Physics 76  Spring 2001

Scanning Tunneling Microscopy

Purpose

The purpose of this experiment is to introduce to you the basic operation and applications of scanning tunneling microscopes. You will attempt to image gold, graphite, a semiconductor (MoS$_2$) and liquid crystals.

References


Preliminary Questions

1. Describe the in words and drawings (if useful) how the following relate to or are used in the operation of a scanning tunneling microscope.
   a) quantum mechanical tunneling
   b) piezoelectric motion control
   c) negative feedback
   d) vibration isolation

2. Derive the one-dimensional tunneling probability in terms of tip to substrate distance. How does this expression change as a function of applied bias and tip-substrate distance? Give numerical examples.

Apparatus

The Burleigh Instructional Scanning Tunneling Microscope™ Workbook will instruct you how to set up for the preliminary measurements.
Experiment

1. Perform experiment 4.1.1.1, imaging of a holographic gold grating and answer the accompanying questions.

2. Perform experiment 4.2.2.1, imaging of a graphite surface and answer the accompanying questions.

3. One of the following (if time permits):
   Perform experiment 4.3.1.1, imaging of a semiconductor (MoS$_2$) and answer the accompanying questions.
   Or,
   Perform experiment 4.4.3.3, imaging of a graphite surface and answer the accompanying questions.