PHY 711 – Assignment #3

08/31/2015

1. In class we evaluated the differential cross section for Rutherford scattering. A slightly different evaluation uses the integral

$$\theta = \pi - 2b\int_{r_{\min}}^{\infty} dr \frac{1/r^2}{\sqrt{1 - \frac{b^2}{r^2} - \frac{\kappa}{r}}} = \pi - 2b\int_{r_{\min}}^{\infty} dr \frac{1/r}{\sqrt{r^2 - b^2 - \kappa r}}.$$

   Here $r_{\min}$ is a solution of the equation

$$1 - \frac{b^2}{r_{\min}^2} - \frac{\kappa}{r_{\min}} = 0.$$

   Here b is the impact parameter which is a function of the scattering angle θ. κ is a length parameter with represents the ration of the interaction strength to the center of mass energy of target and scattering particles. Use Maple or other algebraic manipulation software to evaluate the integral to show that

$$2b = \frac{\kappa}{\tan(\theta/2)}.$$

2. From this form of the impact parameter $b(\theta)$, "derive" the Rutherford scattering cross section.