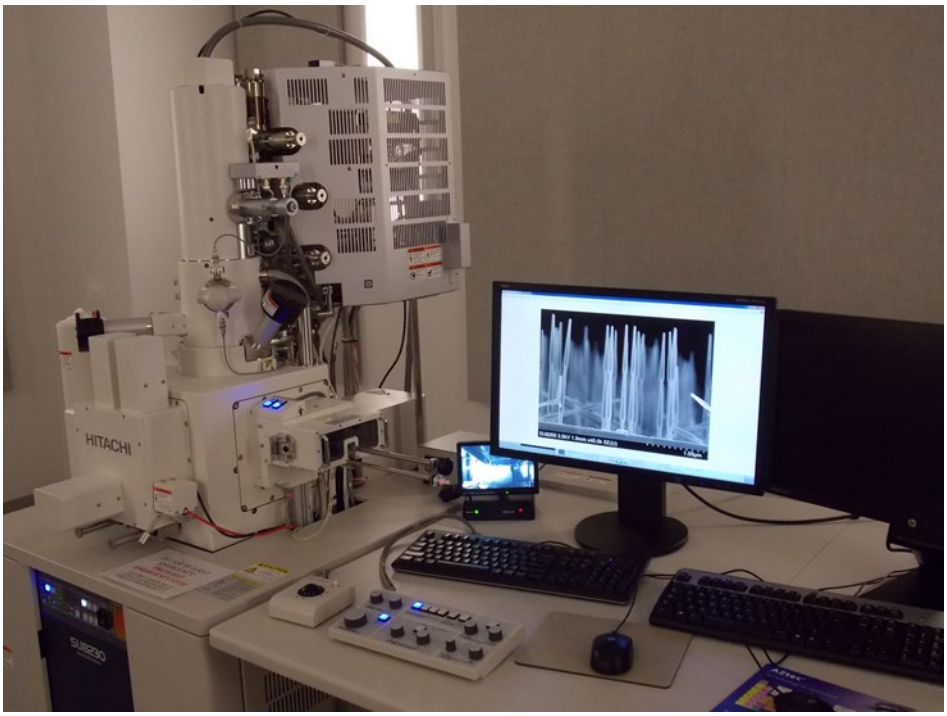
NNCI—Nanoscale Science and Engineering
Exploring Tools of Nanotechnology

Explore!

1. Examine the objects in front of you with your eyes and then with the USB digital scope.
2. Try matching the object to its Scanning Electron Microscope (SEM) image (pictures at this station).
3. Can you match all of the objects and images?



How do we see small things?

Nanotechnology is the science of small things. Nanostructures can be as small as 1/1000th the diameter of a human hair. That is small! It takes very sophisticated instruments to see nanostructures. Optical (light) microscopes have limitations based on the wavelength of light. The resolution power of these instruments is about 250nm much larger than many nanoscale objects. To image nanostructures we use instruments not limited to the range of visible light - these include Scanning Electron Microscopes and Atomic Force Microscopes.

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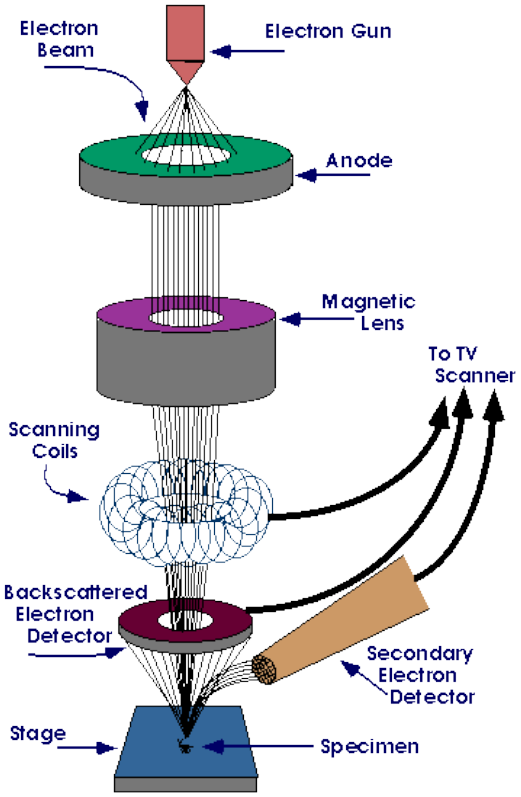
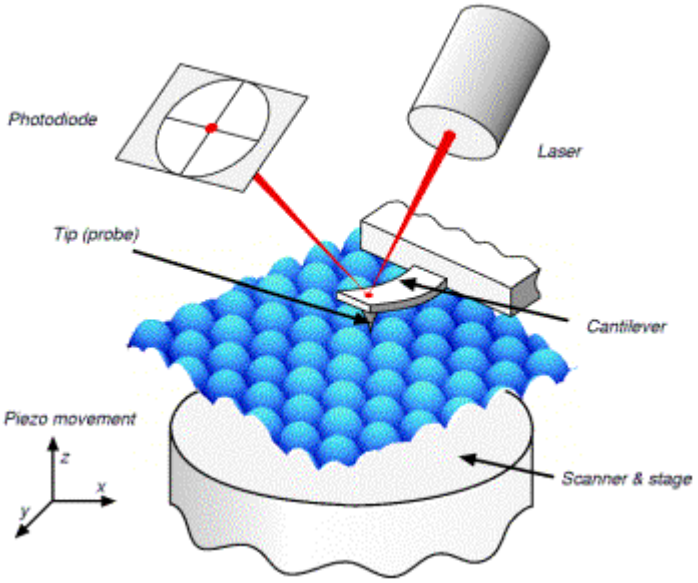
Electron microscopes use electron beams instead of visible light, enabling resolution of features down to a nanometer. Several different types exist, including Scanning Electron Microscopes (SEM) and Transmission Electron Microscopes (TEM). They use a beam of electrons to probe the sample and do not have the resolution limits of light microscopes and can "see" features as small as 0.1nm.



Schematic of SEM
Image courtesy Iowa State University



Schematic of AFM
Image courtesy of SP Technical Research Institute of Sweden and KTH Royal Institute of Technology

Scanning probe microscopes trace surface features by movement of a very fine pointed tip mounted on a flexible arm which moves across the object's surface. One kind, Atomic Force Microscope (AFM), measures interaction forces between the probe tip and sample providing information on the mechanical properties of surface. AFMs are widely used to measure surface topography of many different types of nanoscale samples.