



Nanoscale Tools

- Special microscopes are used to investigate atomic and molecular structures.
- The following pictures are just a few examples of the many different kinds of microscopes that are used to create images at the nanoscale.



Scanning Electron Microscopes

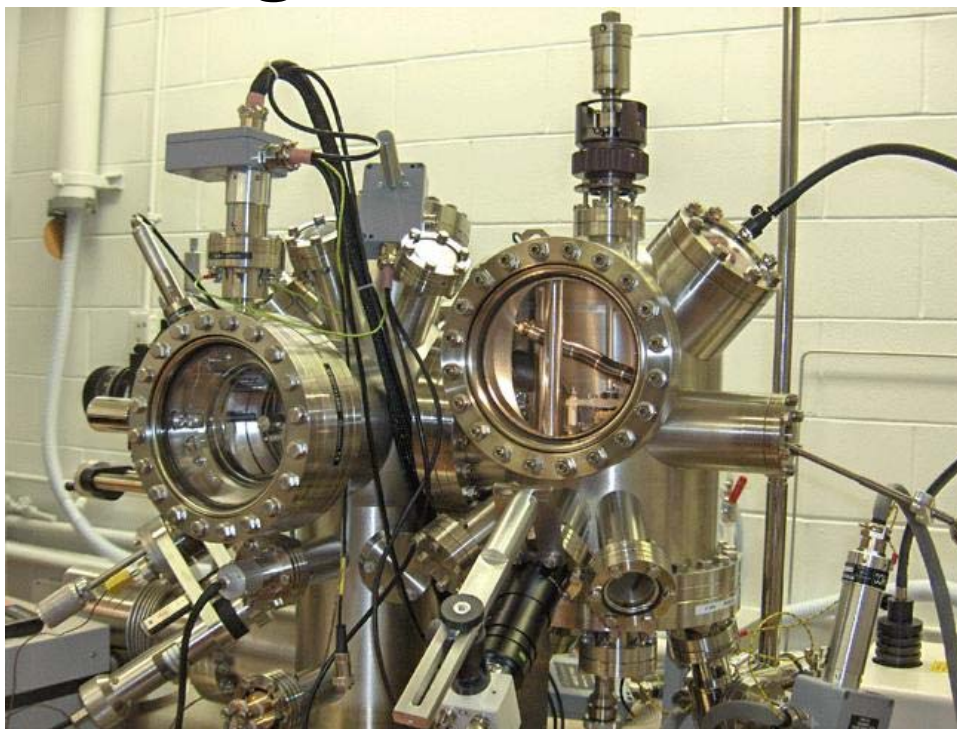


Scanning electron microscopes use electrons to probe the sample. Note that there are no lenses or eyepieces on this SEM. Images are created from measurements of how the electrons scatter off the sample.

Image: Grant Institute of Earth Science, University of Edinburgh



Scanning Probe Microscopes

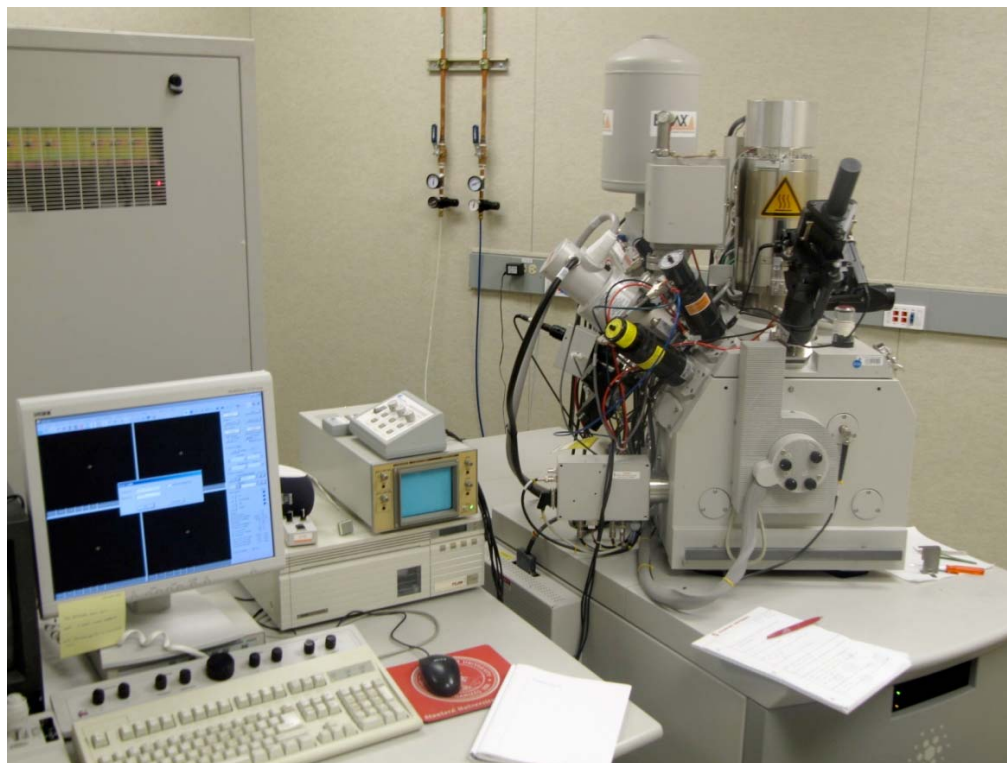


Scanning probe microscopes allow scientists to investigate samples that are much too small to see. Note that there are no lenses or eyepieces on this STM.

Image: Omicron Nanotechnology



Scanning Probe Microscopes

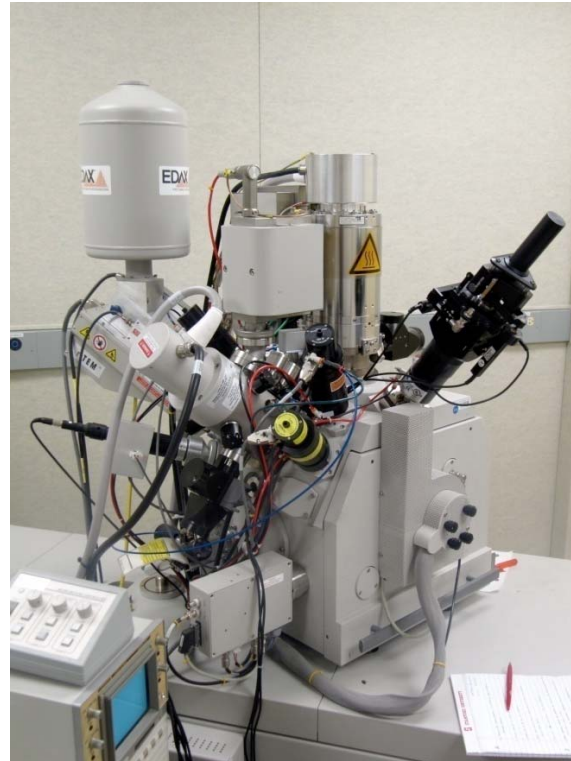


Scanning electron microscope with focused ion beam attachment at the Stanford Nanocharacterization Laboratory.

Image: Craig Young



Scanning Probe Microscopes

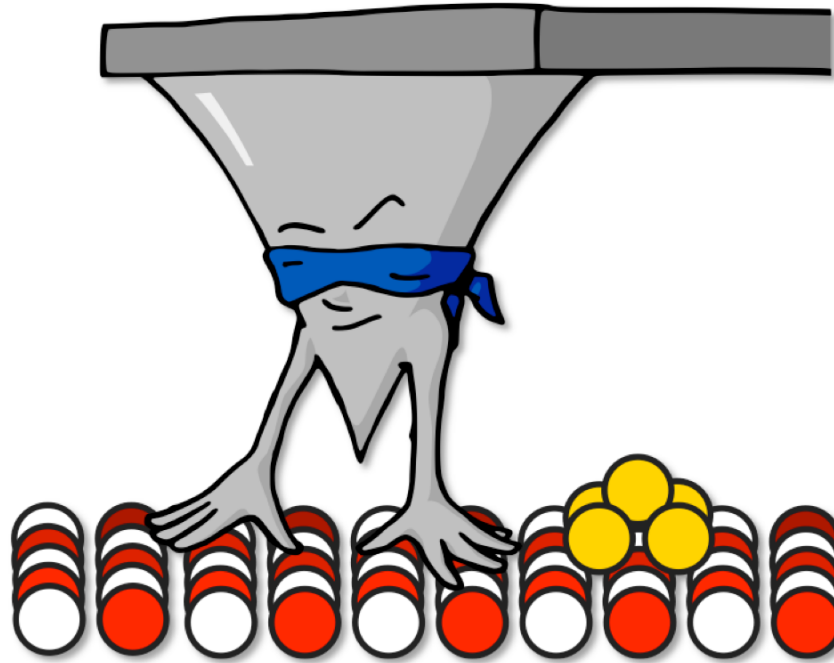


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Scanning Probe Microscopes

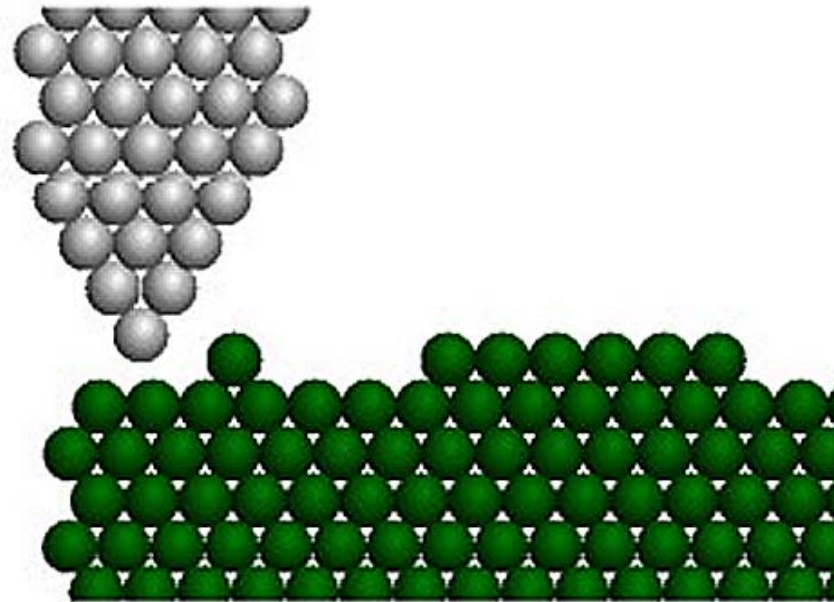


Scanning probe microscopes “feel” changes in surfaces of the sample. They use ultra-sharp tips to measure changes in electric currents, electrostatic forces, or magnetic forces coming from the surface.

Image: <http://butler.cc.tut.fi/~foster/images/afmman.png>



Scanning Probe Microscopes

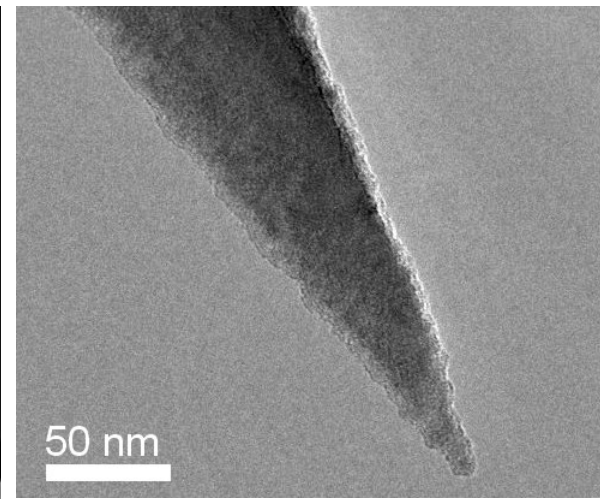
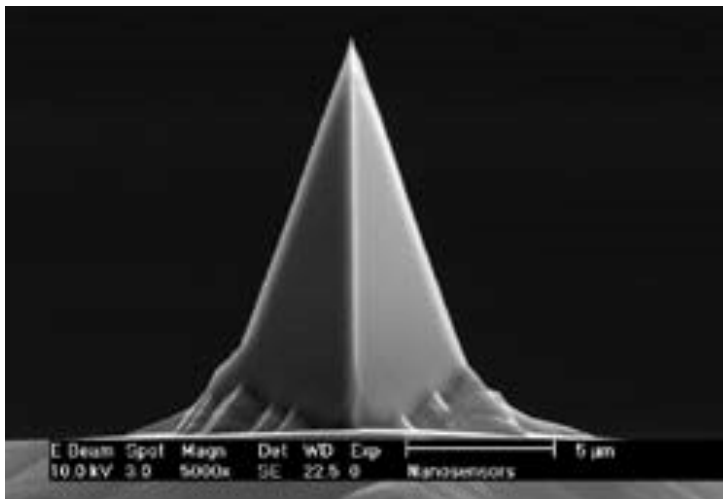


Scanning tunneling microscopes measure changes in electric currents between the probe tip and the surface.

Image: Materials Research Science and Engineering Center, University of Wisconsin-Madison.



Scanning Probe Microscopes

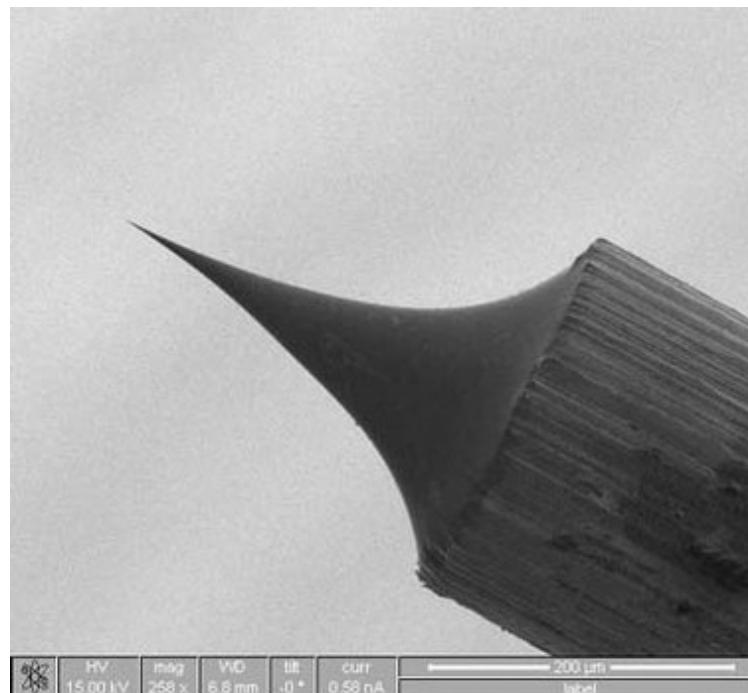


The tips of the microscopes have to be incredibly sharp to allow them to collect information about individual atoms or molecules.

Images: Nanosensors



Scanning Probe Microscopes

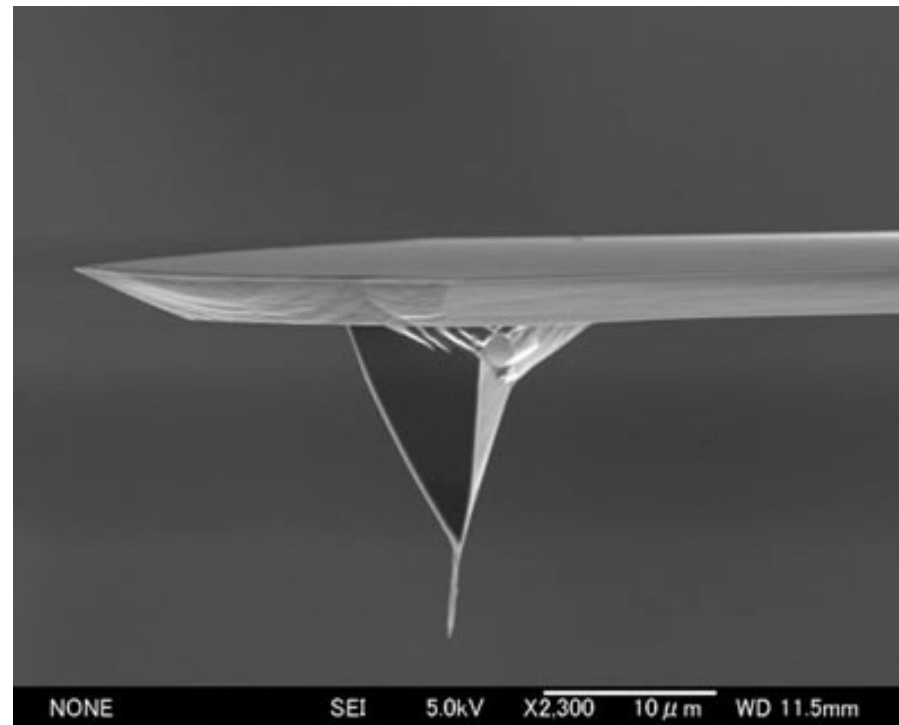


Etched tungsten tip for an STM.

Image: Millunchick research group, University of Michigan.



Scanning Probe Microscopes

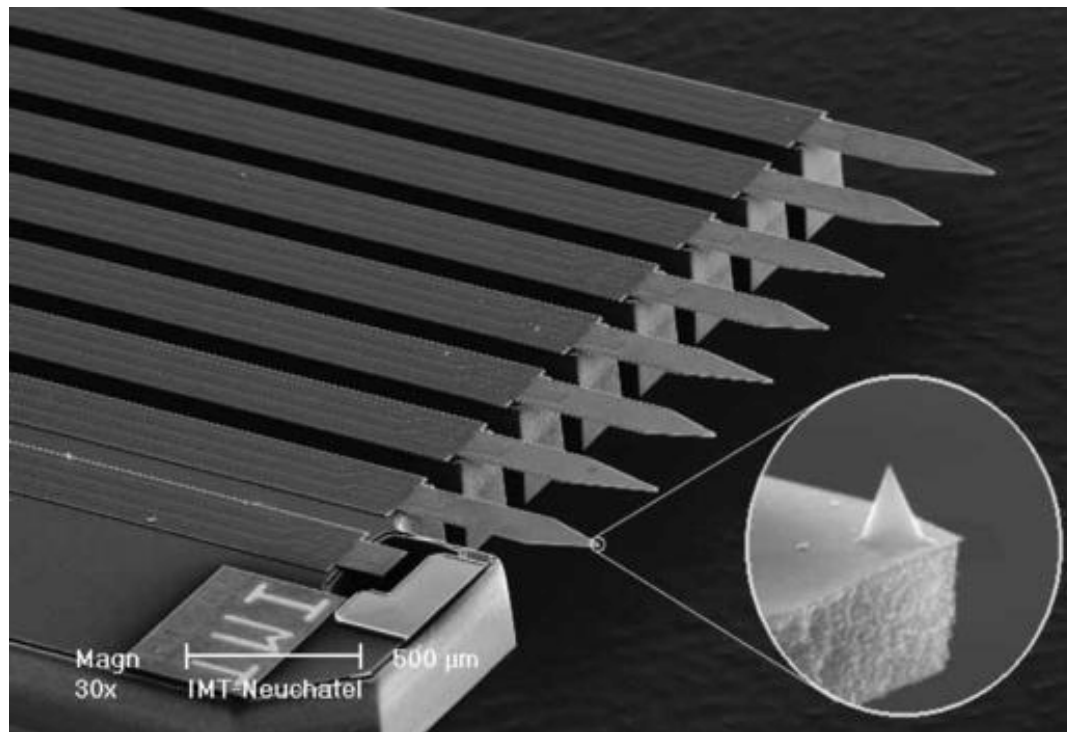


AFM tip with carbon nanotube extension.

Image: Xintek Nanotechnology Innovations



Scanning Probe Microscopes



AFM tips on NASA's Phoenix Mars Lander.

Image: NASA/JPL-Caltech/University of Arizona/University of Neuchatel