

# Summary of Lecture 4

## Solutions to Laplace's equation in spherical polar coordinates

- General solution to systems with  $\phi$  symmetry

$$V(r, \theta) = \sum_{l=0}^{\infty} \left( A_l r^l + \frac{B_l}{r^{l+1}} \right) P_l(\cos \theta),$$

where  $P_l(\cos \theta)$  are the Legendre Polynomials

- $P_l(\cos \theta)$  form a complete and orthogonal set
- If boundary conditions can be expressed as  $f(\cos \theta)$  simplest option is to obtain  $A_l, B_l$  "by inspection"
- Boundary value techniques useful in cases where the charge distribution is :
  - not known a priori
  - difficult to guess