Lecture-7. Microscopy. STM

Sounds like something out of Jules Verne, doesn't it? But if you want to get images of solid surfaces that conduct electricity, you can't beat the oddly named scanning tunneling microscope (STM). It offers the best resolution of the bunch. This method uses an electric current (called a tunneling current) that begins to flow when a very sharp tip moves near to a conducting surface and hovers at about one nanometer away, as illustrated in Figure 3-9. The tip (about the size of a single atom) sits on a piezoelectric tube. When you apply voltage to electrodes attached to this tube, you can make teensy adjustments to keep the tunneling current constant — which also keeps the tip at a constant distance from the sample while an area is scanned. The movement of the piezoelectric tube is recorded and displayed as an image of the sample surface. Using a scanning tunneling microscope, you can see individual atoms on the surface of a sample — in 3-D. This technique is used to study things such as conductive materials and even DNA molecules.

An STM doesn't need to operate in a vacuum, which means you can use it to analyze samples in the air and in liquids. Often, however, a vacuum environment is used anyway to prevent samples from getting contaminated.