

A hollow sphere with a charge at its center

Consider a point like charge q placed at the center of an hollow sphere of radius R which carries a surface charge density

$$\sigma(\theta, \phi) = \frac{3\gamma}{4\pi R} \sin\theta \cos\phi - \frac{q}{4\pi R^2}.$$

- a) Calculate the monopole moment for this charge configuration.
- b) Calculate the dipole vector moment \mathbf{p} for this charge configuration.
- c) Calculate the quadrupole tensor moment q_{ij} for this charge configuration.
- d) Calculate the approximate potential far from the sphere by including the monopole, dipole and quadrupole contributions.