Homework #10, due 4-29-2021, 11:59 pm

1. Do problem 3c of HW 9

2. A magnetic dipole rotates in the xy plane as $\vec{m} = \hat{x}\cos\omega t + \hat{y}\sin\omega t$

a) Give the electric field in the direction $\vec{k}$ at large distance $\vec{r}$

b) Give the polarization for $k_x = k_y = 0$ and for $k_z = 0$

c) Find the angular distribution of the radiated power.

3. Consider a square with sides a that has alternating charges $\pm q$ on its corners. It rotates with angular velocity ω about an axis $\perp$ to the square and through the center of the square

a) Calculate the quadrupole moment

b) Calculate the radiation field for large $\vec{r}$. (it is useful to consider the vector $\sum_\alpha n_\alpha Q_{\alpha\beta}$ with $n_\alpha = \hat{r}_\alpha$

c) Calculate the angular distribution of the radiated power

d) Calculate the total power.

4. In the twin paradox. each twin emits a signal once per year and one twin moves at 0.8c for three years and then moves back with the same speed.

a) Calculate when they receive the signals in their rest frame

b) Draw a space-time diagram and indicat the emission and reception of the signals.