Homework #6
Due 14 October 2003

1. **In the electronic stopping high-velocity regime, what is the value of $dE/dx|_e$ for 10MeV Ar in Cu? Is 10MeV Ar in the high-velocity fully stripped ion regeme?**

2. **Calculate the electronic energy loss factor, $dE/dx|_e$, for a 1 keV Ar ion incident on Cu (Fermi velocity of electrons = 1.6×10^8 cm/sec) using the Fermi-Teller model, the Firsov model, and the Lindhard-Scharff model.**

3. **For 100keV implantation of As ions (single ionization) into Si at a current of 1mA over an area of $200cm^2$ for 10 minutes:**

   Calculate the number of implanted ions per cm^3

   Calculate the projected range and the straggle

   Calculate the concentration of implanted As per cm^3 at $x - R_p$

   Calculate the depth at which the As concentration drops to 0.1 times it's value at R_p

4. **The curve $\rho_L = 3.06\varepsilon$ in Figure 6.6 of the textbook is the reduced reange calculation for the special energy-independent power law approximation to the nuclear stopping, for the condition m = 1/2, given by**

$$\frac{dE}{dx} = 1.308 \cdot \pi \cdot a_{TF} \cdot N \cdot Z_1 \cdot Z_2 \cdot e^2 \cdot \frac{M_1}{M_1 + M_2}$$

   Show that the relationship $\rho_L = 3.06\varepsilon$ can be obtained by the above equation and the chain rule relationship between ε, ρ, E, x and R:

$$\frac{d\varepsilon}{d\rho_L} = \frac{dE}{dx} \cdot \frac{d\varepsilon}{dE} \cdot \frac{dR}{d\rho_L}$$