PHYS 305
Computational Physics II

Assignment No 3
Due: Friday, February 12, 2016

Purpose: Practice solving ODEs using RK4 and acquire an intuition for scattering problems.

In assignment No 2 you solved for the scattering in 2D of a particle of unit mass incoming onto a scatterer built of three Gaussian shape mounds. You calculated the scattering angle and the scattering time as a function of the impact parameter $b = y_0$ for a given energy.

In this assignment you Will study the *energy dependence of the scattering functions* .

The energy available for a scattering event is the kinetic energy of the incoming particle, measured asymptotically,

$$K = \frac{m \ vx^2}{2}$$

Part A

Repeat the calculation of the scattering angle and scattering time for the parameters used in Assignment No 2. Use 1000 values of b in the range $b = (0.0.0.8)$ exactly as in exercise No 2.

Part B

Repeat this calculation for $v0 = 0.25$ and $v0 = 0.35$. Plot the three resulting scattering angles and scattering times. Comment on the similarity, or the lack of it, of the scattering functions.

Part C

The energy dependence of the scattering angle and scattering time can best be illustrated via a color plot showing the color coded value of the scattering angle (and the scattering time in a second plot) versus the initial velocity (vertical axis) and the impact parameter (horizontal axis).

Use 2000 pixels horizontally and 1700 pixels vertically for best rendition of the color plots.
Use the velocity range $v_{0x} = 0.1 - V_{max}$ where V_{max} is the velocity corresponding to the kinetic energy 5% higher than the Gaussian potential mounds. For b, use a range 0.0 to 0.8

Part D

Comment on your results.