

PHY 741 – Problem Set #24

Continue reading Chapter 10 in **Mahan**; homework is due Monday, November 8, 2010.

Consider an electron scattering from a spherically symmetric potential well of the form

$$V(r) = \begin{cases} -\frac{\hbar^2}{2ma^2}\nu_0 & \text{for } 0 \leq r \leq a \\ 0 & \text{for } r > a. \end{cases},$$

where ν_0 is a positive constant.

1. Find a general expression for the scattering phase shift $\delta_l(k)$, where k is related to the energy of the system, expressed in convenient units as:

$$E = \frac{\hbar^2}{2ma^2}(ka)^2.$$

2. Use maple to plot the total scattering cross section of the system as a function of energy $1 \leq (ka)^2 \leq 10$, including contributions from at least 10 values of l and assuming the values $\nu_0 = 100$ and $\nu_0 = 200$.

Note: I have found the following procedure useful for defining functions that are derived from derivatives of functions. Assume that you have defined a function $f(l, x)$ and you want to define

$$g(l, x) = \frac{\partial f(l, x)}{\partial x}.$$

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f1:=diff(f(l,x),x);
g:=unapply(f1,l,x);
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