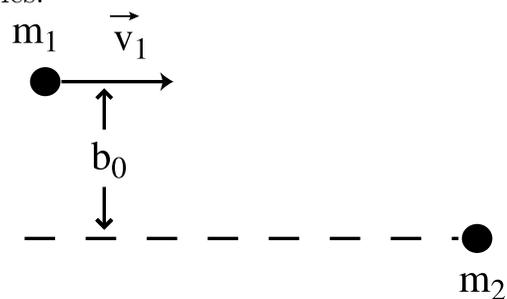


PHY820 Homework Set 7

1. [5 pts] Goldstein, Problem 3.18. Use of the Runge-Lenz vector can be beneficial.
2. [10 pts] Goldstein, Problem 3.31.
3. [5 pts] 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?
4. [10 pts] From an exam: Two particles of masses m_1 and m_2 ($m_1 \neq m_2$) collide. The initial 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 β between the final laboratory velocities of particles 1 and 2, given v_1^f . (Use conservation laws whenever possible.)



5. [5 pts] Goldstein, Problem 4-9.
6. [5 pts] Goldstein, Problem 4-10.