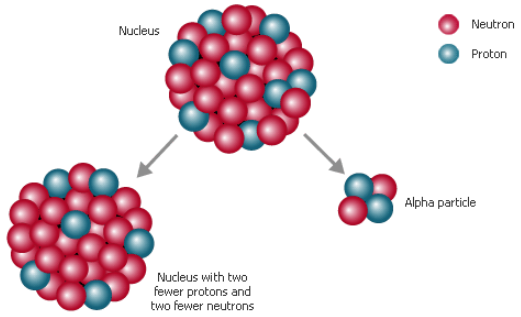
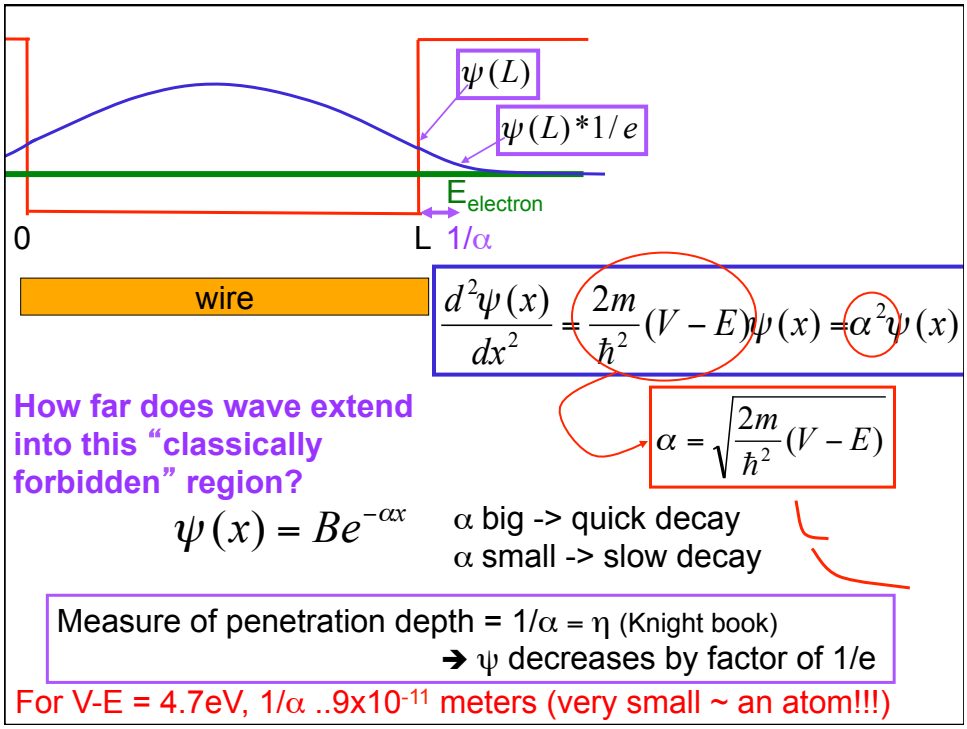
Golly… tunneling seemed pretty abstract… I wonder what those ideas could be applied to? Hmmm…

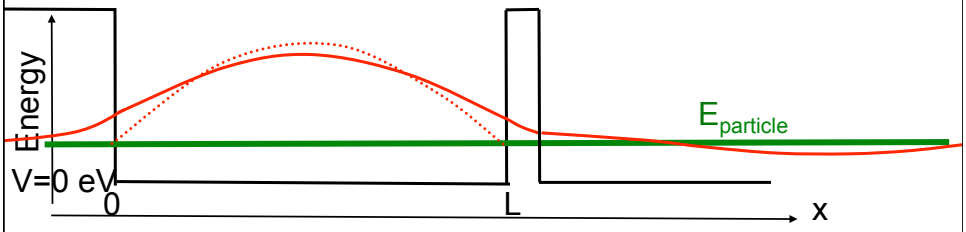


Day 31:
Questions?
Reminders: Schrödinger Wave Eq'n
Potential Wells & Tunneling

Reminders:
HW
Next up: STMs & Nukes



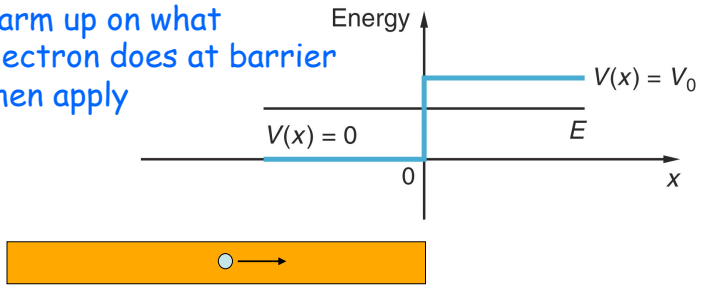
So the thinner, the shorter the barrier, the easier it is to tunnel …



And particle can escape…

Application: Alpha-Decay, Scanning tunneling microscope

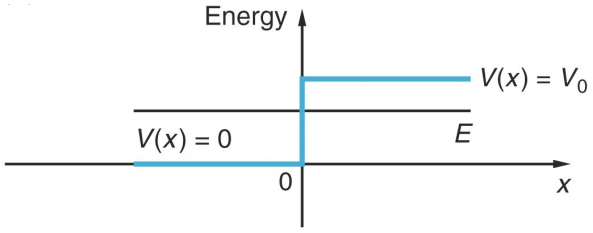
warm up on what electron does at barrier then apply

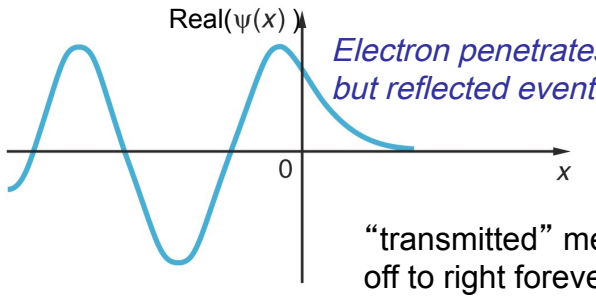


If the total energy *E* of the electron is LESS than the work function of the metal, V_0, when the electron reaches the end of the wire, (and no other wire is near by) it will…

A. stop.
B. be reflected back.
C. exit the wire and keep moving to the right.
D. either be reflected or transmitted with some probability.
E. I have *no* idea

Once you have amplitudes,can draw wave function:

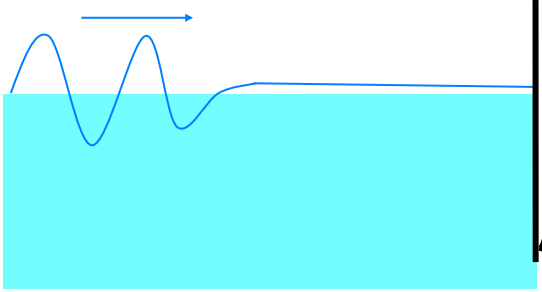




Electron penetrates into barrier, but reflected eventually.

"transmitted" means continues off to right forever. Wave function not go down to zero.

water wave ~ analogy for reflection and tunneling

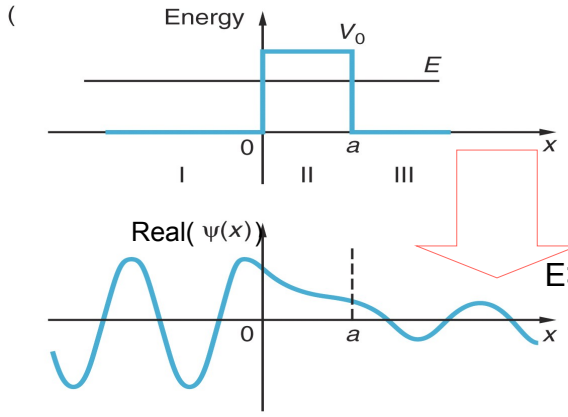


flexible rubber barrier. Too high for wave to go over

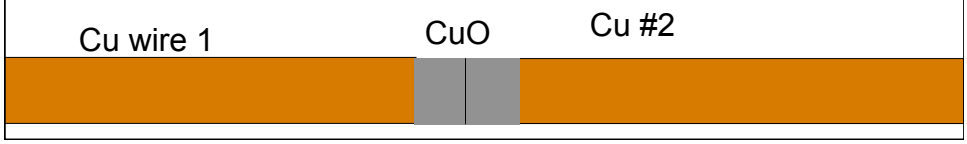
stretched barrier higher potential energy

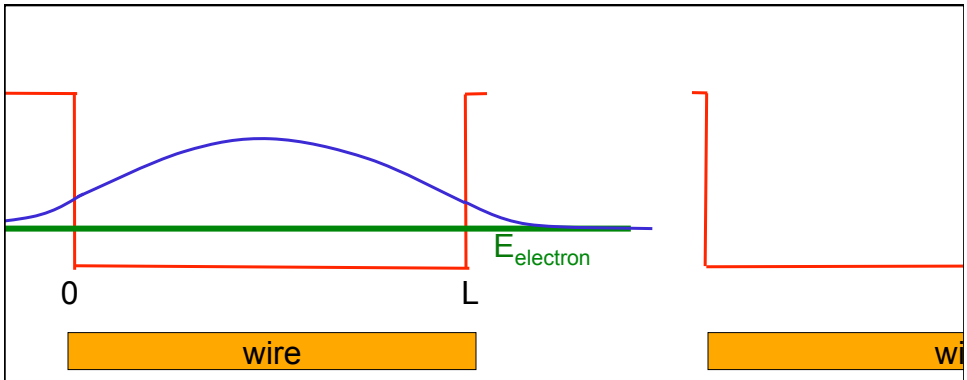
Wave penetrates but still all reflects.

Can have transmission only if third region where solution is not real exponential! (electron tunneling through oxide layer between wires)



E>P,
Ψ(x) can live!
electron tunnel
out of region I





If very very long wire gets closer and closer to this very short, what will eventually happen?

a. electron is "shared" between wires, with fraction in each constant over time
b. the electron will flow away through wire 2
c. electron will jump back and forth between wire 1 and wire 2
d. electron stays in wire 1.
e. something else happens.

Tutorial (Long Answer HW 8)