Relativistic Electrodynamics Workshop 7

December 2015

1 Primary Problem

We consider a problem similar to last week's one, where this time we have an accelerating particle whose acceleration vector is instantaneously colinear with its velocity vector.

- Find the angular distribution of the radiation $\frac{dP}{d\Omega}$, and the total power radiated.

In this special case it is easier to NOT use the BAC-CAB rule for the first triple-cross product (although for the second occurence it is still useful).

Hint: You may find the following result useful;

$$\int_{-1}^{+1} \frac{1-x^2}{(1-\beta x)^5} dx = \frac{4}{3}(1-\beta^2)^{-3} \tag{1}$$

2 Secondary Problem (beyond the course)

Take a particle in hyperbolic motion, whose worldine is given by

$$\vec{w}(t) = \sqrt{b^2 + (ct)^2}\hat{x} \qquad -\infty < t < +\infty \tag{2}$$

- Does this particle radiate? If so, calculate the power radiated.
- Does a particle undergoing hyperbolic motion experience a radiation reaction? If so, determine the reaction force

The reaction force is given by

$$F_{rad} = \frac{\mu_0 q^2}{6\pi c}\gamma^4 \left(\dot{a} + 3\frac{v a^2 \gamma^2}{c^2}\right) \tag{3}$$