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Role of Government Labs in Micro/Nano R&D

Neal D. Shinn, Ph.D.
User Program Manager

DOE Center for integrated Nanotechnologies
Sandia National Laboratories
Albuquerque, NM 87185-1315
ndshinn@sandia.gov

Sandia is a Multiprogram Laboratory Operated by Sandia Corporation,
a Lockheed Martin Company, for the United States Department of Energy
Under Contract DE-ACO4-94AL85000.

Sandia National Laboratories

Government funded R&D Labs serve many functions

- Specific missions in the National interest (e.g., defense, security..)
- Technical challenges beyond the scope of, or inappropriate for, other institutions
- Resource for multiple government agencies
- Resource for technology and economic development
  - tech transfer
  - collaborative R&D
  - spin-outs
  - technical assets & user facilities

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Next generation micro/nano user facilities

A micro/nano user facility can have multiple roles that differ from traditional scientific User Facilities.

- Create a collaborative community to tackle user-defined problems.
- Offer a suite of differentiating capabilities/expertise rather than just rare instrumentation.
- Enable users to benefit technically without risking proprietary intellectual property.
- Create new ways for users to conduct R&D.

Center for Integrated Nanotechnologies

Sandia National Laboratories • Los Alamos National Laboratory

- Highly collaborative U.S. Dept. of Energy User Facility
- Focused on nanoscience integration
- Access to tools and expertise
- Pre-competitive and proprietary research options

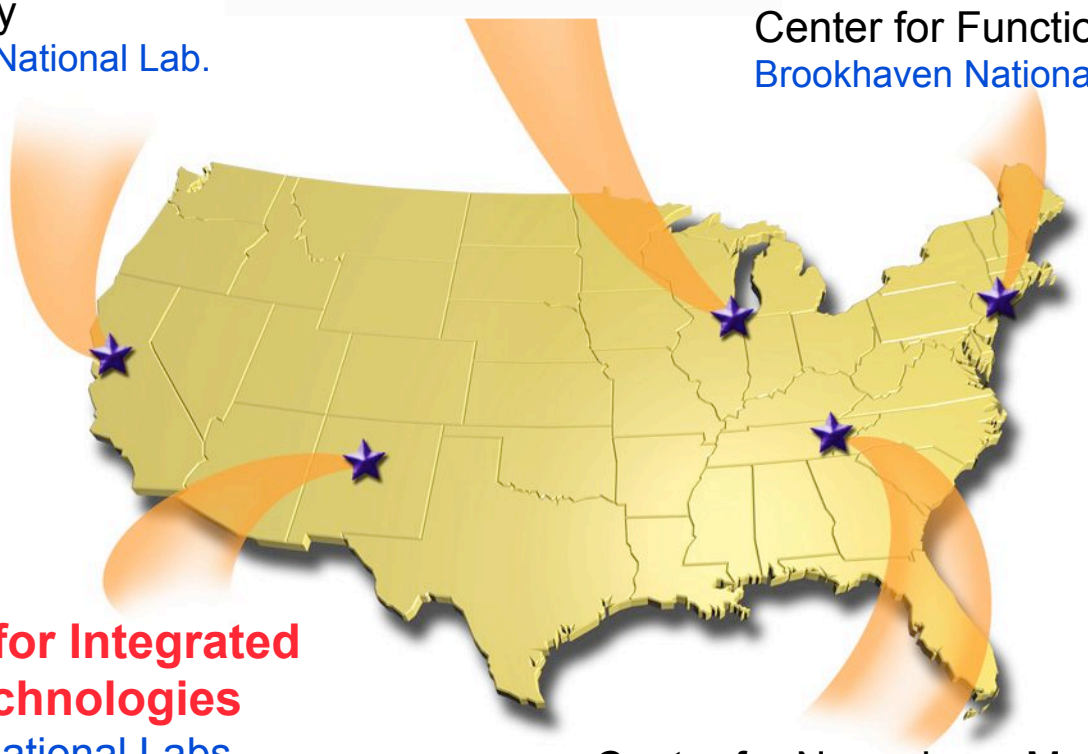
"One scientific community focused on nanoscience integration"

CINT is one of five U.S. Dept. of Energy Nanoscience Centers

Center for Nanoscale Materials
Argonne National Lab.

Molecular Foundry
Lawrence Berkeley National Lab.

Center for Functional Nanomaterials
Brookhaven National Lab.



Center for Integrated Nanotechnologies
Sandia National Labs.
Los Alamos National Lab.

Center for Nanophase Materials Sciences
Oak Ridge National Lab.

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Creating a collaborative community…

Users

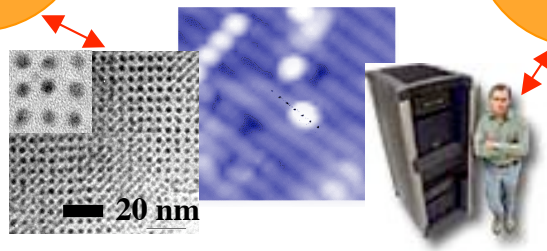
CINT
Core Facility

Microelectronics Development Lab

MESA Complex (microsystems)

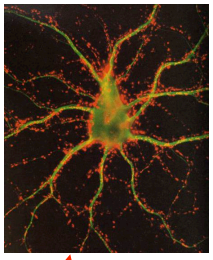
Gateway to SNL

Gateway to LANL



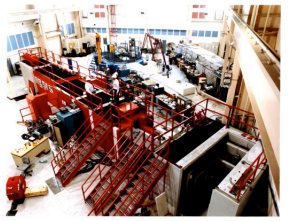
Synthesis, Characterization, & Theory

Biosciences



National High Magnetic Field Lab

Los Alamos Neutron Science Center



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CINT Core and Gateway Facilities are open for business

Core Facility in Albuquerque

CINT Gateway to Sandia
Nanomaterials/Microfabrication

CINT Gateway to Los Alamos
Nanomaterials/Biosciences

Begin Operations	**April 2006**
Fully Operational	**May 2007**

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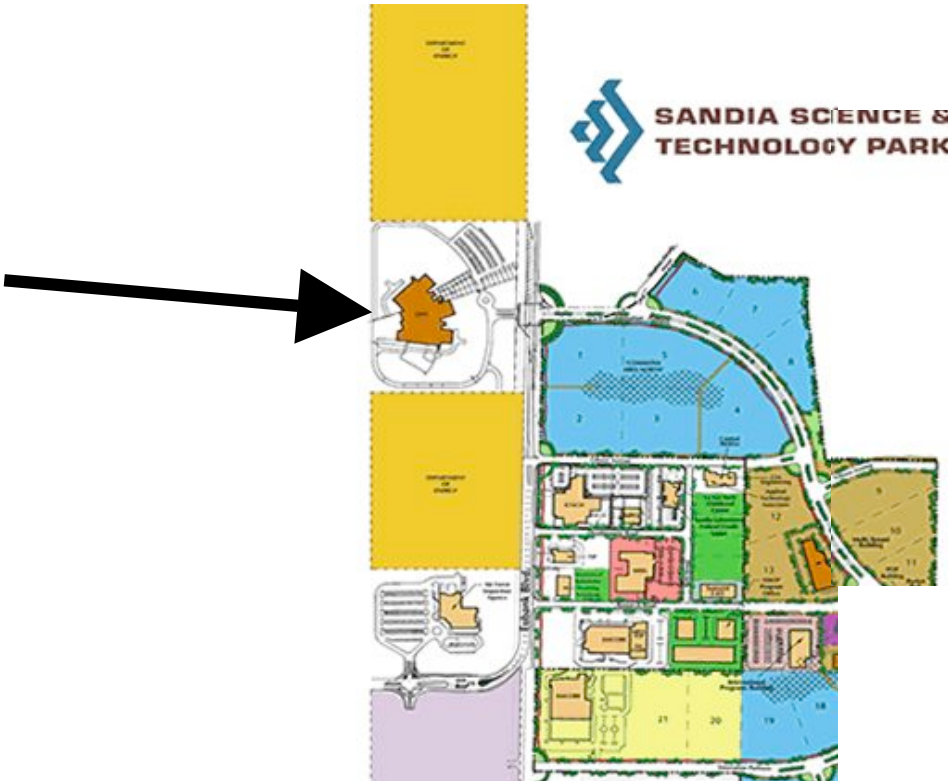
Core Facility is located adjacent to the Sandia Science & Technology Park



- **Low vibration characterization labs**
- **Chemical/biological synthesis labs**
- **Class 1000 clean room**
- **96,000 GSF**

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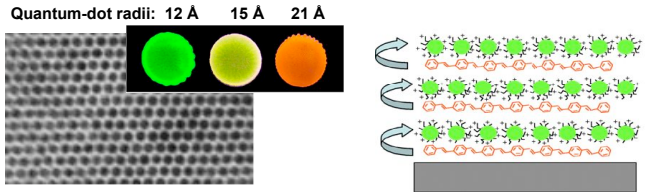
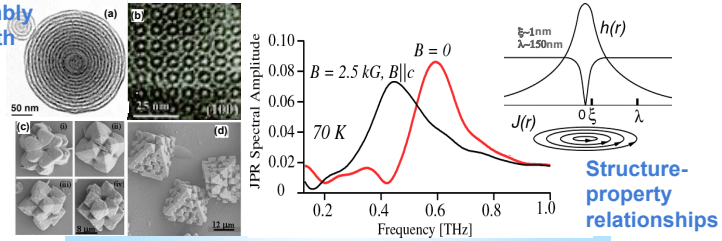
CINT Science Thrusts: expertise for integration challenges

Nanoelectronics & Nanophotonics:
Precise control of electronic and photonic wavefunctions



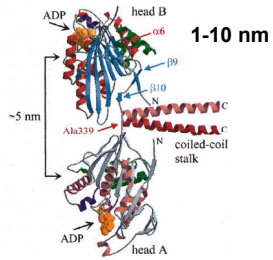
Complex FunctionalNanomaterials:
Relationships between synthesis, structure and complex and emergent properties

Self-assembly on all length scales

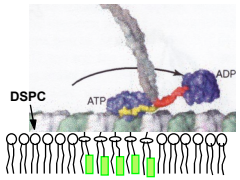


Structure-property relationships

Nano-Bio-Micro Interfaces:
Biological principles & functions imported into artificial bio-mimetic systems



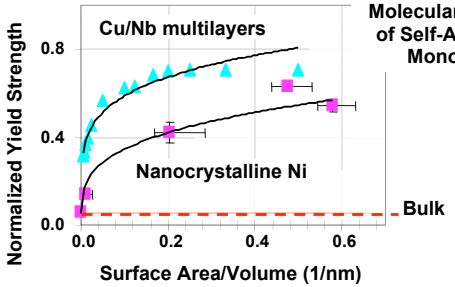
1-10 nm

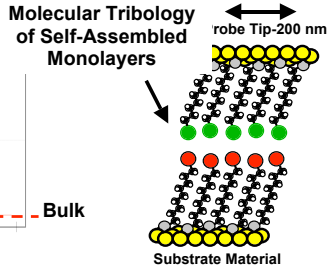


Aggregated receptors

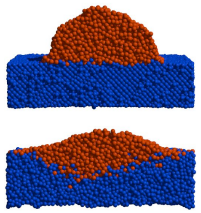
10 -100 nm

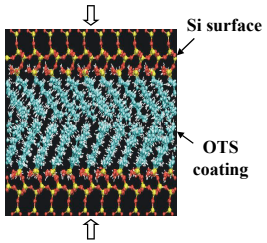
Nanomechanics:
Understanding the mechanical behavior of nanostructured materials

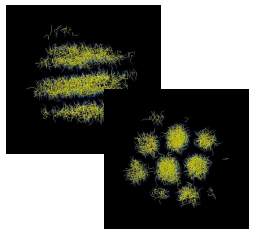




Theory & Simulation:
Theoretical, modeling and simulation techniques for multiple length and time scales and functionality







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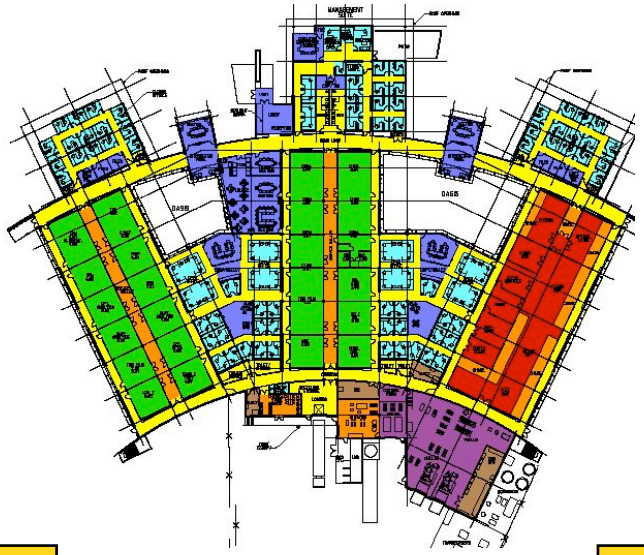
CINT laboratories are supported by state-of-art special equipment

Characterization

- TEM
- AFM
- FTIR, UV-VIS
- Nano-indenter
- Low Temp Transport
- Ultra-fast Laser Spec.
- Raman Spec.



Integration

- E-beam lithography
- Photolithography
- Thin Film Deposition
- Reactive Ion Etch
- Plasma Etch
- Dual beam SEM

Gateway to Sandia

- AT-STM
- IFM
- Chemistry labs
- LB Film
- µ-fluidics

Synthesis

- MBE
- Wet Chemistry
- Bio labs
- Molecular films

Gateway to Los Alamos

- NSOM, AFM
- Environmental SEM
- Nano-indenter
- Ultra-fast Laser
- Computer Cluster

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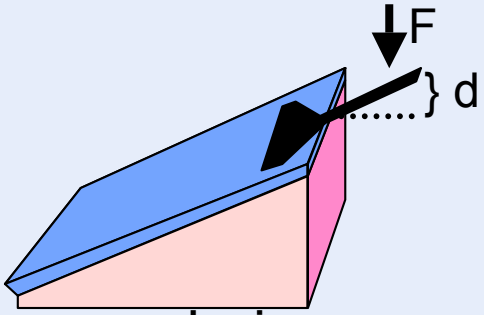
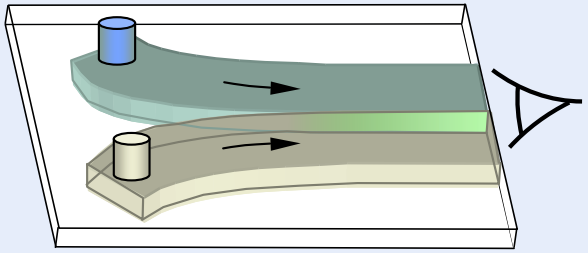
Create new ways to conduct research (CINT Discovery Platforms™)

Stimulate, interrogate and exploit
nanoscale materials in a microsystem environment

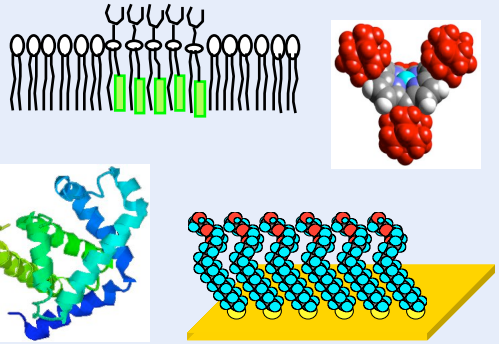
CINT provides platforms… for user-inspired problems

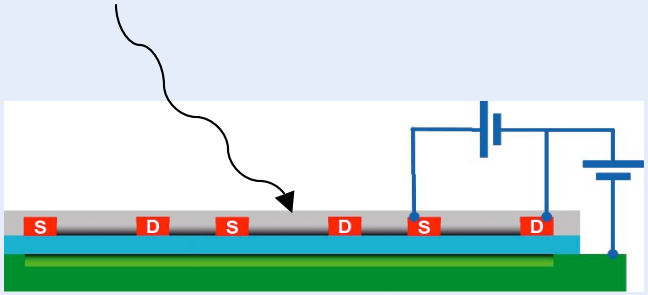


nanomechanics

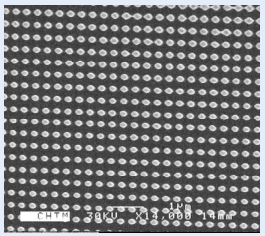


microfluidics





optical, transport



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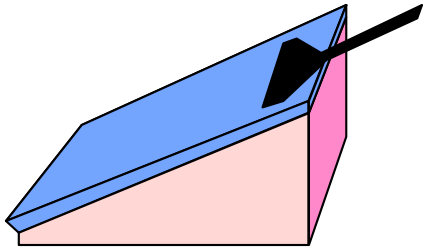
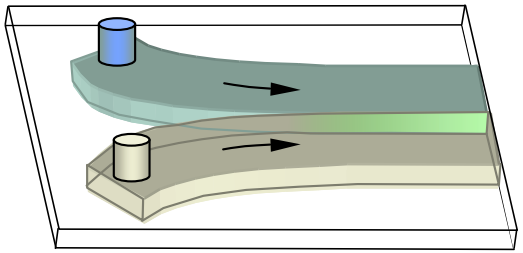
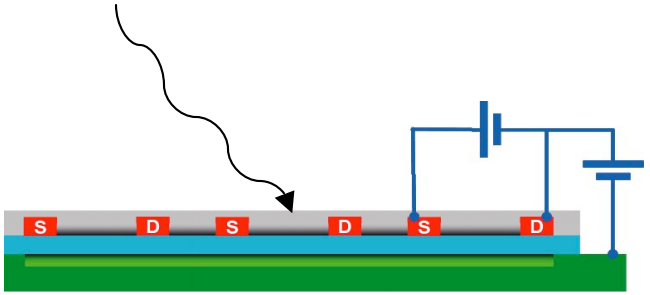
CINT Discovery Platforms™ under development now



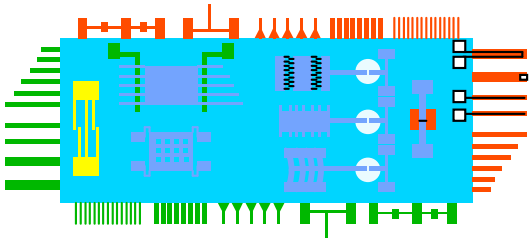
nanomechanics

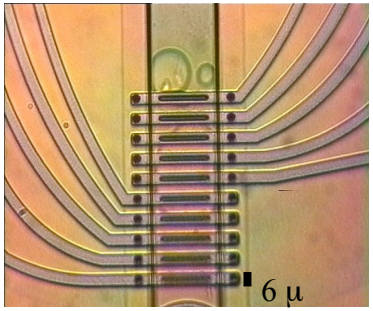


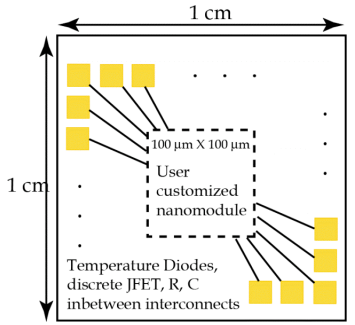
microfluidics



optical, transport







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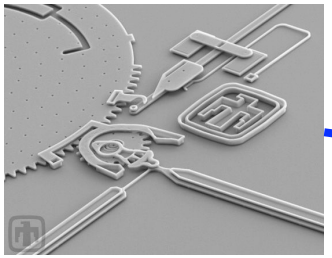
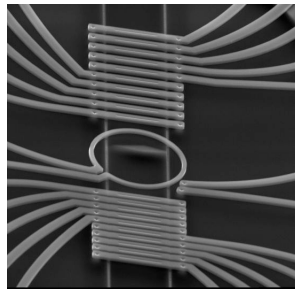
Future CINT Discovery Platforms™ will exploit MEMS components

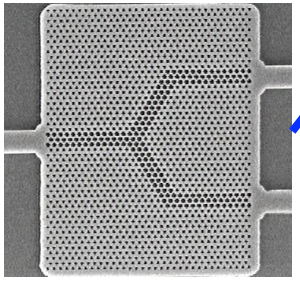
Mechanics



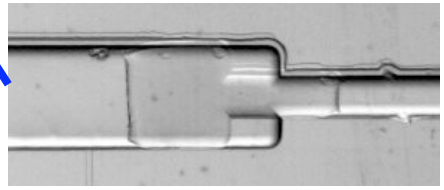
Electronics

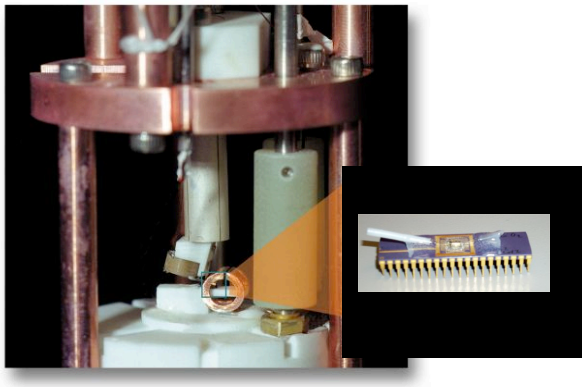


Optics



Fluidics





Discovery Platforms™ will be compatible with characterization instruments

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The CINT User Program

- **Universities**
  - Postdocs, students and visiting faculty researchers.
- **Industry**
  - Pre-competitive and propriety research mechanisms.
- **Other Laboratories**
  - Other Federal agencies.
- **International Science Community**
  - Open to the international science community

Key Aspects of User Program

- **Open access to facilities based on user proposal quality**
- **Spectrum of user modes**
  - **Access to equipment**
  - **Collaborative research**
  - **Multi-year projects**
- **External proposal review**
- **Mechanisms for proprietary work**

http://CINT.sandia.gov* or *http://CINT.lanl.gov

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Approaches to involve Industry at CINT

- **IP Agreement: fair treatment of joint IP**
- **Discovery Platforms: new application of MEMS**
- **General Users: no-cost, pre-competitive work**
- **Partner User: investment in facility**
- **Proprietary Research: at full cost recovery ($$)**

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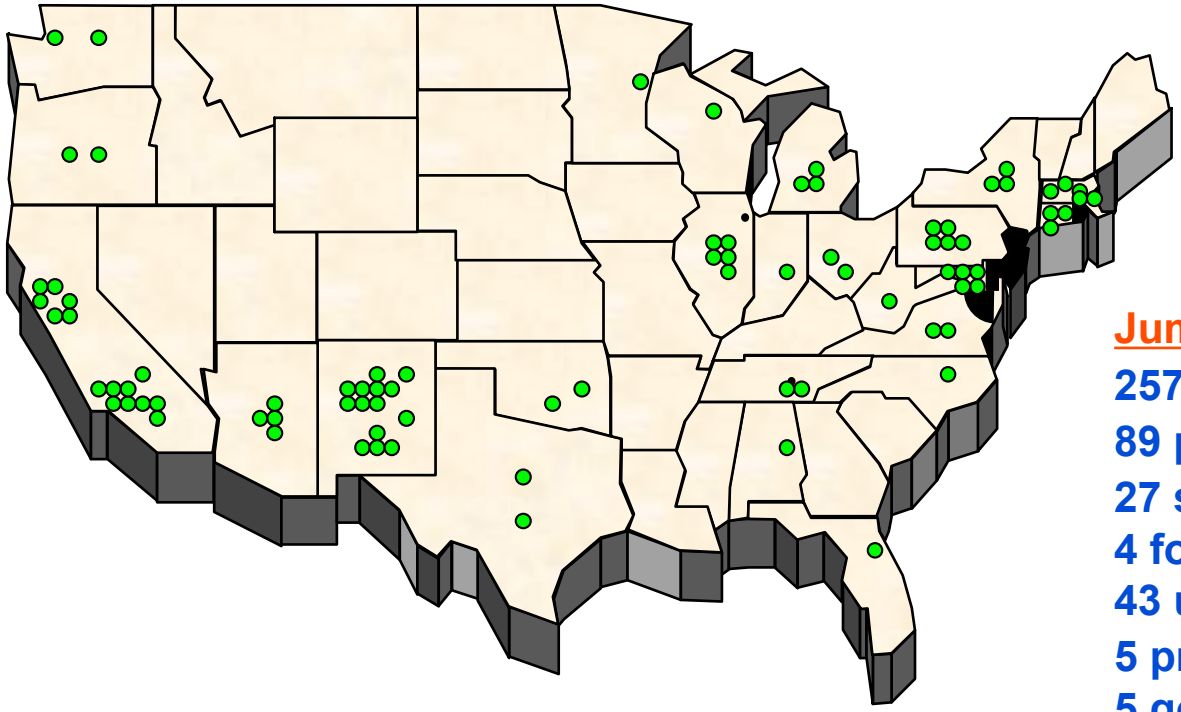
Users are already working at CINT



Jump-start User Projects

257 requests (2003-05)
89 projects approved
27 states
4 foreign countries
43 universities
5 private-sector
5 government labs

2006 Call-for Proposals

175 requests
>120 approved (others pending)

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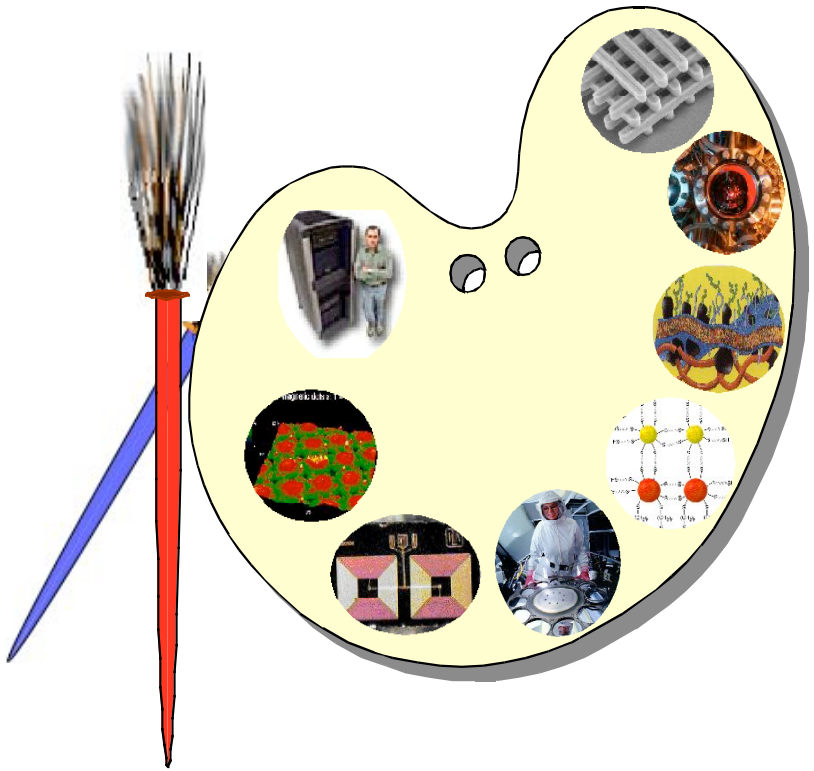
CINT: A National user facility dedicated to nanotechnology integration



Dedicated Facilities

- Clean rooms
- Synthesis
- Characterization

Access to National Laboratories

- Microfabrication
- Biosciences
- Computing
- Nanomaterials

No Cost Access

- Peer reviewed proposals
- University/Industry/Gov. Lab.
- Publication required

Proprietary Access

- Full cost recovery

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http://CINT.sandia.gov *or* http://CINT.lanl.gov

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