January 18, 2011

PHY 712 – Problem Set #3

Continue reading Chaper 1 - 3 in **Jackson**; homework is due Friday Jan. 21, 2011.

1. Consider a one-dimensional charge distribution of the same form considered in HW2:

$$\rho(x) = \begin{cases} 0 & \text{for} \quad x \leq -a/2 \\ \rho_0 x/a & \text{for} \quad -a/2 \leq x \leq a/2 \\ 0 & \text{for} \quad x \geq a/2, \end{cases}$$

   where ρ_0 and a are constants.

   (a) Solve the Poisson equation for the electrostatic potential $\Phi(x)$ with the boundary conditions $\frac{d\Phi}{dx}(-a/2) = 0$ and $\frac{d\Phi}{dx}(a/2) = 0$ using the appropriate Green's function derived from an orthogonal function expansion as discussed in Lecture Notes #3.

   (b) Compare your results for the potential with the results obtained using the Green's function $G(x, x') = 4\pi x_<$, also considering the convergence with increasing numbers of expansion terms.