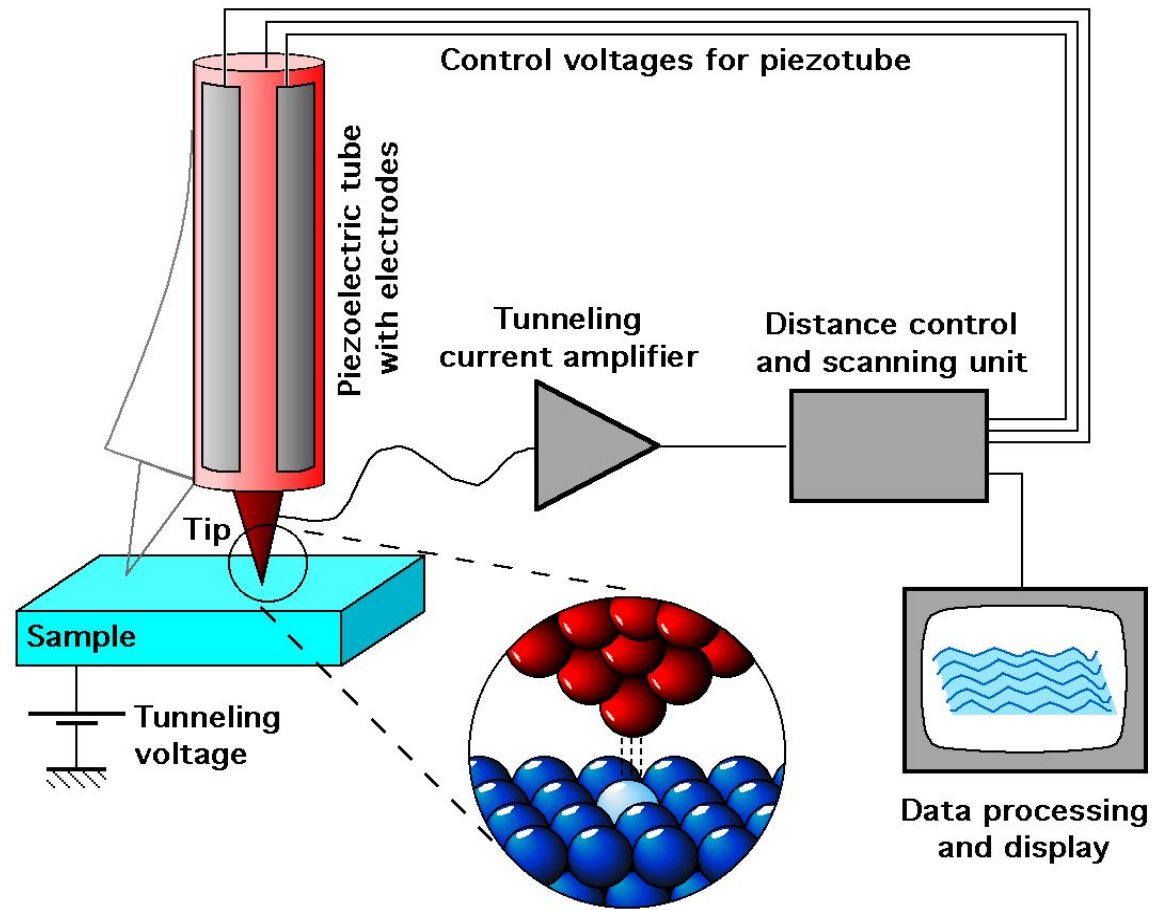


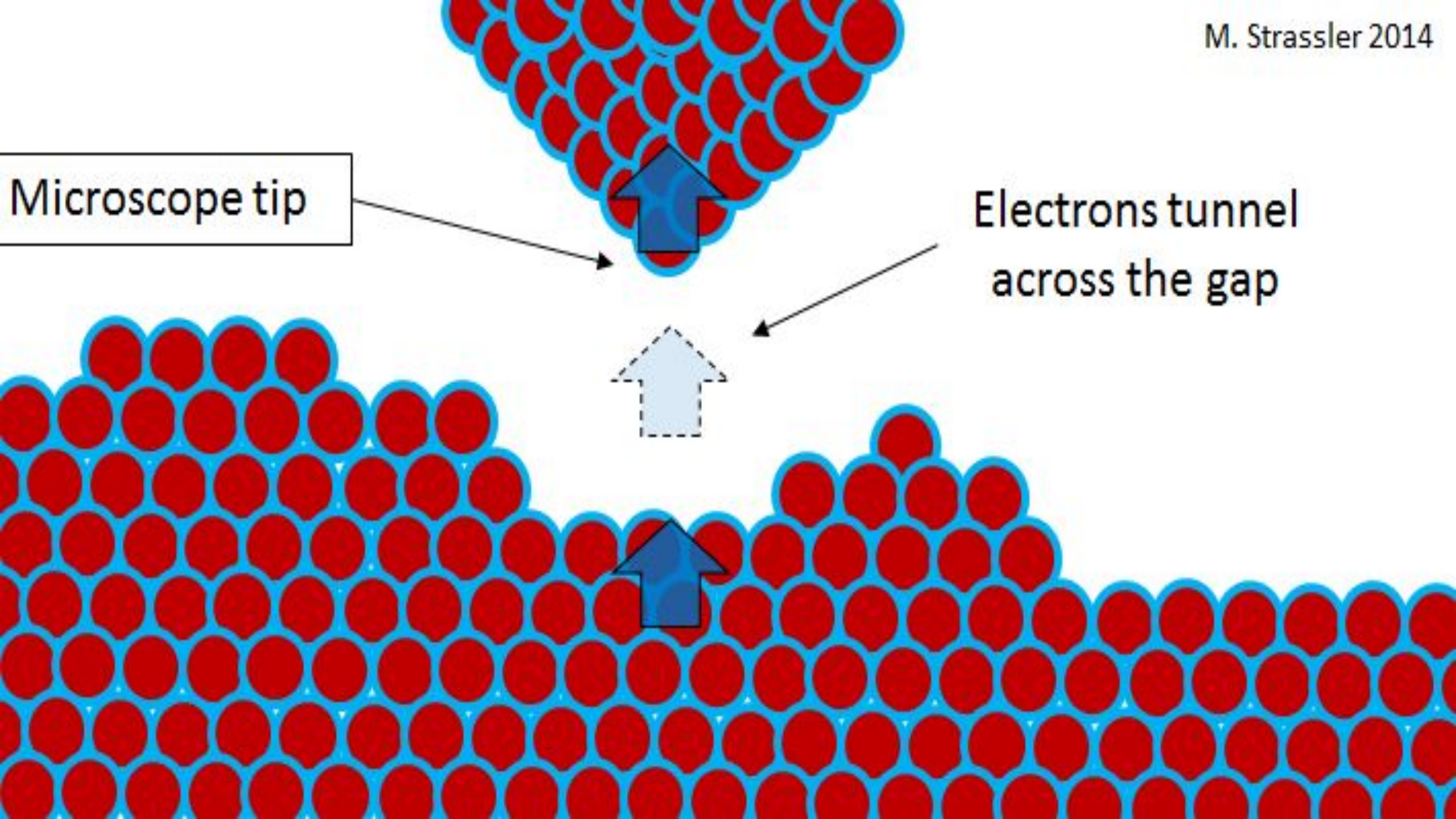
# Scanning tunneling microscope (STM)



# History

- STM was invented in 1981 by Gerd Binnig and Heinrich Rohrer (IBM Zurich).
- Five years later, they were awarded the Nobel Prize for their invention in physics.

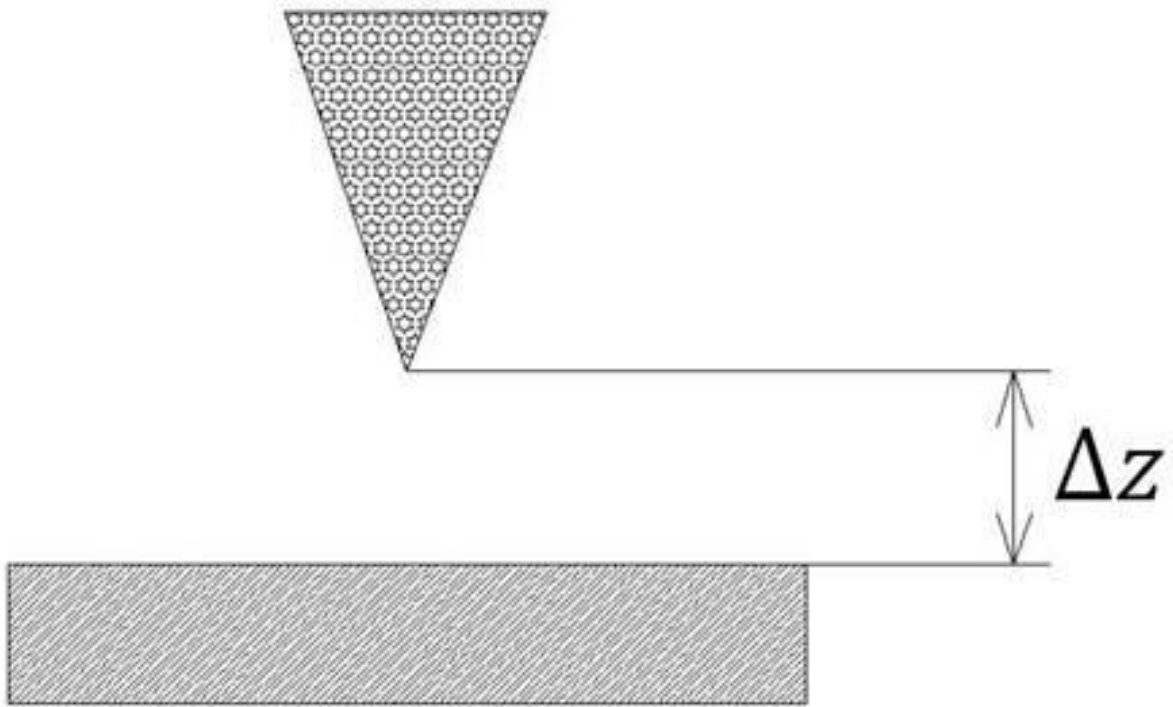


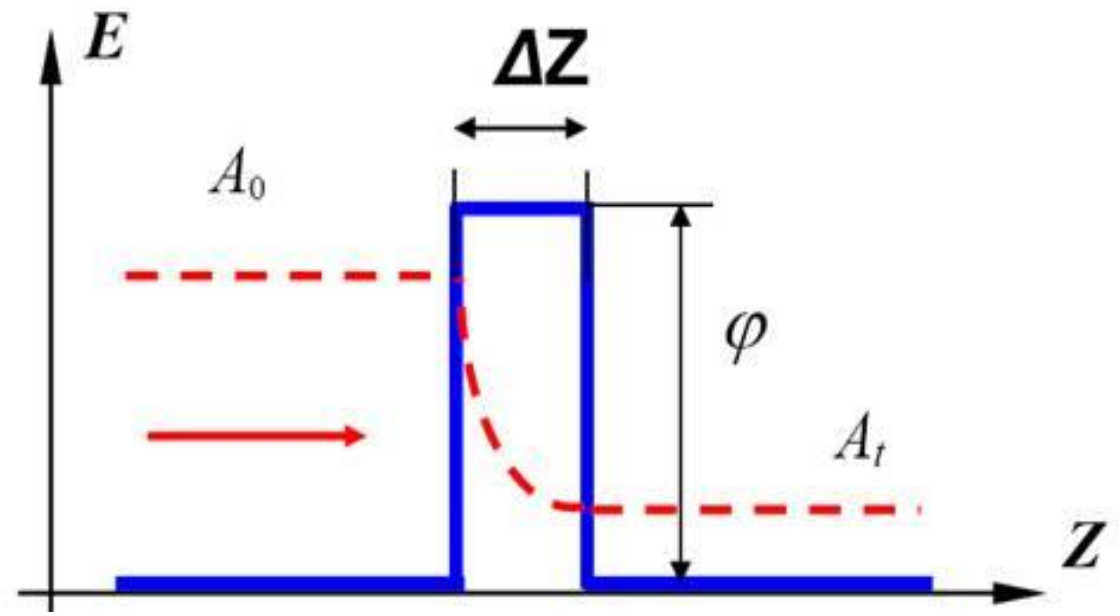
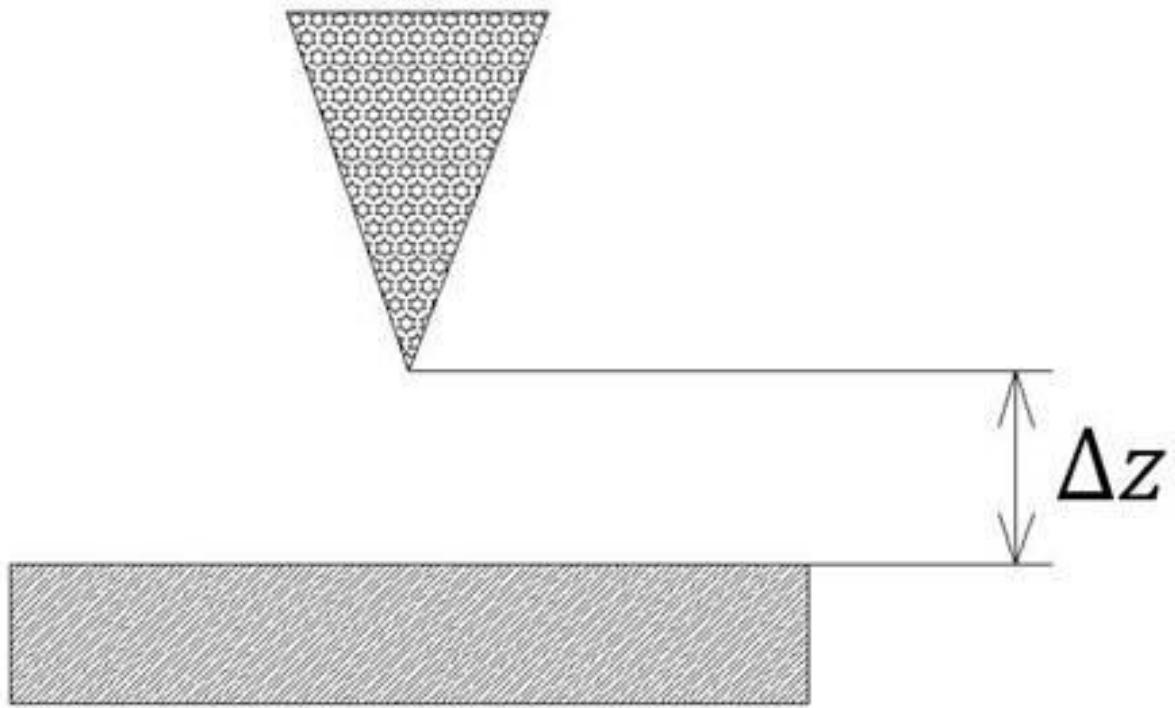


Microscope tip

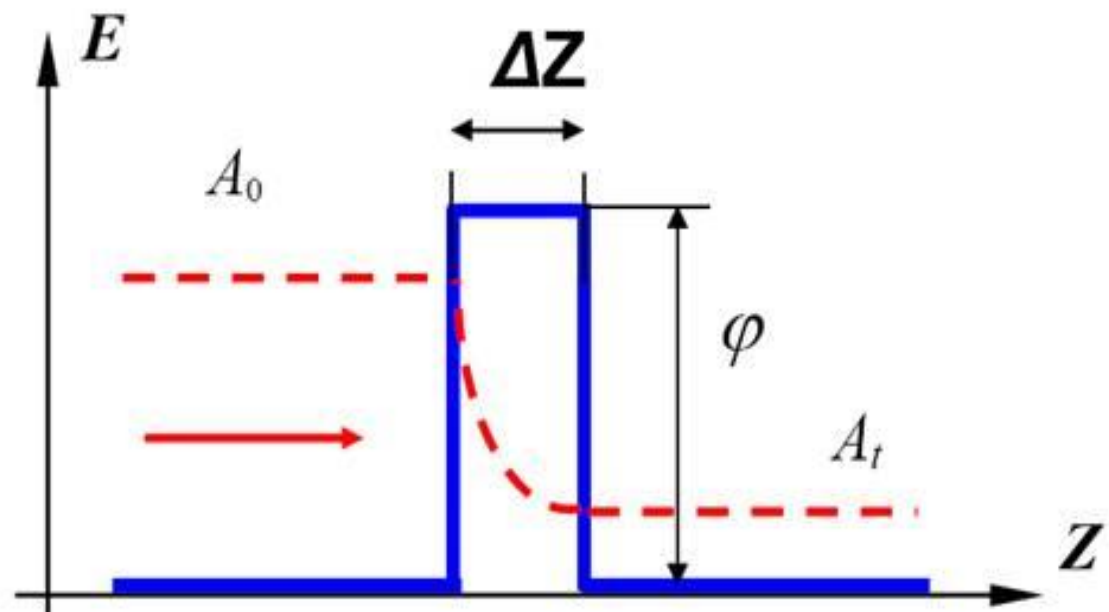
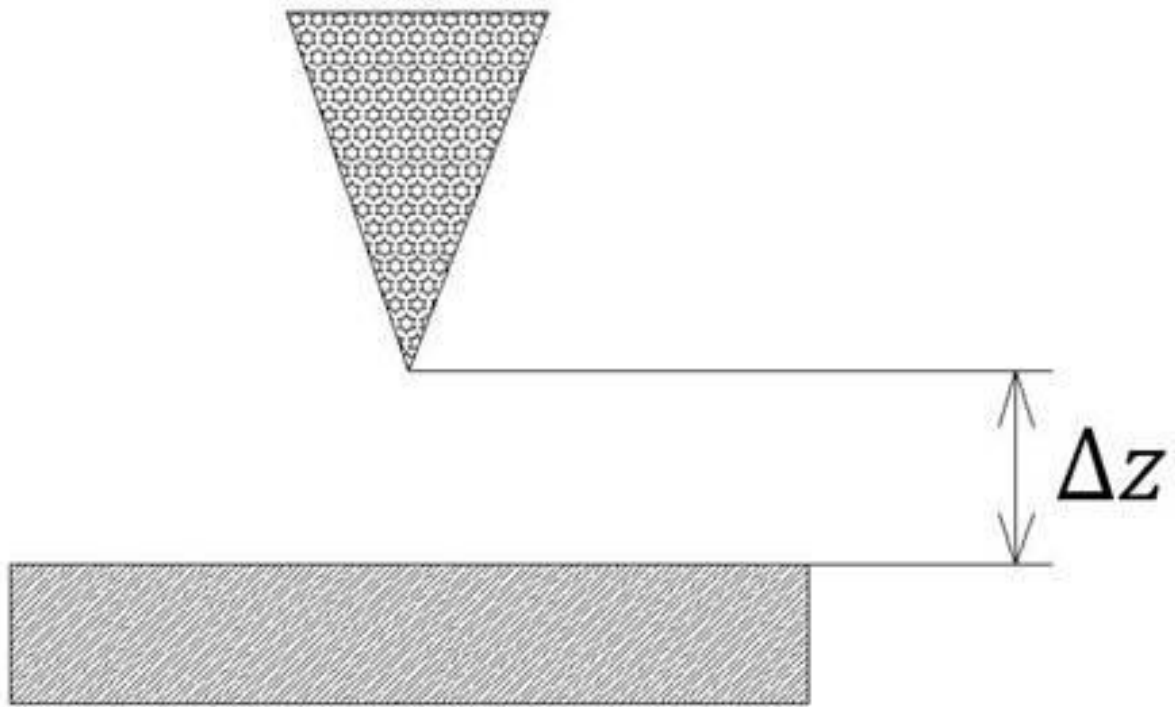
Electrons tunnel  
across the gap







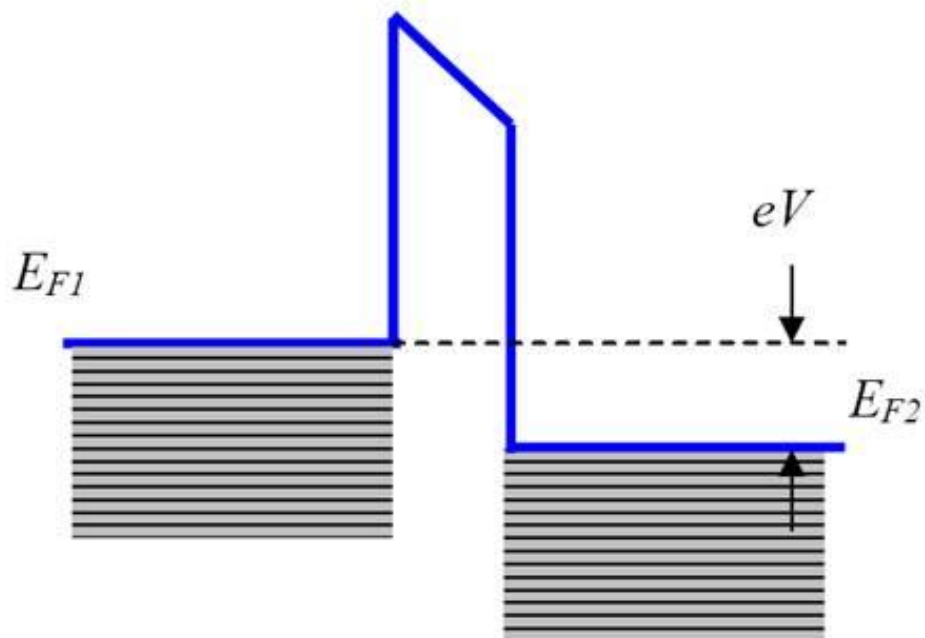
$$\varphi = \frac{\varphi_{\text{зонда}} + \varphi_{\text{образца}}}{2}$$



$$\varphi = \frac{\varphi_{\text{зонда}} + \varphi_{\text{образца}}}{2}$$

$$= j_0(V) e^{-2\sqrt{\frac{2m\phi}{\hbar^2}} \Delta z} = j_0(V) e^{-k\Delta z} =$$

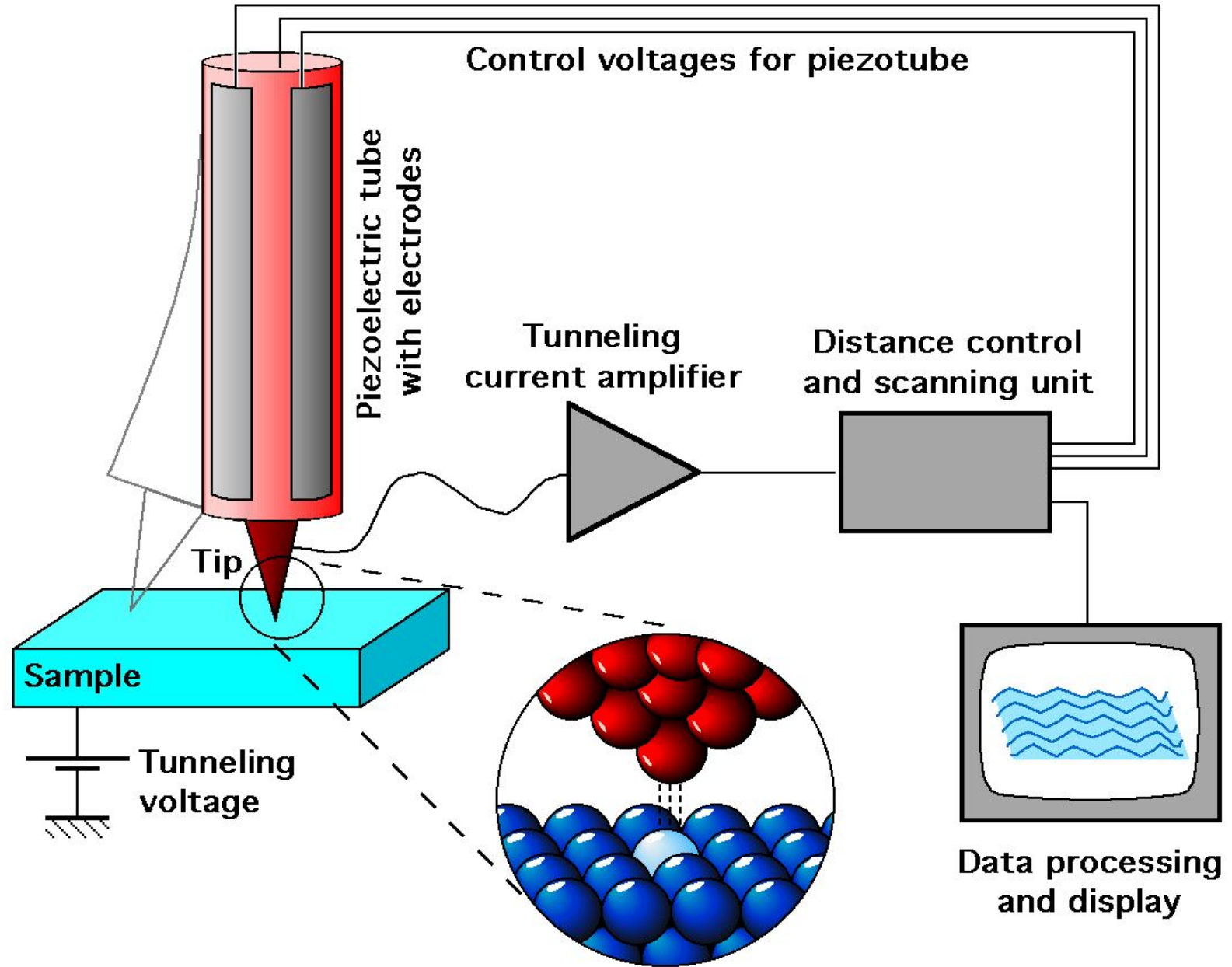
$$k = 2A - 1$$



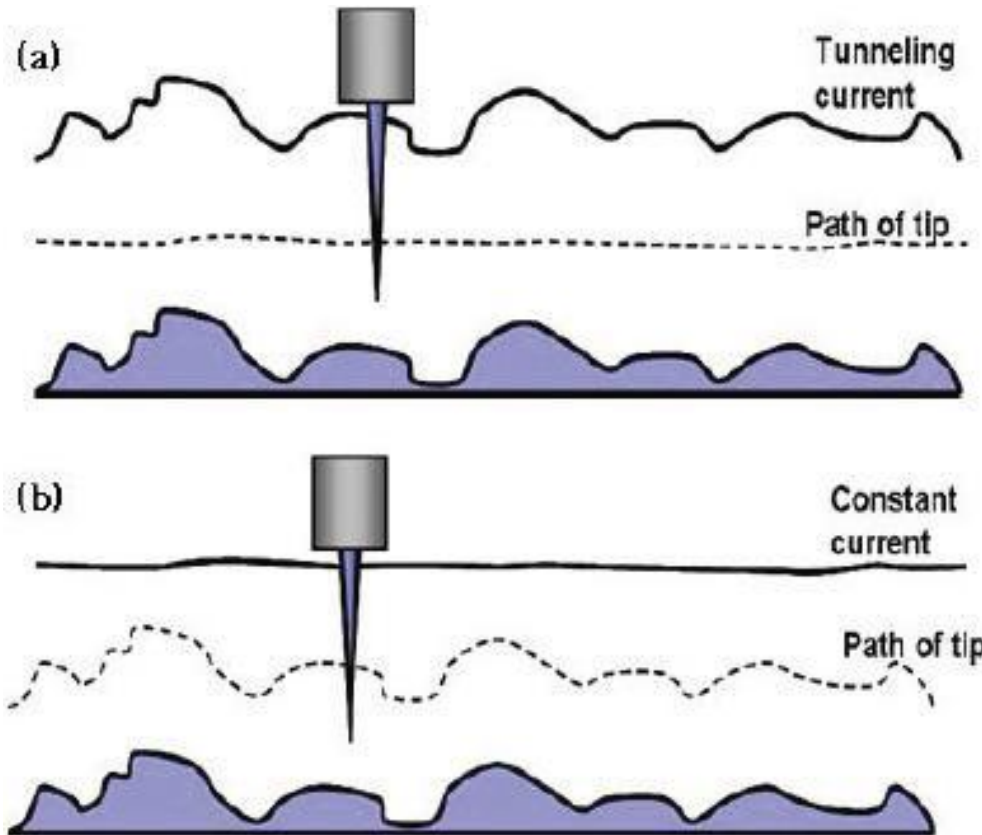


$$I_t = e^{-kd}$$

tunnel current ( $I_t$ )  
where  $d$  is the distance  
between the probe and the  
sample surface.



# Surface scanning methods



Constant height mode - at a constant tip height, measure the strength of the tunnel current

Constant tunneling current mode - the tip changes the height at a certain current value

*Comparison of methods (a) of constant height and (b) of constant tunneling current for STM*

# Restrictions

- Sample surface resistance
- Groove geometry
- Needle sharpening
- Vacuum
- Mechanical collision

Thank you for your  
attention!