

Home Work PHY 554 #11.

Due April 13, 2020

HW 1 (3 points):

Consider an electron storage ring at an energy of 1 GeV, a circulating current of 200 mA and a bending radius of $\rho=2.22$ meters. Calculate the energy loss per turn, the critical photon energy, and the total synchrotron radiation power.

HW 2 (2 points): Make a short argument about why the trajectory of a charged particle can not intersect with light cone more than once (see slide #8 from the lecture 17)

HW 3 (5 points):

As shown in slide #15, the angular distribution of radiation power is given by

$$\frac{dP(t_r)}{d\Omega} = \frac{1}{4\pi\epsilon_0} \frac{e^2}{4\pi c} \frac{\dot{\beta}^2}{(1-\beta\cos\theta)^3} \left[1 - \frac{\sin^2\theta\cos^2\phi}{\gamma^2(1-\beta\cos\theta)^2} \right]$$

Show that for $\gamma^{-4} \ll \theta \ll 1$ and $\gamma \gg 1$, the angular spread of the radiation power is in the order of γ^{-1} .