

**Physics 425, Spring 2012:**

Assignment set #11

Due March 28:

26. Griffiths Problem 11.10

27. Consider a conduction electron with initial velocity  $v_0$  that is brought to rest due to collision over a distance  $d$ .

(a) What is the total radiation energy during the collision, assuming that the acceleration is constant? What is the ratio  $f$  of the total radiation energy to the initial kinetic energy of the electron?

(b) Let  $v_0$  be the Fermi velocity ( $mv_0^2 = 2kT_F$ ; for Cu,  $T_F = 81600$  K) and  $d$  the typical lattice dimension  $d = 4 \times 10^{-10}$  m. Calculate  $f$ .

Due March 30:

28. Griffiths Problem 10.18

29. Griffiths Problem 11.15

Due April 2:

30. In this problem, you will evaluate the synchrotron and bremsstrahlung radiation by a relativistic electron of kinetic energy 500 keV.
- (a) Consider the electron having circular motion in a constant magnetic field of 1 T. Calculate the total radiation energy by the electron during one period of the circular motion. How does it compare with the electron's kinetic energy?
- (b) Consider that the electron suddenly encounters a proton and is brought to rest by collision with the proton over a distance of  $10^{-8}$  m. Estimate the total radiation energy. How does it compare with the electron's initial kinetic energy?

Note: for relativistic particles, the kinetic energy is  $\varepsilon_k = (\gamma - 1)mc^2$ , where  $m$  is the particle's rest mass.