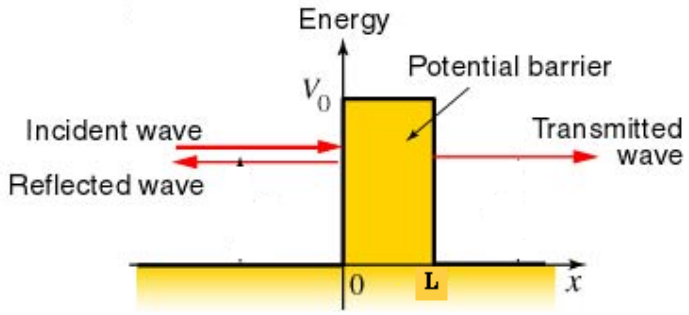
Tunnel Effect

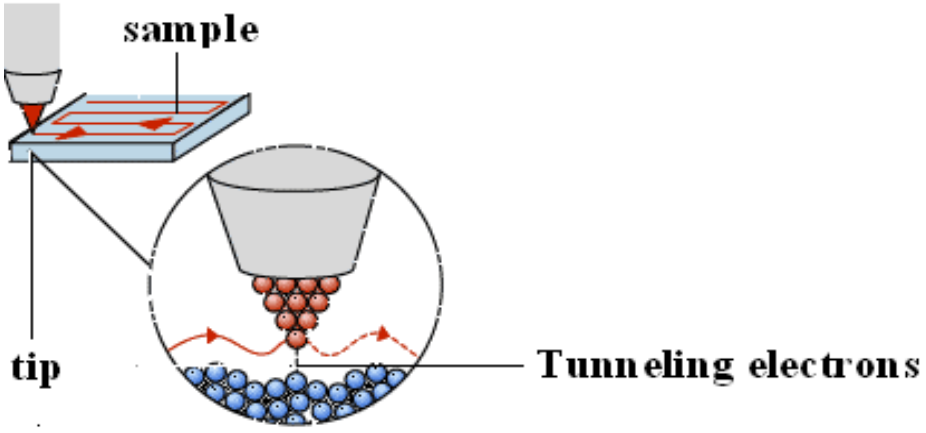
- Particle can penetrate into a potential wall (or barrier)



- Incident particle with energy E coming from left colloides the potential barrier.
- E is assumed to be lower than the top of the barrier
- In classical mechanics the particle is completely reflected by the potential barrier
- In quantum mechanics some probability will be reflected, other penetrates the barrier and pass through-right side region.
- Tunnel effect
- Electronic elements use the tunnel effect
- Principle of STM is based on the tunnel effect

Scanning Tunneling Microscope (STM)

- Type of electron microscope that shows 3D images of a sample
- Structure of the surface is studied using a stylus that scans the surface at a fixed distance from it



- An extremely fine conducting probe is held close to the sample.
- Electrons tunnel between the surface and the stylus, producing an electrical signal.
- Stylus is extremely sharp, the tip being formed by one single atom.
- Slowly scans across the surface at a distance of only an atom's diameter.
- Stylus is raised and lowered inorder to keep the signal constant and maintain the distance.
- Smallest details of the surface is scanning.
- Vertical moment of the stylus makes it possible to study the structure of the surface atom by atom.
- A profile of the surface is created, and from that a computer-gernerted control map of the surface is produced.

Applications

- Used in both industrial and fundamental research to obtain atomic scale images of metal surfaces.

- It provides a 3D profile of the surface which is very useful for characterizing surface roughness and observing surface defects.

- Surface organic molecules can be studied and also their structures.