

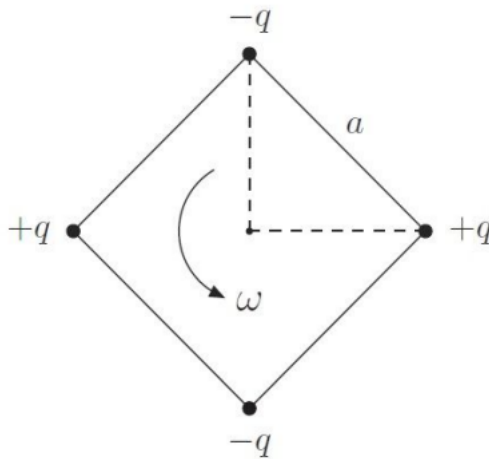
# Homework 10

## Question 1

An electrical current  $I = I_0 \exp(-t^2/\tau^2)$  flows in circular loop with radius  $R$ , where  $\tau$  is a constant such that  $R \ll c\tau$ . Find the angular distribution, the total energy and the spectral distribution of the radiation.

## Question 2

A radiating quadrupole consists of a square of sides  $a$  with charges  $\pm q$  at alternate corners (see figure). The square rotates with angular velocity  $\omega$  about an axis normal to the plane of the square and through its center.



Calculate:

1. the dipole and quadrupole moments,
2. the corresponding radiation fields,
3. the angular distribution of radiation,

4. the total radiated power,

all in the long wavelength approximation. What is the frequency of the radiation?

### Question 3

An electric charge  $Q$  is homogeneously distributed within a spherical volume of radius  $R$ . At the surface of the volume, a charge  $-Q$  is distributed such that there is no electric field outside the volume. A non-relativistic electron with energy  $E_0$  crosses the volume along the diameter.

Find the angular distribution of the emitted radiation, the total energy and the spectrum of the emission.