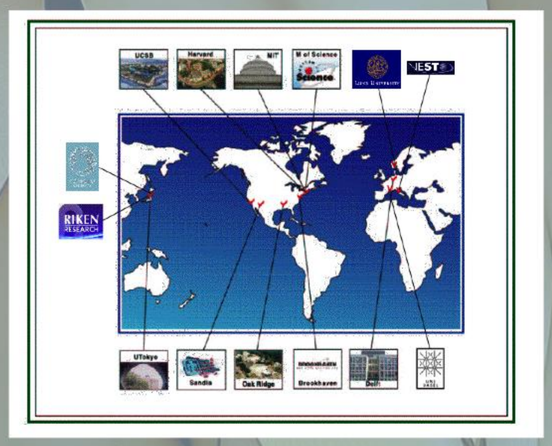
Nanoscale Science and Engineering Center

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.



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)
Efthimios Kaxiras (Harvard)
*Leo Kouwenhoven (Delft)
Marko Loncar (Harvard)
*Daniel Loss (U Basel)
Charles Marcus (Harvard)
Eric Mazur (Harvard)
Venky Narayanamurti (Harvard)
*Hideo Ohno (Tohuku 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

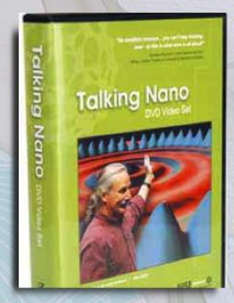
Carol Lynn Alpert (Museum of Science)
Robert Graham (Harvard)
Kathryn hollar (Harvard)

*Senior contacts at the ational Laboratories and International Institutions

Education and Outreach Activities

Prof. Jennifer Hofman explains how she moves individual atoms at the Museum of Science, Boston during NanoDays

Prof. Kit Parker spearheads an initiative to recruit veterans to the REU

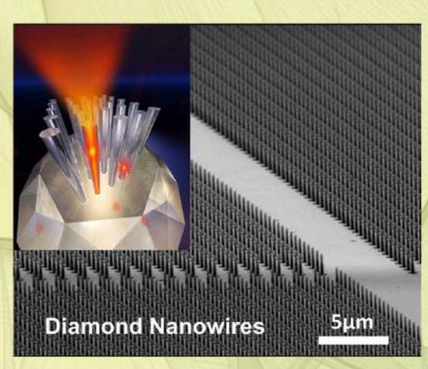


Talking Nano DVD set featuring NSEC researchers communicating on a wide variety of nano science topics

The NISE Network grew out of the collaboration betweeen our NSEC and the Museum of Science, Boston.

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

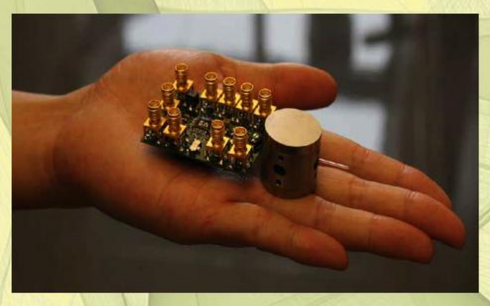
Interdisciplinary Research



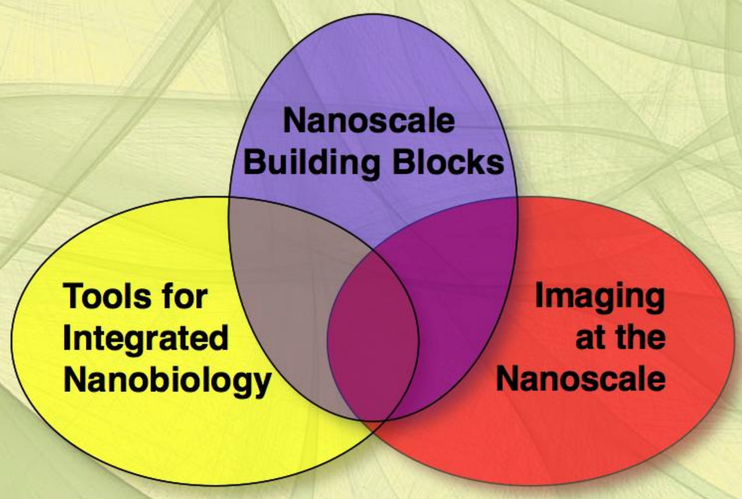
Diamond Nanowire NV Centers

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

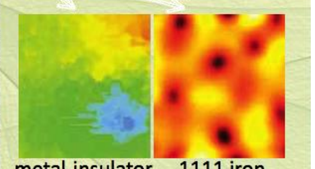
Hand held NMR-based Biosensor



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



metal-insulator transition in VO_2 | 1111 iron pnictide

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)

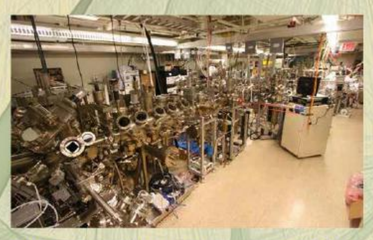
Shared Experimental Facilities

Center for Nanoscale Systems

The new Cameca LEAP 4000X HR 3D Atom Probe overseen by Prof. David C. Bell and Adam Graham.

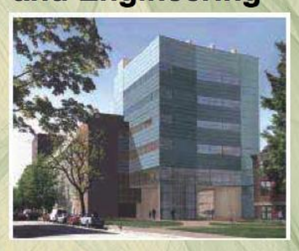
Scientific Director: Roy Gordon

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

NSEC Students went on to:
36 Faculty Positions
29 Postdoctoral Assoc.
34 Jobs in Industry, Govt , and Research Staff

NSEC Knowledge Transfer to Industry
23 Startups by NSEC Faculty
484+ High Tech Jobs Created
30 Companies Licensed NSEC Researcher Intellectual Property (180+ Licenses)
43 Industrial Collaborations
60 Connections with Industry & Other Sectors