PHYS 1444 – Section 02
Lecture #7

Tuesday Feb 15, 2011
Dr. **Andrew Brandt**

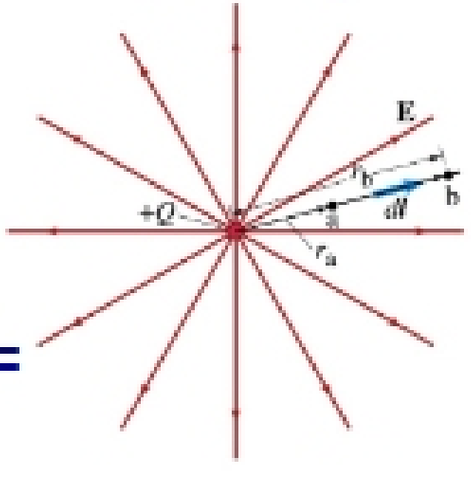
- Chapter 23:
  - Potential from System of Charges
- Chapter 24
  - Capacitors and Capacitance
  - **HW3 due Weds at 9pm**

Potential due to Point Charges

- E field due to a point charge Q at a distance r?

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2} = k\frac{Q}{r^2}$$

- Electric potential due to the field E for moving from point r_a to r_b away from the charge Q is



$$V_b - V_a = -\int_{r_a}^{r_b} \vec{E}\cdot d\vec{l} = -\frac{Q}{4\pi\varepsilon_0}\int_{r_a}^{r_b}\frac{\hat{r}}{r^2}\cdot dr =$$

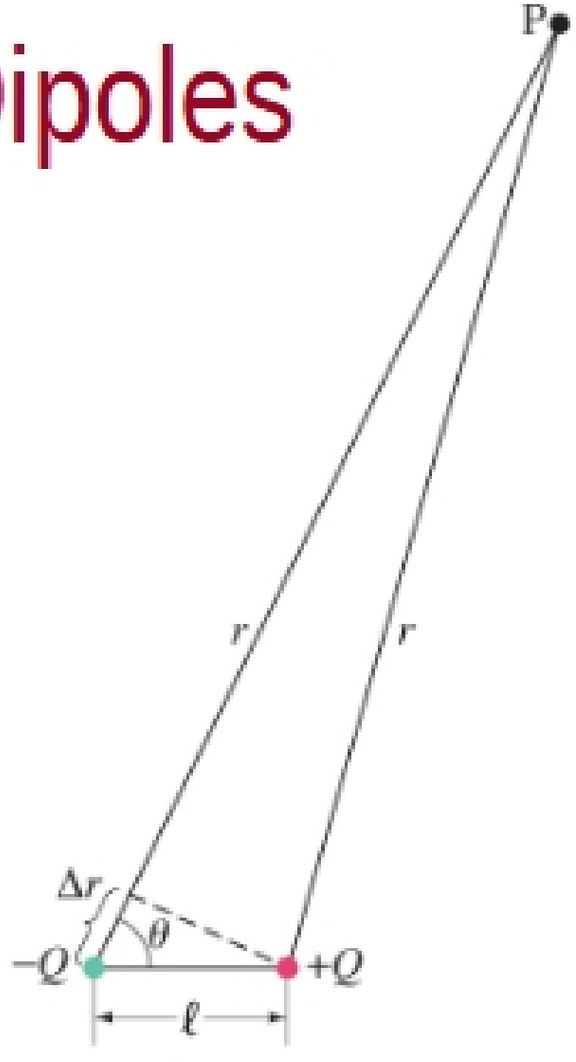
$$= -\frac{Q}{4\pi\varepsilon_0}\int_{r_a}^{r_b}\frac{1}{r^2}dr = \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$$

Potential due to Electric Dipoles

$\Delta r = l\cos\theta$

$$V = \sum_i \frac{Q_i}{4\pi\varepsilon_0}\frac{1}{r_{ia}} = \frac{1}{4\pi\varepsilon_0}\left[\frac{Q}{r} + \frac{(-Q)}{r+\Delta r}\right]$$

$$\frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r} - \frac{1}{r+\Delta r}\right] = \frac{Q}{4\pi\varepsilon_0}\frac{\Delta r}{r(r+\Delta r)}$$



$$V = \frac{Q}{4\pi\varepsilon_0}\frac{l\cos\theta}{r^2} =$$

V due to dipole a distance r from the dipole

$$V = \frac{1}{4\pi\varepsilon_0}\frac{p\cos\theta}{r^2}$$