

1. This homework is mostly a big reading assignment: §9.6–9 of the Jackson's textbook about the spherical waves and their multipole expansion. Specifically:
  - §9.6 about the scalar spherical waves, their expansion into multipoles, and their radial dependence in the intermediate zone  $r \sim \lambda$ .
  - §9.7 about the EM spherical waves and their expansion into electric and magnetic multipoles.
  - §9.8 (first half) about the energy in spherical EM waves. You may skip the second half of this § about the angular momentum.
  - §9.9 about angular distribution of the multipole radiation.
  
2. To test your understanding of the above reading assignment, write down explicit formulae for the electric and magnetic fields for the following multipoles:
  - (a) Electric dipole.
  - (b) Magnetic dipole.
  - (c) Electric quadrupole.
  - (d) Magnetic quadrupole.

For each multipole, assume a *divergent* spherical wave and spell out the complete radial profiles of the electric and magnetic fields in the intermediate zone  $r \sim 1/k$ . Also, write down explicit angular profiles of the electric and magnetic fields.