Physics 71100 **Analytical Dynamics** **Fall 2014**

Problem Set 8 – due November 12

1. A particle of mass M decays into two identical particles of mass m (with $M \gg 2m$). Find the maximum and minimum angle between the decay products in a frame where the original particle has velocity V.

2. Show that a *relativistic* rocket satisfies the equation

$$m\frac{dv}{dm} + u\left(1 - \frac{v^2}{c^2}\right) = 0$$

where v is its velocity in some fixed inertial reference frame, m is its instantaneous mass, and u is the velocity of the exhaust gases relative to the rocket. Solve for the velocity as a function of m.

3. Obtain Hamilton's equations for a plane pendulum of length ℓ and mass m whose point of suspension lies on the rim of a vertical disc of radius a rotating at constant angular velocity ω. Is the energy conserved in this system? What is the physical significance of the canonical momentum?

4. A particle of mass m and charge q moves in a constant magnetic field $\mathbf{B}$. Using Hamilton's equations, solve for its motion as a function of time.