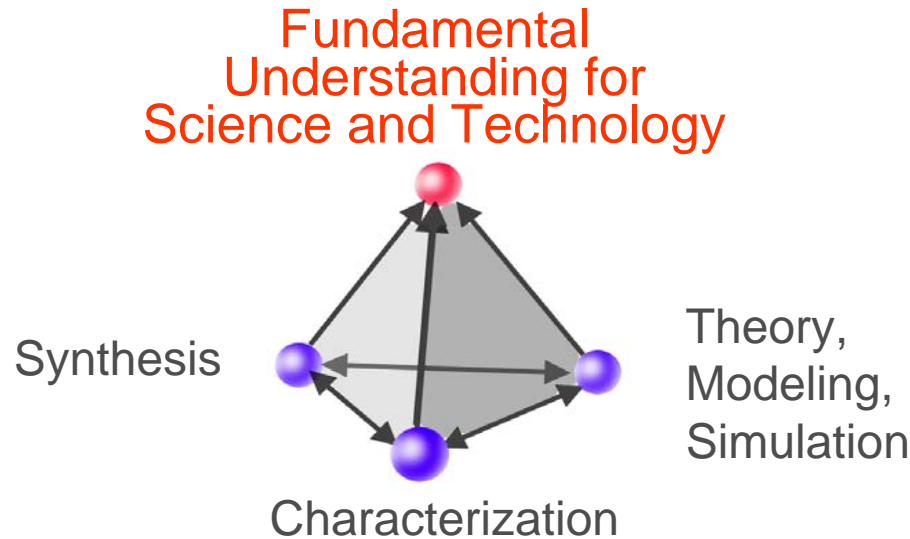


Center for Nanophase Materials
Sciences – Opportunities for Synergies
with the Neutron Scattering User
Community

**SNS HFIR User Meeting
October 13, 2005**

**Linda L. Horton
Director
Center for Nanophase Materials Sciences**

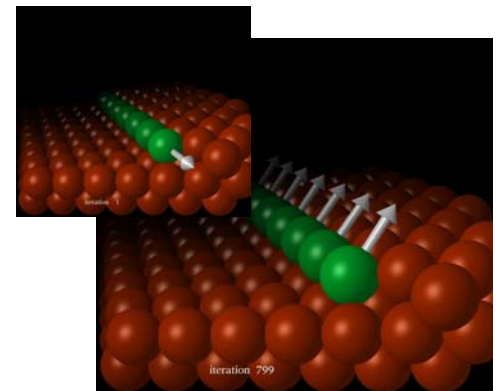
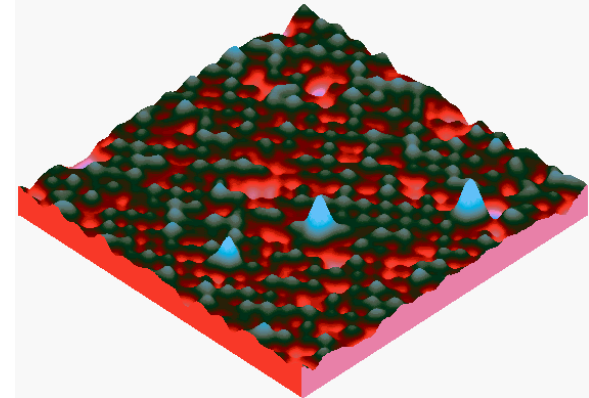
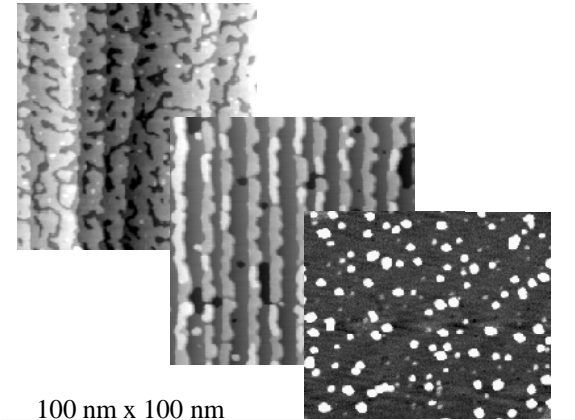
Complexity of today's research requires inter/multidisciplinary research



- Nanoscience Research Centers: A new paradigm in user facilities: broad capabilities not focused on a single family of techniques/instrumentation
- ORNL will provide an **integrated environment** where all the tools and capabilities can be brought together to solve the problem at hand for both expert and casual users
- Interdisciplinary focus: Physics, chemistry, materials science, mathematics, engineering

Users will Benefit from Co-location of Capabilities at ORNL

- **Center for Nanophase Materials Science**
 - Advanced synthesis, characterization, and theory/modeling/simulation expertise
- **Neutron Scattering**
 - In-situ phenomena
 - special environments synthesis, processing, evolution in environment
 - Magnetic properties, Dynamics
 - Soft Materials, especially with H/D substitution
- **Leadership Computing**
 - Theory and modeling are critical to advances in nanoscale research
 - Capability computing: Nanoscience end station requires both nano and computational expertise
 - Analysis and visualization of large data sets (including neutron scattering)
- **Microscopy**
 - A natural partner in nanoscale research
 - TEAM focus on next generation microscopy



CNMS Scientific Themes

Macromolecular Complex Systems

Synthetic (polymeric) and bio-inspired materials

Functional Nanomaterials

Nano- tubes, wires, dots, composites; artificial oxide film structures

Nanoscale Magnetism and Transport

Reduced and variable dimensionality; quantum transport

Catalysis and Nano-Building Blocks

Highly selective catalysts; nanoscale synthesis & organization

Nanomaterials Theory Institute: Theory, Modeling, Simulation

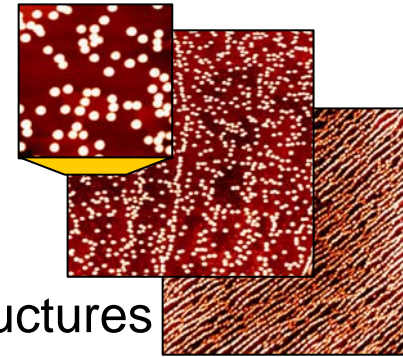
Grand challenges of “computational nanoscience”

Nanofabrication Research Laboratory

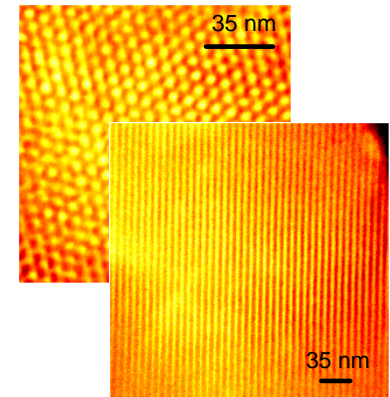
Controlled synthesis & directed assembly; functional integration of “soft” and “hard” materials

Nanoscale Imaging, Characterization, and Manipulation

Unique instruments to characterize and manipulate nanostructures; simultaneous imaging and environmental control



AFM images of Fe nanodots and nanowires on flat and stepped NaCl surfaces (edge length 750 nanometers)



Ordered nanoporous silica synthesized using an organic template

Center for Nanophase Materials Sciences – Opportunities for Synergies with the Neutron Scattering User Community

8:45 Molecular Complex Systems (Phil Britt)

9:05 Nanofluidics and Nanobio (Anatoli Melesko)

9:25 Functional Nanomaterials (Doug Lowndes)

9:45 Catalysis (at the CNMS) (Steve Overbury)

10:05 – BREAK

10:20 Bulk Nanomaterials (Mike Simonson)

10:40 Magnetism (Jian Shen)

11:00 Theory Modeling and Data Analysis (Thomas Schulthess)

Examples of Neutron Scattering in Nanoscience Research

11:20 Catalysis (John Larese)

11:40 Nanoparticles: Complete Structural Finger Print (Thomas Proffen)