

# Scanning Tunneling Microscopy– Instruction Notes

**Keywords:** electron tunneling, scanning microscopy, piezoelectric effect, Fourier transform, image processing

## I. GOALS OF THE EXPERIMENT

Scanning tunneling microscopy (STM) is an experimental technique which provides three-dimensional images of surface structures with atomic resolution. STM uses the principles of electron tunneling between a sharp metal tip and the sample surface. A feedback network, based on piezoelectric effect, changes the height of the tip to keep the current constant (constant current mode) or monitors the current while keeping the height constant (constant height mode). The vertical position of the tip at each data point is stored by the computer to form the topographic image of the sample surface.

## II. LEARNING CONTENT

- Electron tunneling through a rectangular barrier
- Tunneling current
- Piezo scanners, their use in scanning probe microscopes, and possible scanning artifacts
- General setup of an STM
- STM imaging modes
- Control theory

## III. PROCEDURE

- Fabrication of STM tips by wire cutting
- Experimental setup
- Structure of graphite and gold: What do we see in the STM?
- Discrete Fourier Transform in 1- and 2D

## IV. REFERENCES:

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