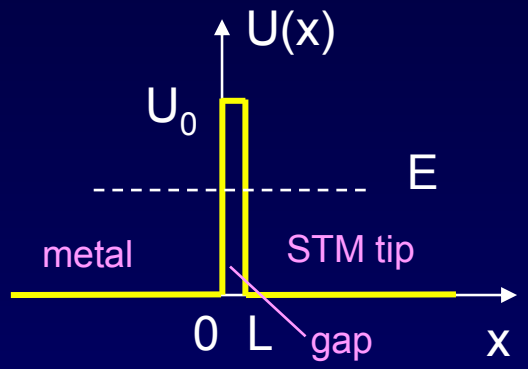
The STM

The STM (scanning tunneling microscope) tip is L = 0.18 nm from a metal surface.

An electron with energy of E = 6 eV in the metal approaches the surface. Assume the metal/tip gap is a potential barrier with a height of U_o = 12 eV. What is the probability that the electron will tunnel through the barrier?



$$T \approx Ge^{-2KL} = 4e^{-2(12.6)(0.18)}$$
$$= 4(0.011) = \boxed{4.3\%}$$

$$G = 16\frac{E}{U_0}\left(1-\frac{E}{U_0}\right) = 16\frac{1}{2}\left(1-\frac{1}{2}\right) = 4$$

$$K = \sqrt{\frac{2m_e}{\hbar^2}(U_0 - E)} = 2\pi\sqrt{\frac{2m_e}{h^2}(U_0 - E)}$$
$$= 2\pi\sqrt{\frac{6\,\text{eV}}{1.505\ \text{eV-nm}^2}} \approx 12.6\ \text{nm}^{-1}$$

T << 1, so our use of the KL >> 1 approximation is justified.

Q: What will T be if we double the width of the gap?