Physics 820 homework VII, due Mon Oct 18

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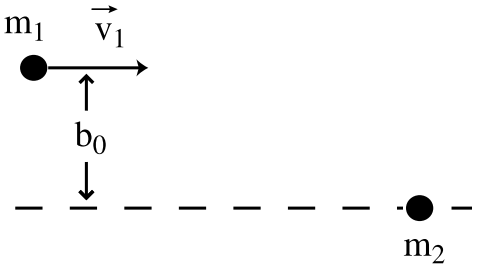
Reading: Chapters 3.10-11, 4

Problems:

1. A proton of energy 4 MeV scatters off a second proton at rest. One proton comes off at an angle of 30° in the lab system. What is its energy? What is the energy and scattering angle of the second proton?

2. From the August '03 Subject Exam:
Two particles of masses $m_1$ and $m_2$ ($m_1 \neq m_2$) collide. The initial velocity velocity of particle 1 is $\vec{v}_1$, while the particle 2 is initially at rest. The initial impact parameter is $b_0$, as shown.




The particles interact through a repulsive potential $V = V_0/|\vec{r}_1 - \vec{r}_2|^4$. (a) Find the magnitude of net angular momentum and the net energy in the *center of mass*, in terms of provided quantities. (b) Obtain an equation for the rate of change of the separation $r = |\vec{r}_1 - \vec{r}_2|$ in time. Find the distance of closest approach between the particles. (c) Consider a situation where $b_0$ is unknown but the magnitude $v_1^f$ of the final velocity of particle 1 has been measured in the laboratory frame. Find the angle $\beta$ between the final laboratory velocities of particles 1 and 2, given $v_1^f$. (Use conservation laws whenever possible.)

3. Goldstein, Problem 4-6.

4. Goldstein, Problem 4-10.

5. Goldstein, Problem 4-14.