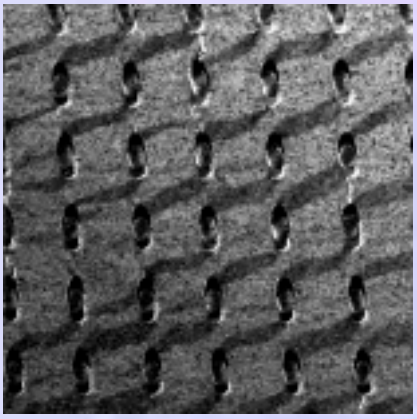
In order to accelerate science and innovation by cross-fertilization of ideas, it is necessary to bring together different kinds of scientists who otherwise might rarely interact due to their separation in time and space. Telepresence collaboration can mitigate this problem also. Using software developed by DOE (tpm.amc.anl.gov/MMC), researchers are able to collaboratively use electron microscopes located at Oak Ridge National Laboratory (ORNL) and Argonne National Laboratory (ANL) to study the details of materials without leaving their home institutions.

Remote Collaboration Speeds Nanomagnetism Studies

Research in magnetism and magnetic materials is undergoing explosive growth, driven, for the most part, economically by the $150G/yr magnetic-storage industry, and the semiconductor industry. The ability to control thin-film growth and characterize these materials at the atomic level can now be used to tailor build complex nanostructures made to have properties not found in nature. Researchers are using these novel materials to provide technology not only to answer fundamental scientific questions but also to serve society's ever growing passion for a better quality of life. There is a powerful synergy between science and technology that is driving each to higher levels of accomplishment. Advances in understanding magnetism will affect every facet of society, including, energy production and conservation, and industrial competitiveness and innovation.

DOE researchers have confirmed that by controlling the shape and spacing of nanostructures we can control many properties of magnetic materials

The magnetic properties of arrays of nano-particles and nano-holes are receiving considerable attention due to their potential for practical applications. Using telepresence microscopy, carried over ESnet, collaborating researchers are able to observe the actual nanoscale domain structure using a newly developed technique of Lorentz STEM, which proved that the domain location is dramatically controlled by the elliptical holes. Based upon a combination of experiments, researchers formulated a theoretical model describing the domain size, shape and interactions. From this work they confirmed that the shape of the individual elements plays a dominant role in the switching mechanism; which means that the shape anisotropy is an important contribution to the magnetic energy of the system. The reliable and high bandwidth provided by ESnet was essential in allowing real time observation, control and analysis of real time data, from which these conclusions were drawn.