

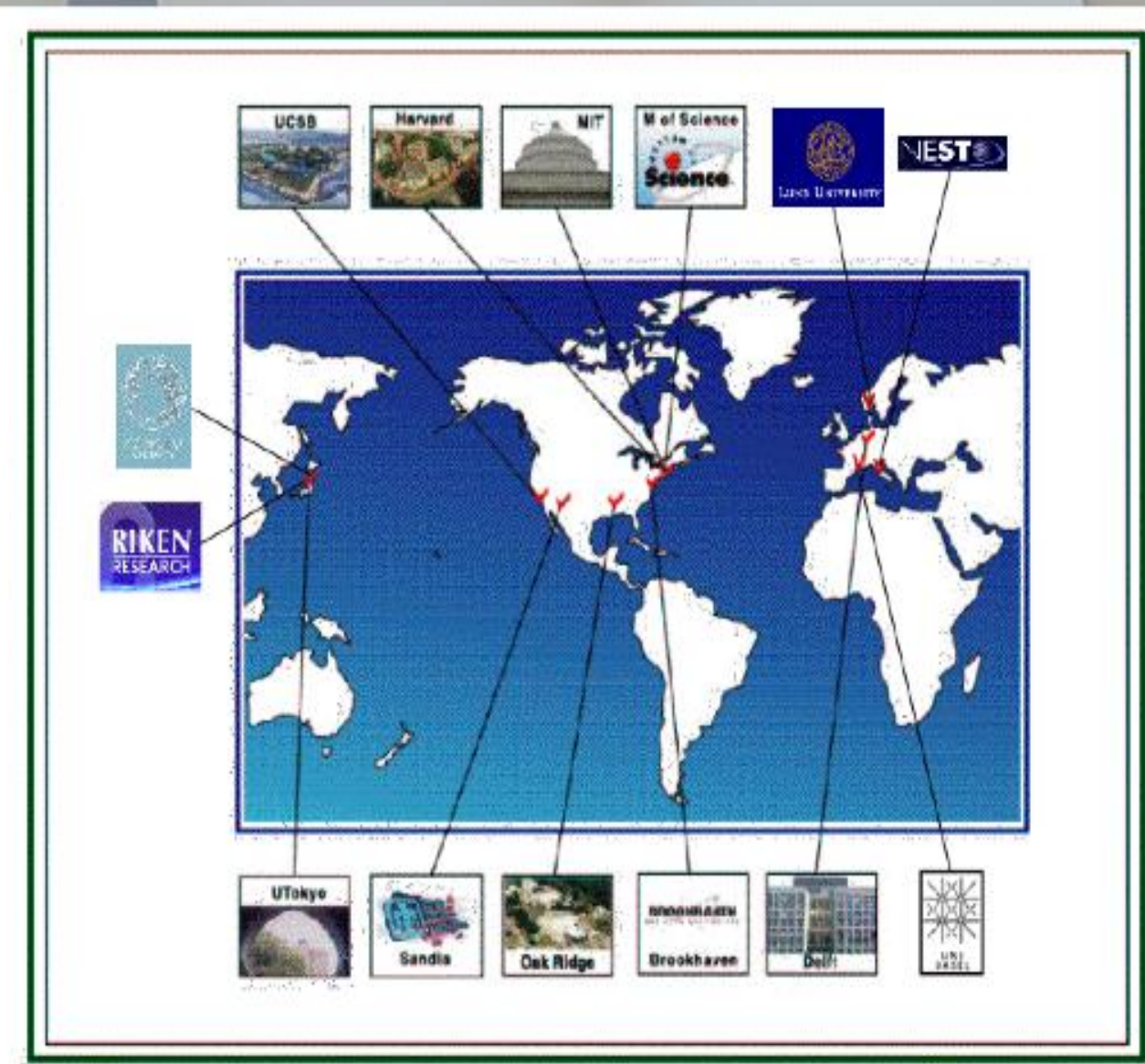
# Nanoscale Science and Engineering Center

## Science of Nanoscale Systems and their Device Applications

Harvard • MIT • University of California, Santa Barbara •  
Museum of Science, Boston



**Research Goals:** To make and understand ultra-small electronic devices and to develop physical tools for the study of biological cells as systems.



## Education and Outreach Activities



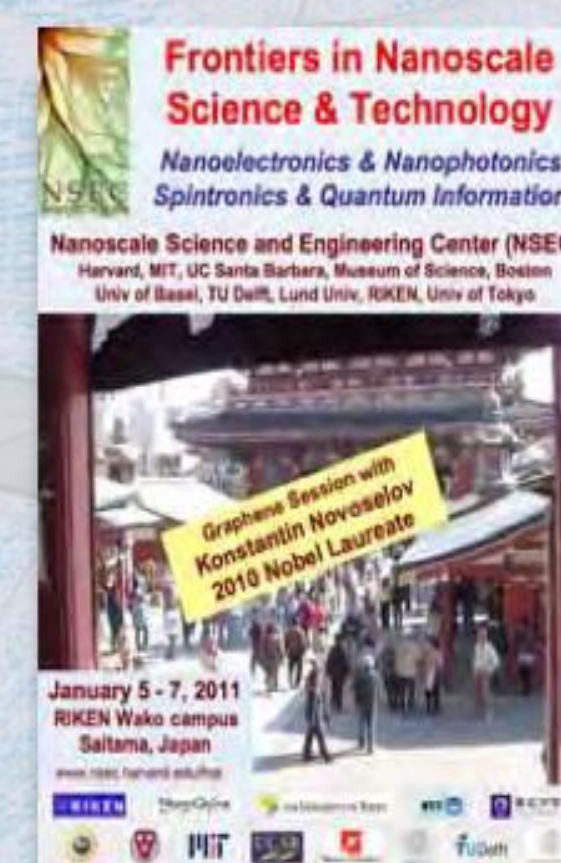
Bert Halperin explains the hydrophobic properties of magic sand at the Museum of Science, Boston during NanoDays 2010



RET's with Prof. Kit Parker at their summer poster session



Education associate Karine Thate gives public presentation on *Tiny Solutions to our Big Energy Problem* at the Museum of Science, Boston.



Annual Frontiers in Nanoscale Science and Technology workshop held at RIKEN, Japan January 2011

## PARTICIPANTS

### Research Clusters

- \*Tools for Integrated Nanobiology
- ✓Nanoscale Building Blocks
- Imaging at the Nanoscale

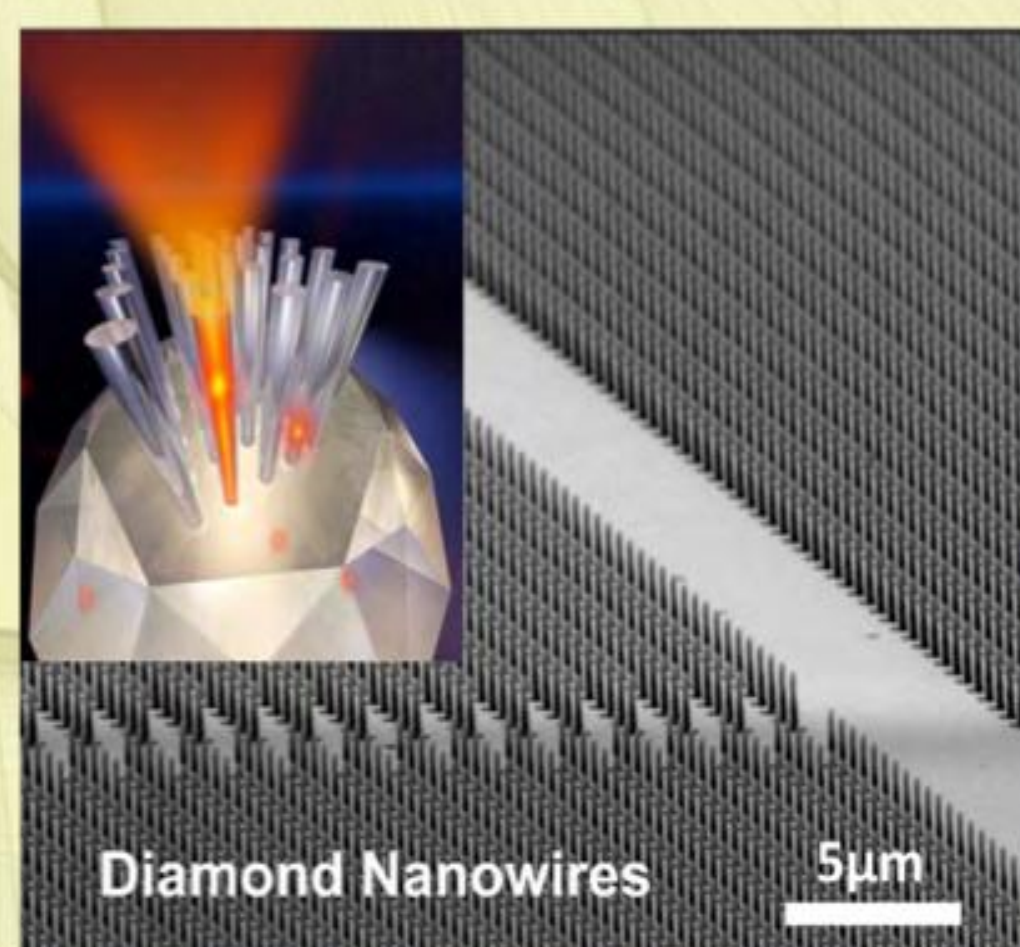
Joanna Aizenberg (Harvard) \* ✓  
 \*Yasuhiko Arakawa (U Tokyo) ✓  
 Raymond Ashoori (MIT) ✓  
 Moungi Bawendi (MIT) \* ✓  
 \*Fabio Beltram (NEST, Pisa, Italy) ✓  
 Federico Capasso (Harvard) ✓  
 Kenneth Crozier (Harvard) ✓  
 Cynthia Friend (Harvard) ✓  
 Arthur Gossard (UCSB) ✓  
 Bertrand I. Halperin (Harvard) ✓  
 Donhee Ham (Harvard) \* ✓  
 \*Gary Harris (Howard) ✓  
 Eric Heller (Harvard) ✓  
 Jennifer Hoffman (Harvard) ✓  
 \*Jan Hrbek (Brookhaven) ✓  
 Evelyn Hu (Harvard) \* ✓  
 \*Koji Ishibashi (RIKEN) ✓  
 Marc Kastner (MIT) ✓  
 Efthimos Kaxiras (Harvard) \* ✓  
 \*Leo Kouwenhoven (Delft) ✓  
 Marko Loncar (Harvard) ✓  
 \*Daniel Loss (U Basel) ✓  
 Charles Marcus (Harvard) ✓  
 Eric Mazur (Harvard) \* ✓  
 Venky Narayanamurti (Harvard) ✓  
 \*Hideo Ohno (Tohoku Univ) ✓  
 Christopher Palmstrom (UCSB) ✓  
 Hongkun Park (Harvard) \* ✓  
 Kevin (Kit) Parker (Harvard) \* ✓  
 Pierre Petroff (UCSB) ✓  
 Shriram Ramanathan (Harvard) ✓  
 \*Lars Samuelson (Lund) ✓  
 Michael Stopa (Harvard) \* ✓  
 \*Seigo Tarucha (U Tokyo) ✓  
 Robert M. Westervelt (Harvard) \* ✓  
 George M. Whitesides (Harvard) ✓  
 Amir Yacoby (Harvard) \* ✓  
 Xiaowei Zhuang (Harvard) \* ✓

### Educational Activities

Carol Lynn Alpert (Museum of Science)  
 Robert Graham (Harvard)  
 Kathryn hollar (Harvard)

\*Senior contacts at the ational Laboratories and International Institutions

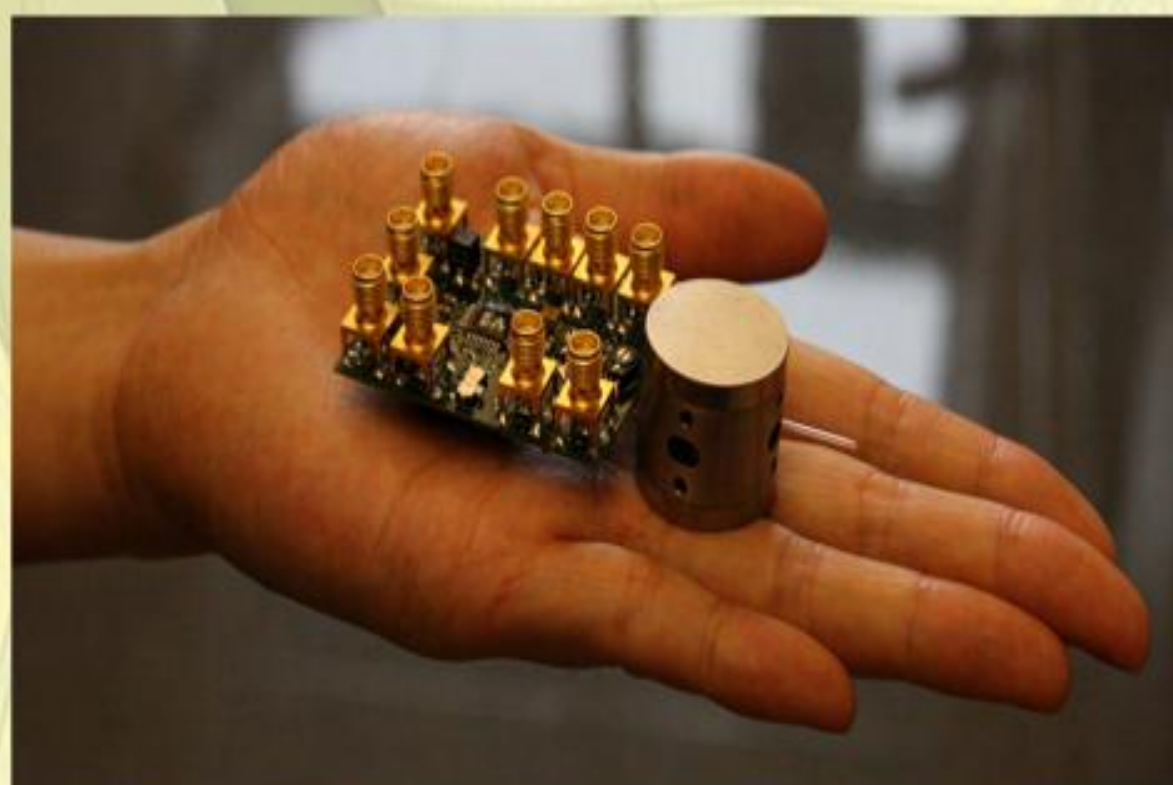
## Interdisciplinary Research



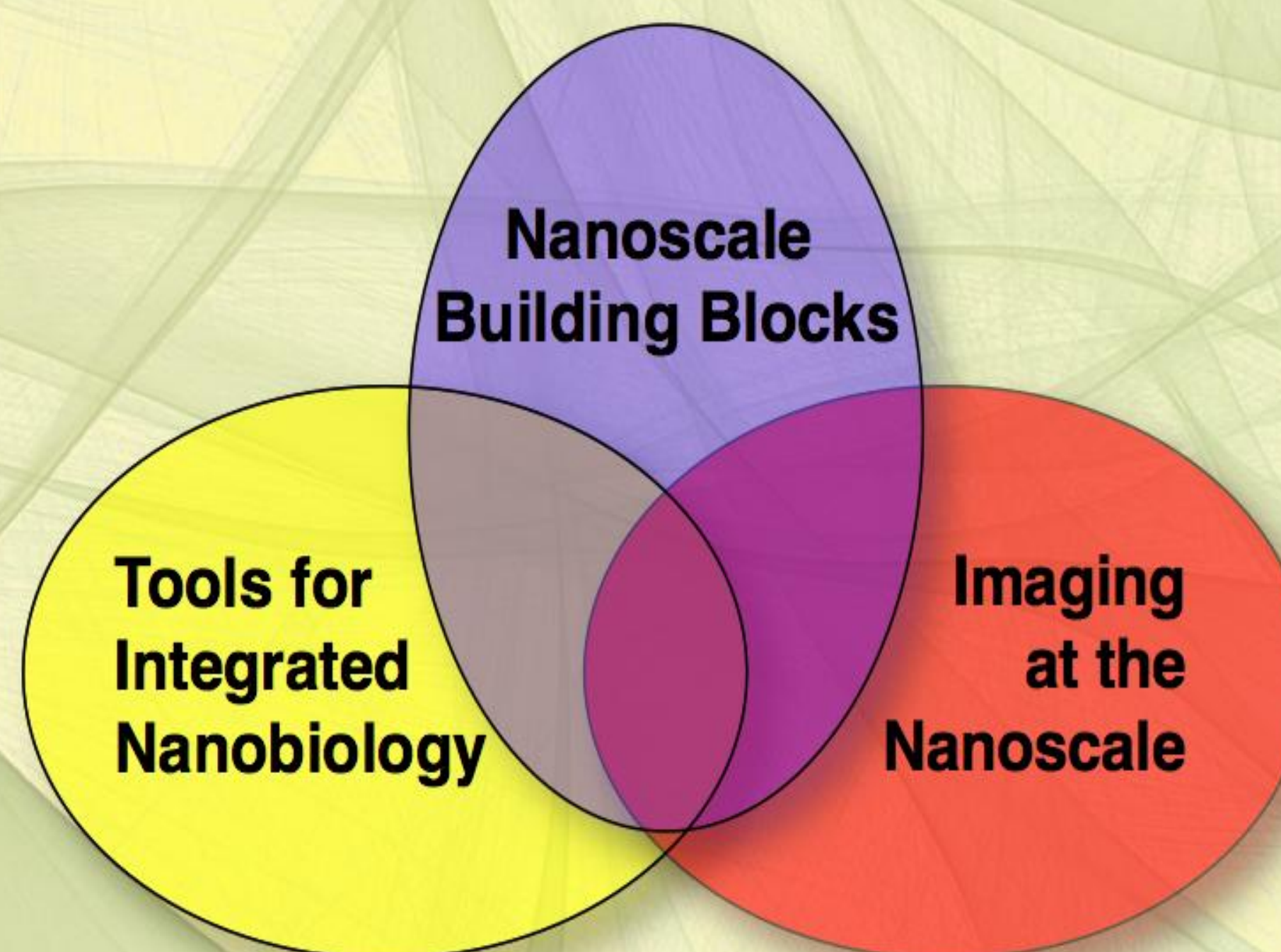
### Diamond Nanowires

Diamond nanowires are promising for single-photon communication - they act as an optical antennas to couple the spin on a nitrogen-vacancy (NV) center to a single photon. (Marko Loncar)

### Hand held NMR-based Biosensor



A recently developed prototype incorporating a 0.1-kg NMR system that is both 1000 times lighter and smaller, yet 150 times more spin mass sensitive than a 120-kg state-of-the-art commercial bench top instrument. These handheld, low-cost NMR platforms can be used as sensitive biomolecule detectors for disease screening. (Donhee Ham).



### Scanning Probe Microscope probes New Materials

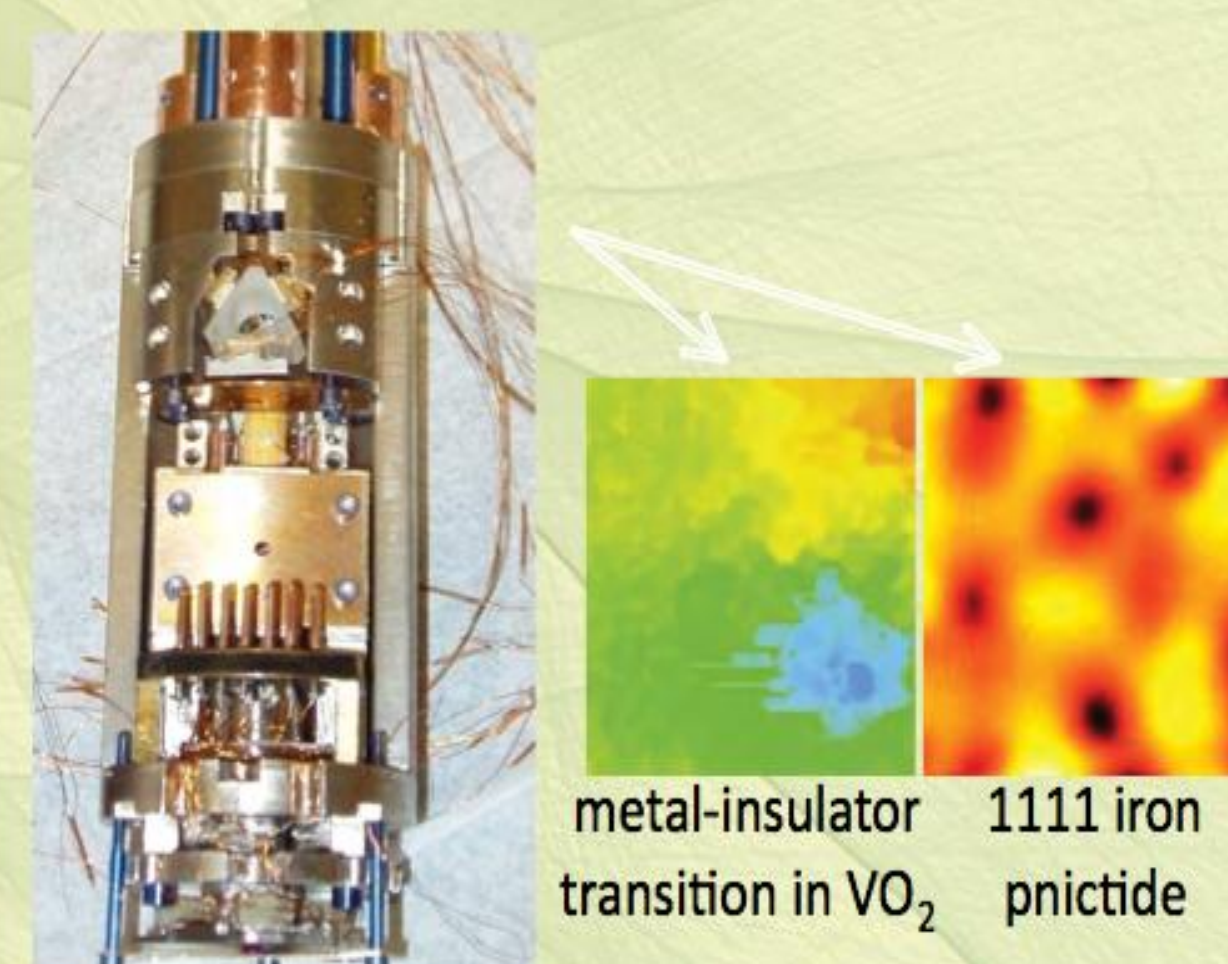


Photo of a cooled SPM that images the characteristics of new materials using atomic or magnetic forces, or electrical conductance. SPM image of the conductance of a VO2 thin film undergoing a metal-insulator transition. SPM image of the density of electron states and magnetic vortices in an iron pnictide high Tc superconductor. (Jennifer Hoffman)

## Shared Experimental Facilities

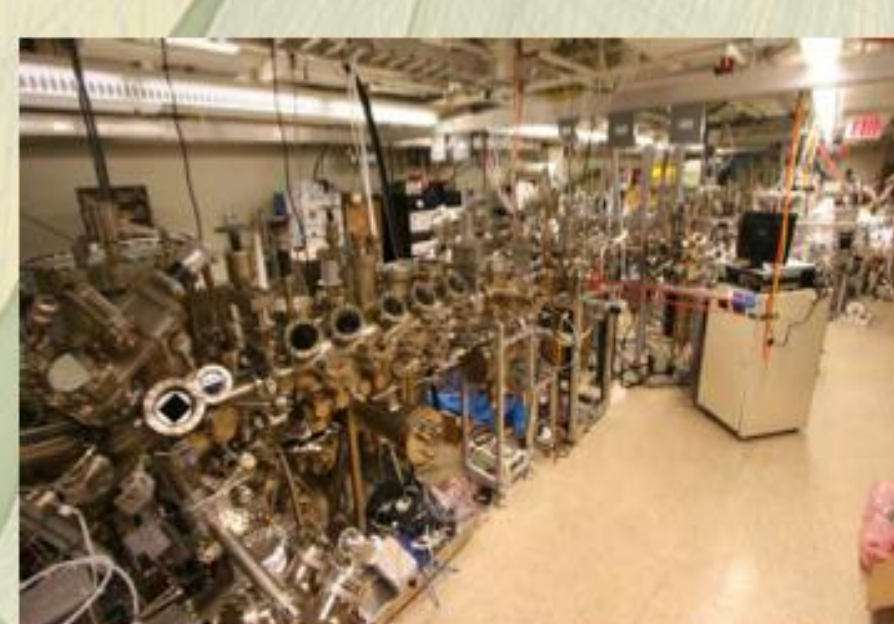
### Center for Nanoscale Systems



A student training on the new Zeiss Libra 200 aberration corrected STEM by David Bell.

Scientific Director: Roy Gordon

### Molecular Beam Epitaxy (UCSB)



Magnetic semiconductors and Fe/GaAs heterostructures Arsenide antimonide/phosphide devices Arsenide quantum structures GaN/AlN structures. Chris Palmstrom and Arthur Gossard

### Laboratory for Integrated Science and Engineering



LISE building that joins McKay, Cruft, and Lyman Laboratories at Harvard University.

### National Nanotechnology Infrastructure Network



NNIN at Harvard - soft lithography, assembly of molecular electronics, computer simulations of electrons in nanoscale structures. Michael Stopa

## Outcomes for Technology and Society

Create a center of excellence for nanoscience in the United States linked to the National Labs, and to centers in Europe and Asia, by active visitor and exchange programs.

Through a close integration of education and public outreach, the Center encourages and promotes the training of a diverse group of people to be leaders in this new interdisciplinary field.