Compare a plane wave incident normally on a conducting surface, and a plane wave incident on a dielectric surface such that there'll be total reflection and an evanescent wave.  What can you say about the energy flow in the transmitted region in either case?

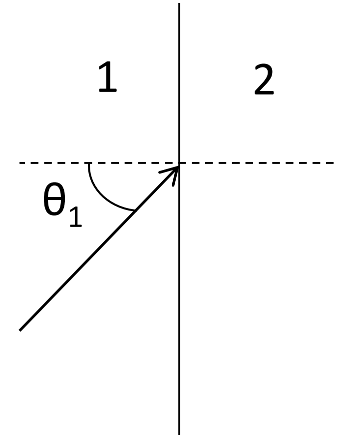
A. Energy flows normal to the surface for the evanescent wave, normal to the surface for the wave in the conductor.
B. Normal for evanescent, parallel to the surface for the conductor wave
C. Parallel for both
D. Parallel for evanescent, normal for the conductor wave

What is the electric field in a *perfect* conductor if an EM wave is incident on the surface?

A. Zero
B. Depends on the angle of incidence
C. Depends on whether the EM wave is in a dielectric or vacuum
D. Perfectly in phase with the incident wave but decreasing with distance into the conductor
E. Not enough information to say

Evanescent waves and waves propagating through conductors share some commonalities, but also have some significant differences.

A. Energy flows normal to the surface for the evanescent wave, normal to the surface for the wave in the conductor.
B. Normal for evanescent, parallel to the surface for the conductor wave
C. Parallel for both
D. Parallel for evanescent, normal for the conductor wave




Our general solution for a transmitted wave is

$$\tilde{\vec{E}}_T(\vec{r},t) = \tilde{\vec{E}}_{0T} e^{i(\vec{k}_2 \cdot \vec{r} - \omega t)}$$

Snell's law tells us $n_1 \sin\theta_1 = n_2 \sin\theta_2$

If $n_2 < n_1$, there is a critical angle, $\sin\theta_{1,C} = n_2 / n_1$,
beyond which there is no real solution for $\theta_2$.

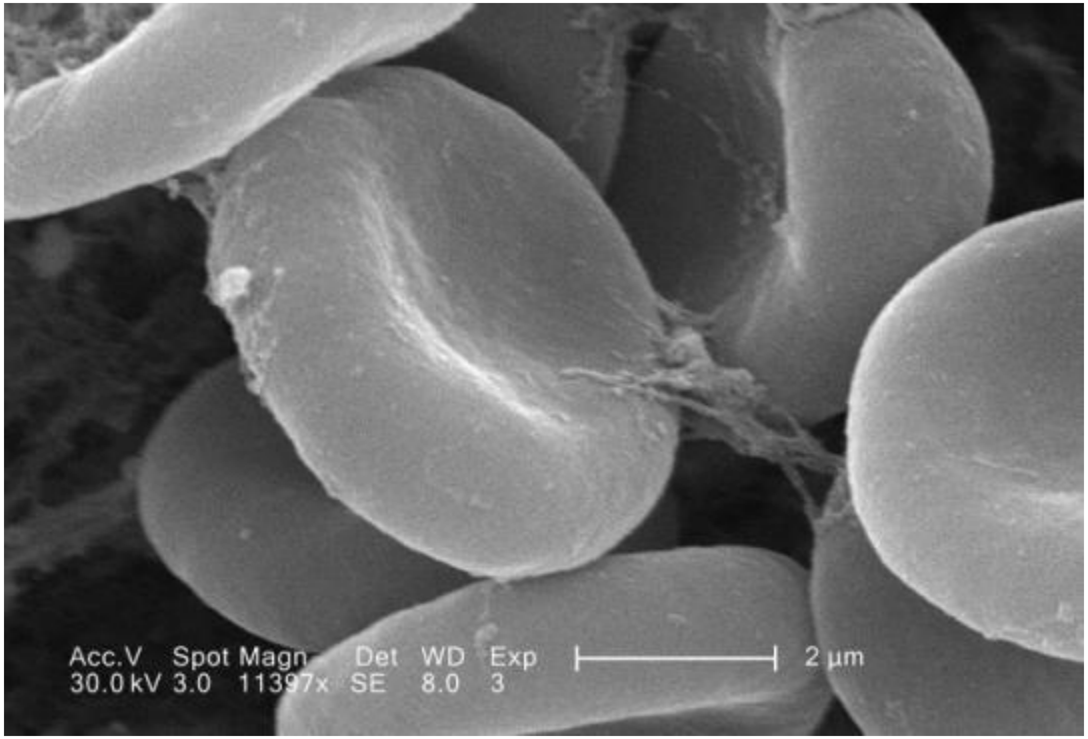
How do we interpret this lack of solution *physically?*

# Frustrated total internal reflection – A classical analog to quantum tunneling

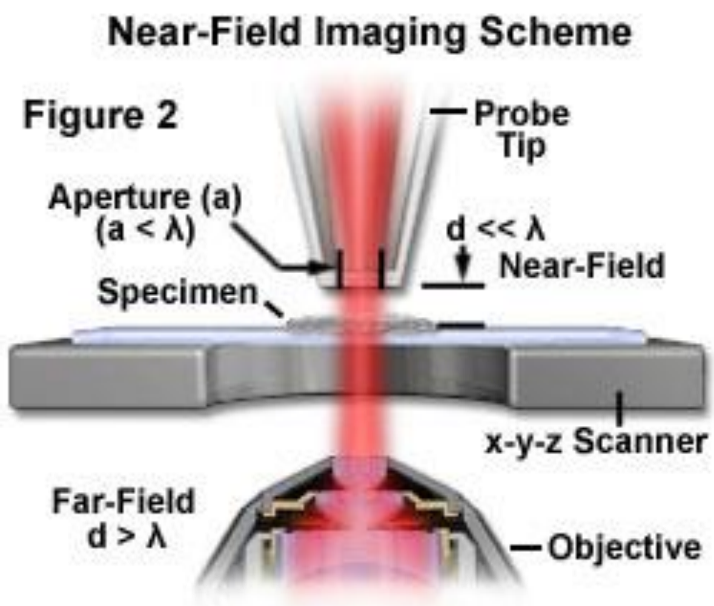
# The Rayleigh criteria – A classical limit to optical imaging

$$\sin\theta_R = 1.22\frac{\lambda}{D}$$

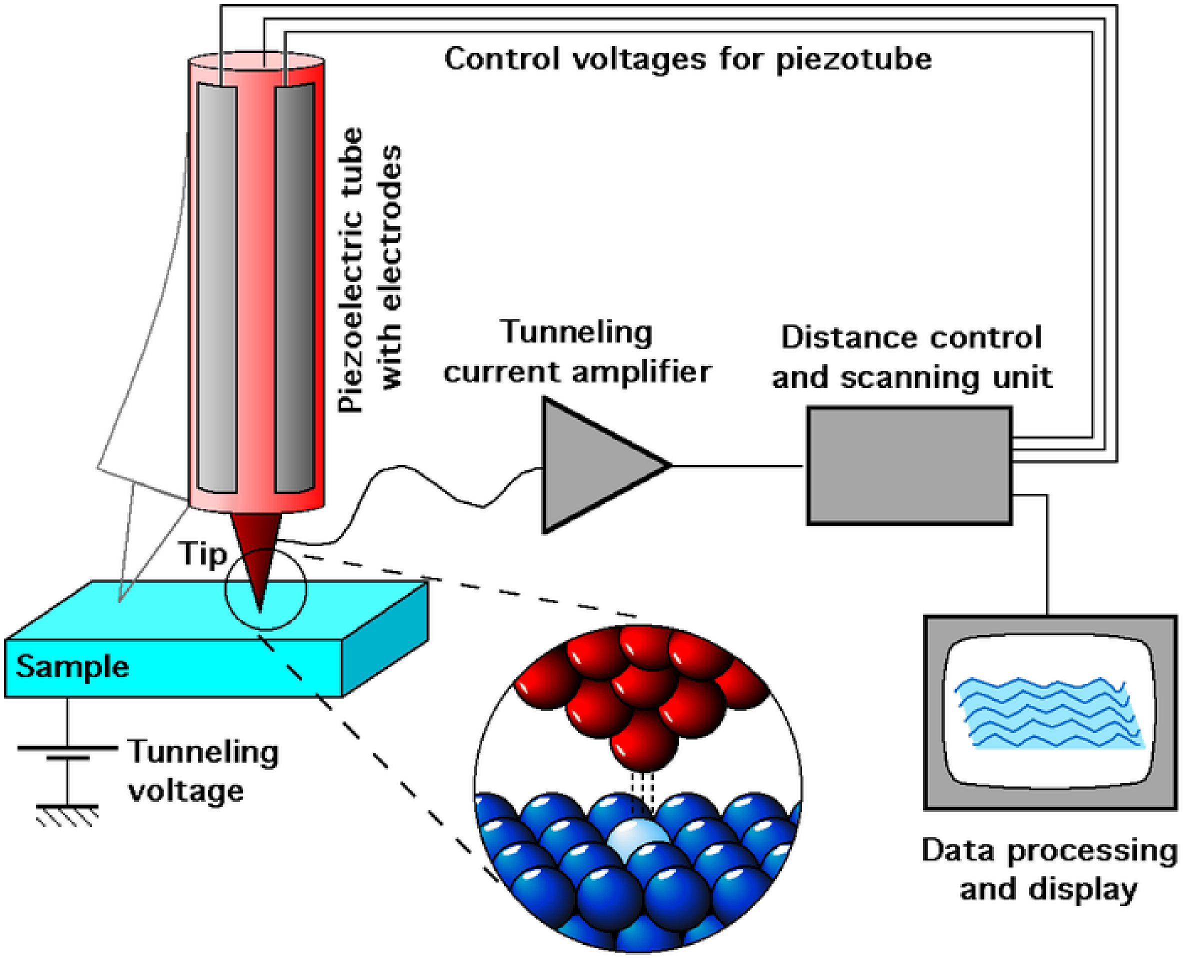
# Electron microscopy – Making λ small

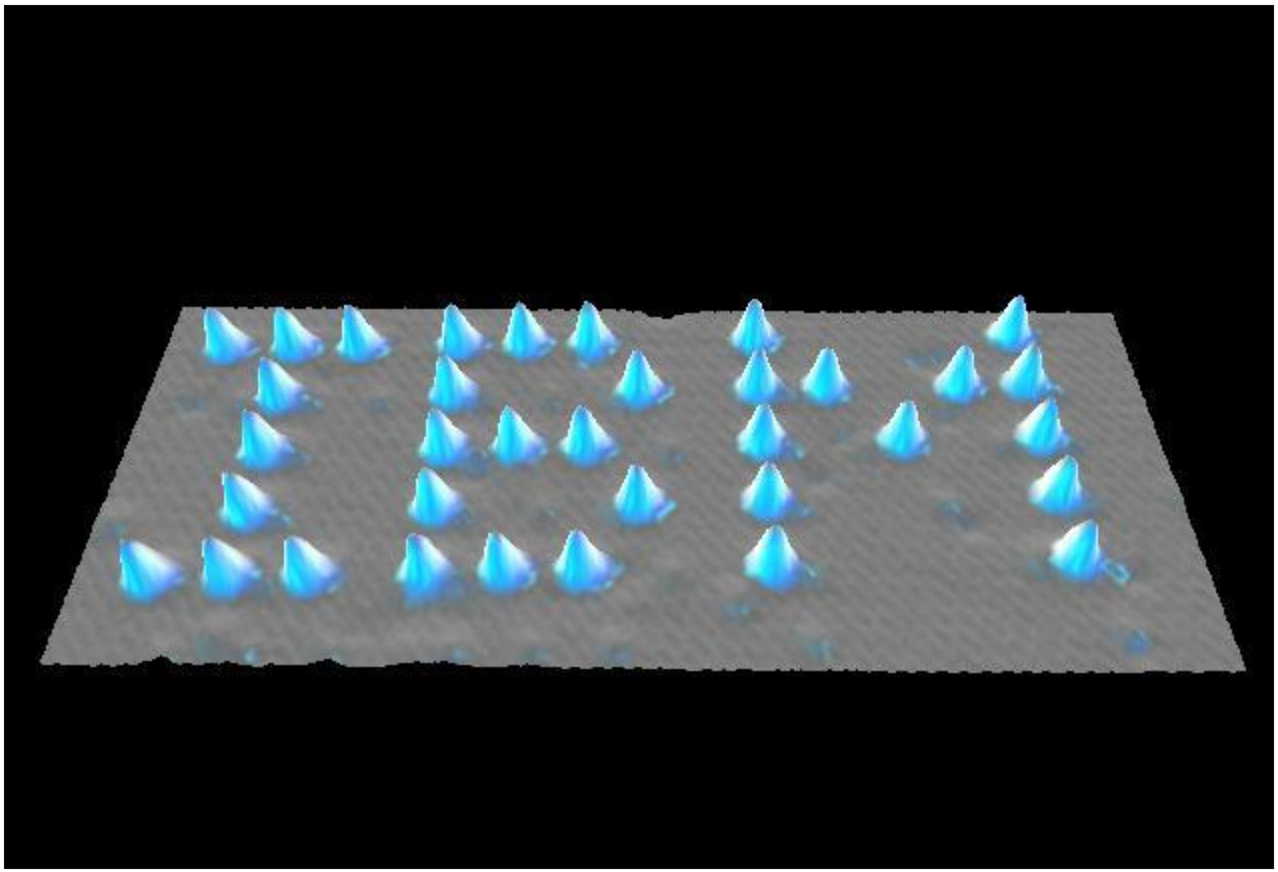


# NSOM – Near field Scanning Optical Microscopy



# STM:  Scanning tunneling microscopy

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