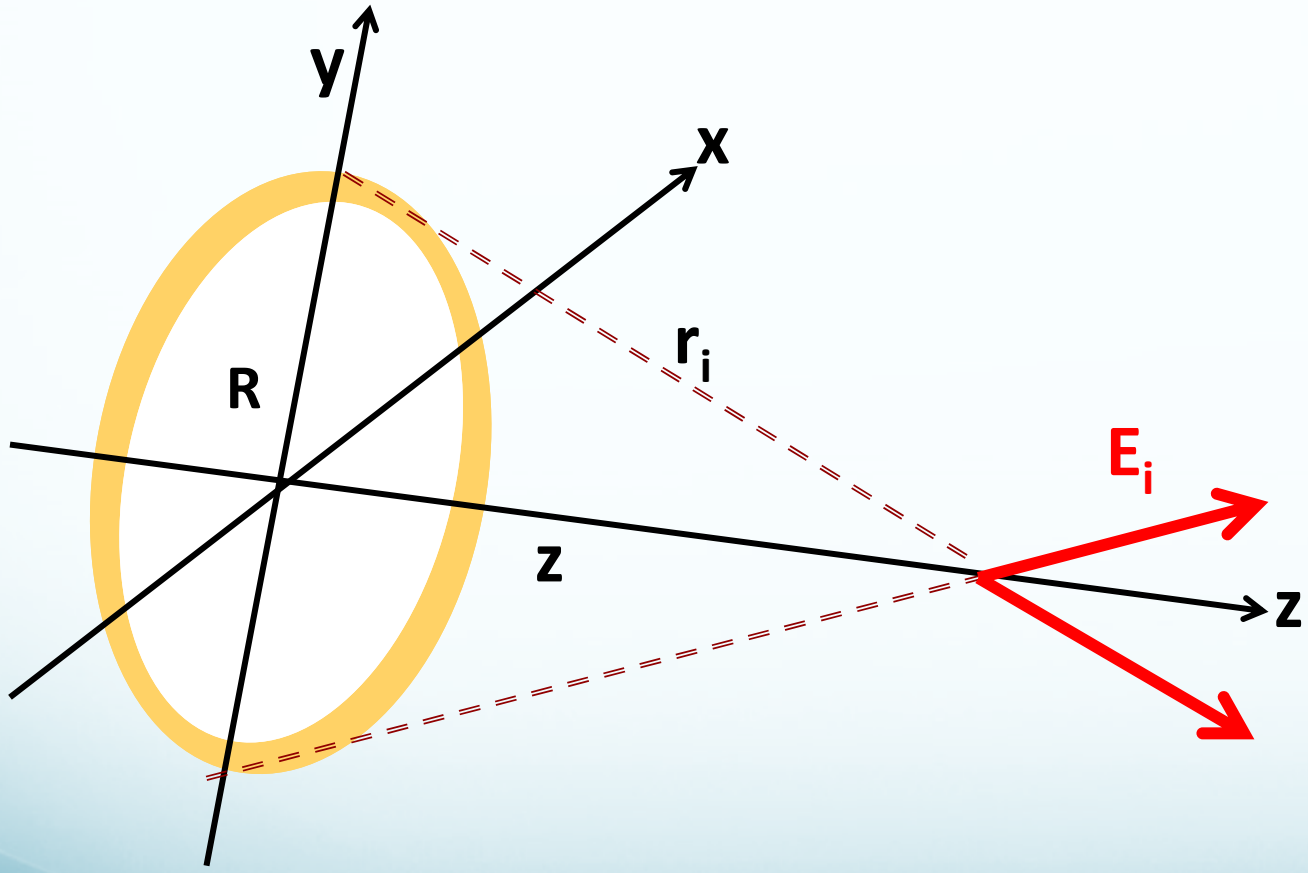
Example #3: Force from a ring of charge



Why should we care? Applications:

Ring antenna (very directional)

Photo taken from https://en.wikipedia.org/wiki/Loop_antenna

This section we talked about:

Chapter 21.1-3: Examples

See you on Friday