

P507

Problem Set 16

(Due: March 12, 2009)

1) Jackson, problem 9.3.

Two halves of a spherical metallic shell of radius R and infinite conductivity are separated by a very small insulating gap. An alternating potential is applied between the two halves of the sphere so that the potentials are $\pm V \cos \omega t$. In the long-wavelength limit, find the radiation fields, the angular distribution of radiated power, and the total radiated power from the sphere.

2) Derive the vector spherical harmonics \mathbf{X}_{lm} for $l = 2$, and derive the angular distributions in Jackson Table 9.1.

3) For the radiating quadrupole source in Jackson Eqn. (9.50), find the corresponding multipole moment Q_{lm} of Eqn. (9.170). What is the angular distribution of the radiation based on your result for problem 2? *Caution: the definition of the cartesian tensor in Eqn. (9.41) is related to, but not the same as, the spherical tensor in Eqn. (9.170).*