

PHYS4210 Electromagnetic Theory Spring 2009

Posted Problem for Homework Due Thursday 23 March 2009

A particle with charge q is moving along the z -axis with speed v and acceleration a . Find the radiated power as a function of angle θ with respect to the direction of motion. You might want to follow these steps:

- a. Use equation 6-3-9 in your textbook to find the electric field $\mathbf{E}(\mathbf{r}, t)$. Identify the term which contributes to radiation.
- b. Use equation 6-3-11 in your textbook to find the magnetic field $\mathbf{B}(\mathbf{r}, t)$.
- c. Evaluate the Poynting vector and use this to find the power as a function of angle at some distance r from the particle.

Compare, perhaps with a plot for certain values, the radiation pattern for $\beta \equiv v/c \ll 1$ and for β close to (but still less than) one. You will discover an effect which astrophysicists call “relativistic beaming.”

Note: This is similar to Problem 6-3 in your textbook.