Imaging and spectroscopy using aberration corrected electron microscopy

The development of aberration correction for electron optics has allowed imaging at resolutions not previously possible. Commercially available microscopes now provide the possibility of routine resolution of an Ångström or less. The TEAM project (Transmission Electron Aberration Corrected Microscope) aims to develop the next generation of electron microscopes with a resolution of 0.5 Å for both the conventional high resolution transmission electron microscope (HRTEM) and the scanning transmission electron microscope (STEM). Oak Ridge National Laboratory has been developing aberration corrected STEM techniques for several years and now hosts the next generation aberration corrected STEM for the TEAM project.

The STEM offers the possibility of simultaneous imaging using a variety of detectors, most commonly annular dark field (ADF or Z-contrast imaging), bright field imaging and electron energy loss spectroscopy (EELS). Not only has aberration correction lead to higher resolution, it has made possible techniques such as 3D depth sectioning and simultaneous ADF and phase contrast imaging. However, as resolution increases, effects such as the channelling of the electron probe and the effective nonlocal nature of the core-loss EELS potential means rigorous theoretical modelling is required to aid interpretation of images.