# Electrodynamics III: Assignment 7.
# Due May 31 at 11:00am in class or 10:45am in the instructor's mailbox.

1. Loose ends from lecture. Consider Bethe's calculation of the ionization energy-loss (Jackson eqn. 13.14).
a. Show that the energy loss can be written as $-\frac{dE}{dx} = z^2\eta\left(\frac{E}{m}\right)$, where *E* is the kinetic energy of a projectile of mass *m* and $\eta$ is a function of energy.
b. Similarly, show that fie change in the projectile velocity can be written as $-\frac{dv}{dx} = \frac{z^2}{m}z^2\zeta(v)$, where $\xi$ is a function of velocity.

Integrating (a) or (b) from 0 to the initial *E* (or *v*) gives the range. We discussed why this calculation becomes increasingly inaccurate as the projectile velocity gets smaller.

2. Cherenkov radiation I. From the Frank and Tamm result (Jackson eqn. 13.48). find an expression for the number of photons emitted in the frequency interval $\omega$ to $\omega$+d$\omega$.

3. Cherenkov radiation II. Assume a 5 GeV proton is traversing lead-glass.
a. What is the emission angle of optical photons?
b. Approximately how many optical photons are emitted per cm of path length?

4. Transition radiation. A 1 TeV proton enters a tungsten block.
a. Estimate the energy released as transition radiation.
b. What is the characteristic photon energy?
c. Approximately how many photons are emitted?

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