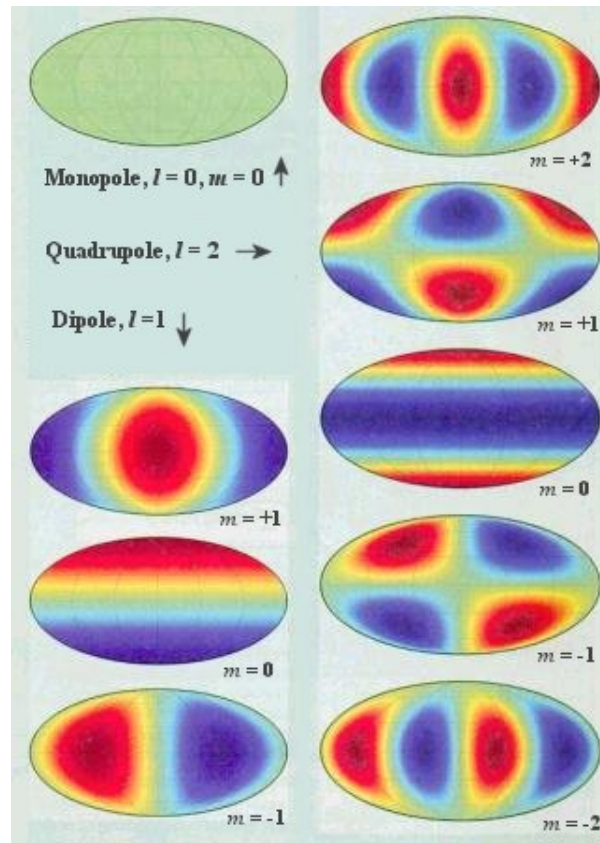


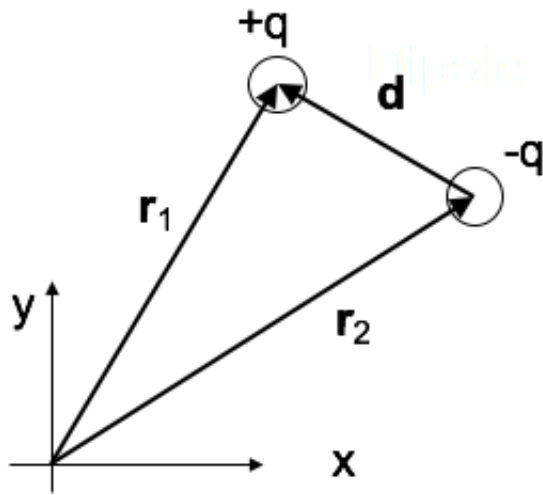
Two charges are positioned as shown to the left. The relative position vector between them is \mathbf{d} . What is the value of the dipole moment? $\sum_i q_i \mathbf{r}_i$

- A. $+q\mathbf{d}$
- B. $-q\mathbf{d}$
- C. Zero
- D. None of these

MULTIPOLE EXPANSION



Multipole Expansion of the Power Spectrum of CMBR



Two charges are positioned as shown to the left. The relative position vector between them is \mathbf{d} . What is the dipole moment of this configuration?

$$\sum_i q_i \mathbf{r}_i$$

A. $+q\mathbf{d}$

B. $-q\mathbf{d}$

C. Zero

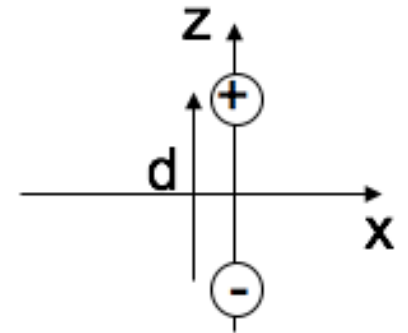
D. None of these; it's more complicated than before!

For a dipole at the origin pointing in the z-direction, we have derived:

$$\mathbf{E}_{dip}(\mathbf{r}) = \frac{p}{4\pi\epsilon_0 r^3} (2 \cos \theta \hat{\mathbf{r}} + \sin \theta \hat{\boldsymbol{\theta}})$$

For the dipole $\mathbf{p} = q\mathbf{d}$ shown, what does the formula predict for the direction of $\mathbf{E}(\mathbf{r} = 0)$?

- A. Down
- B. Up
- C. Some other direction
- D. The formula doesn't apply



IDEAL VS. REAL DIPOLE

