SAND2007-1765C

The DOE Center for Integrated Nanotechnologies (CINT)

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User Program Manager

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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.

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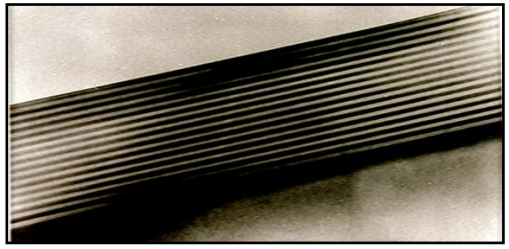
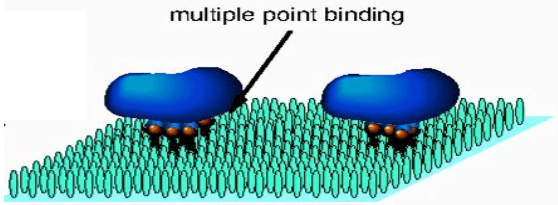
Nanoscience discoveries will have impact via integrated nanotechnologies

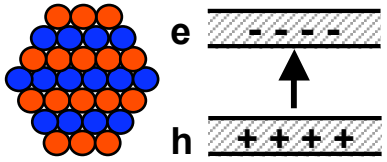
Energy

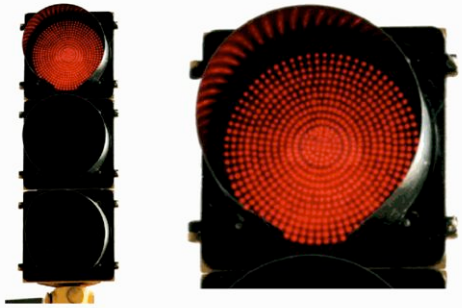


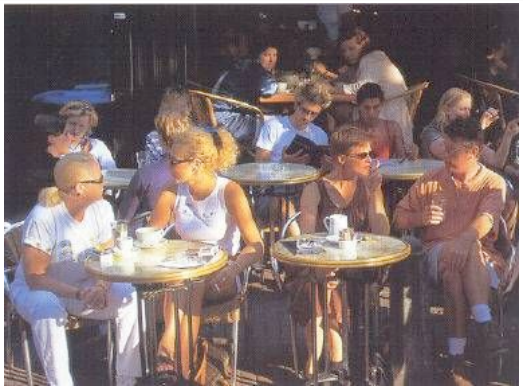
Bio/Medical

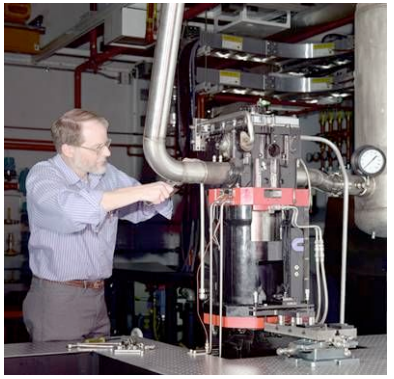


Environment









Connecting scientific disciplines and length-scales is key to success

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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

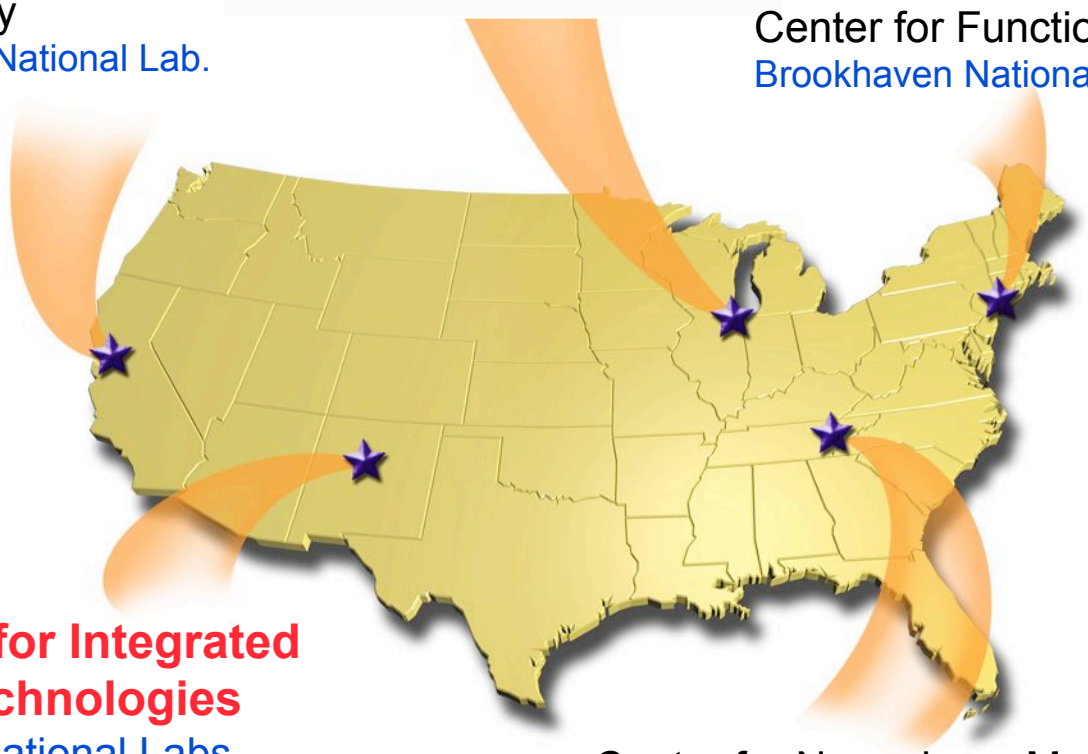
"One scientific community focused on nanoscience integration"

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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Two Laboratories creating one community focused on nanoscience integration

Users

Microsystems

MESA

CINT
Core Facility

Gateway to SNL

Gateway to LANL

National High Magnetic Field Lab

Los Alamos Neutron Science Center

Los Alamos NATIONAL LABORATORY

Sandia National Laboratories

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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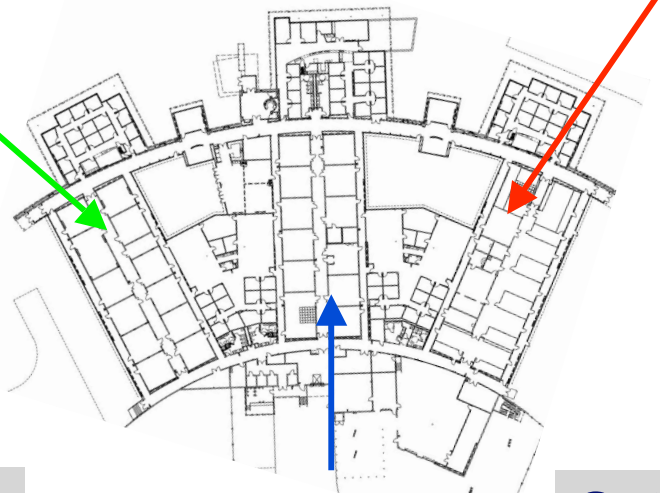
CINT laboratories are supported by state-of-art equipment

Characterization Wing

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

Core Facility



Integration Lab

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

Gateway to Sandia

IFM
- Chemistry labs
- LB Film
- μ-fluidics

Synthesis Wing

- MBE
- Wet Chemistry
- Bio labs
- Molecular films

Gateway to Los Alamos

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

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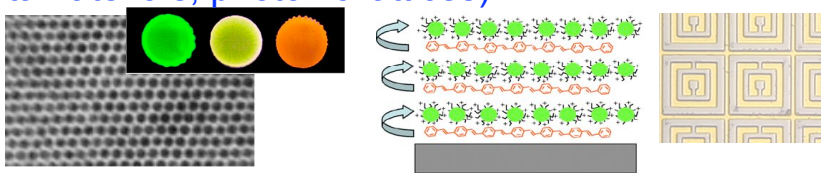
Science Thrusts provide broad expertise

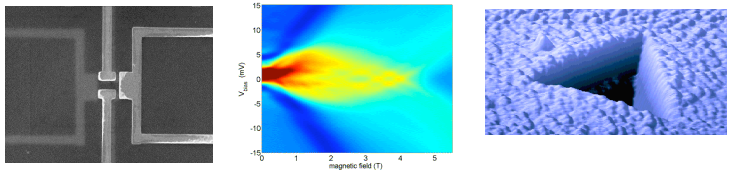
Nanophotonics & Optical Nanomaterials

Synthesis, excitation and energy transformations of optically active nanomaterials and collective or emergent electromagnetic phenomena (plasmonics, metamaterials, photonic lattices)



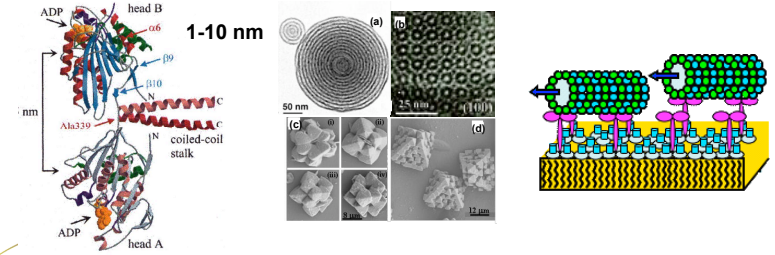
Nanoscale Electronics, Mechanics & Systems

Control of electronic transport and wavefunctions, and mechanical coupling and properties using nanomaterials and integrated nanosystems



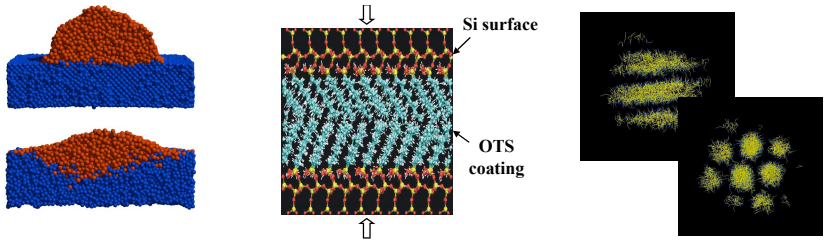
Soft, Biological, & Composite Nanomaterials

Solution-based materials synthesis and assembly of soft, composite and artificial bio-mimetic nanosystems



Theory & Simulation of Nanoscale Phenomena

Assembly, interfacial interactions, and emergent properties of nanoscale systems, including their electronic, magnetic, and optical properties



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CINT Grand Challenges in Nanoscience Integration

Goals

- Focus CINT on central science issues underlying nanotechnology integration
- Use science-based innovation to drive center synergy spanning multiple science thrusts
- Have long term impact on areas of major significance to national missions

Energy Transfer

Emergent Properties

Success depends on advances in our Science Thrusts

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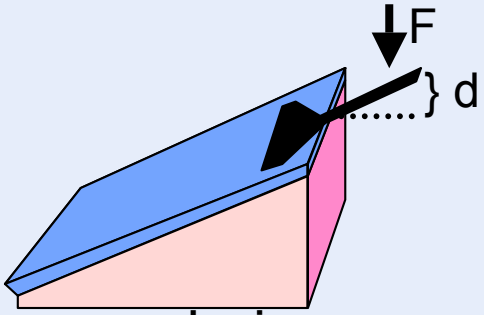
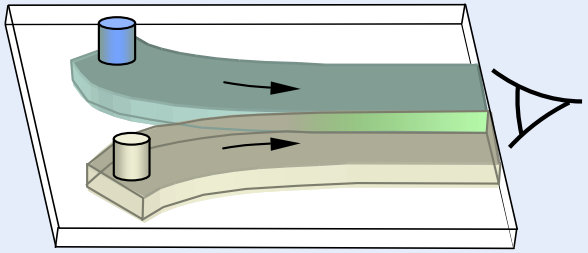
CINT Discovery Platforms™: micro-labs for nanoscience exploration

Stimulate, interrogate and exploit
nanoscale materials in a microsystem environment

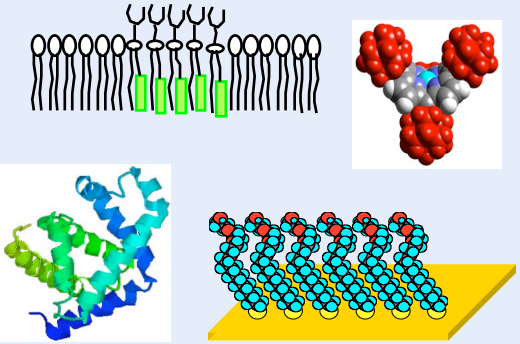
CINT provides platforms… for user-inspired problems

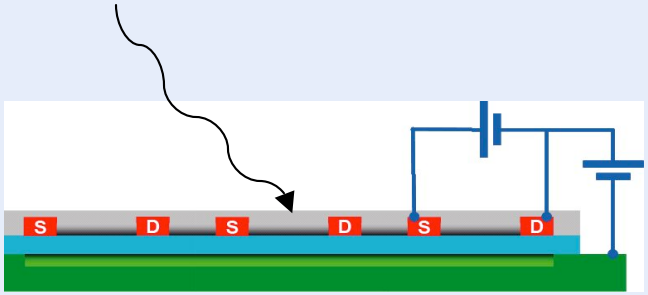


nanomechanics

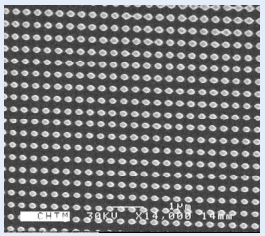


microfluidics





optical, transport



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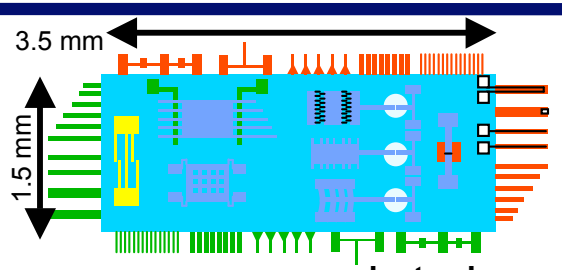
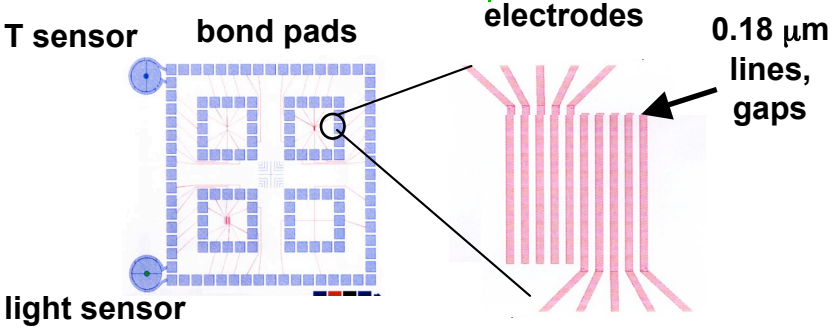
CINT Discovery Platforms™

The first platforms have been fabricated and are undergoing in-house testing, characterization and integration

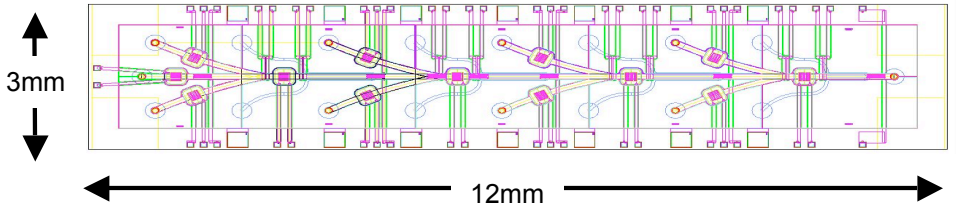
Cantilever Array Platform

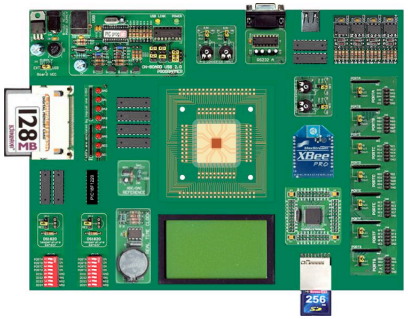


Electrical Transport & Optical Spectroscopy Platform



Microfluidic Synthesis Platform





NEW! Hybrid Discovery module

Drop-in user-friendly modules for connecting chips to the real world

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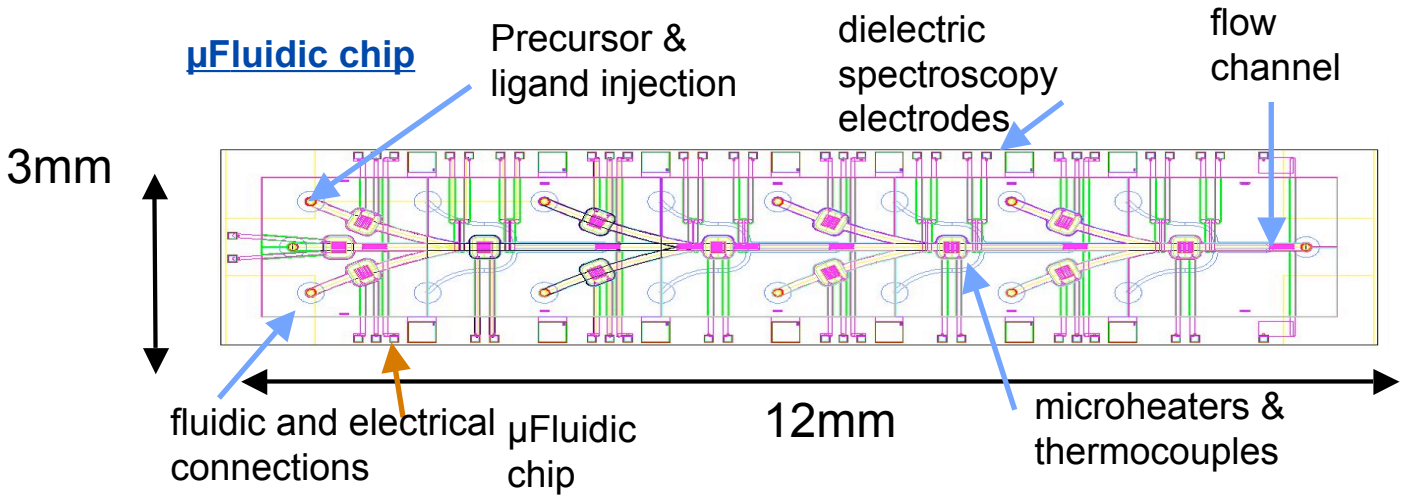
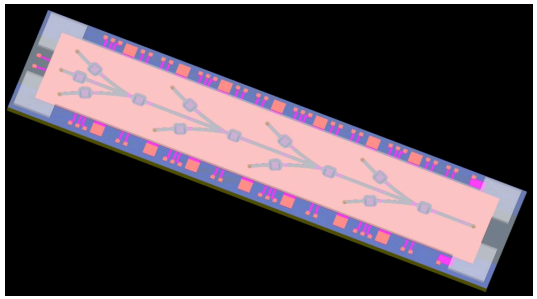
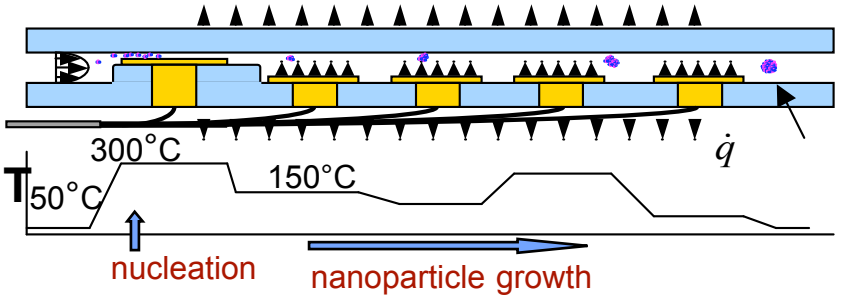
Microfluidic Synthesis Discovery Platform™







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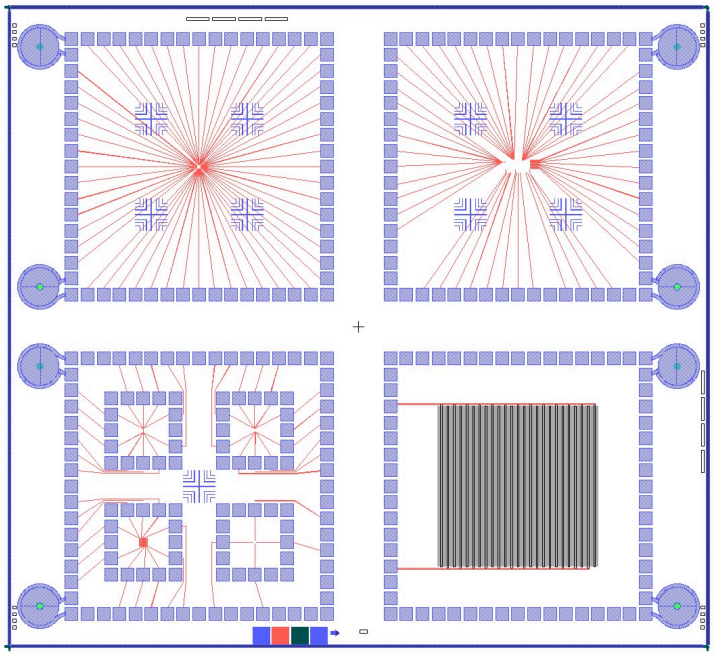
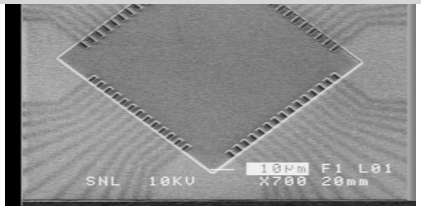
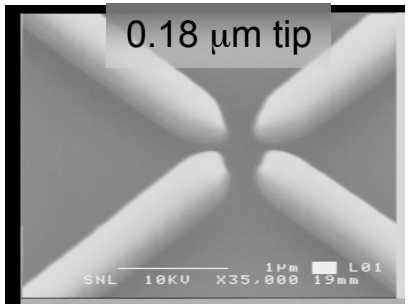
Optics & Transport Discovery Platform



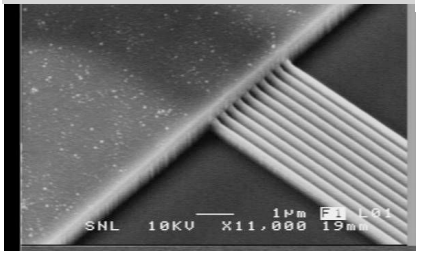
user-customizable area



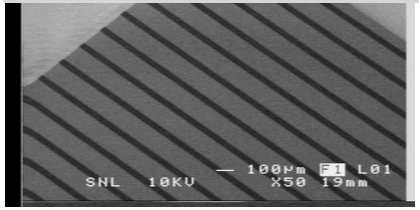
0.18 μm tip



0.18 μm lines & spaces



50 μm interdigitated lines & 150 μm spaces



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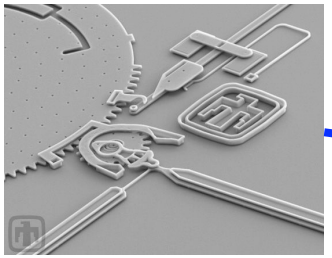
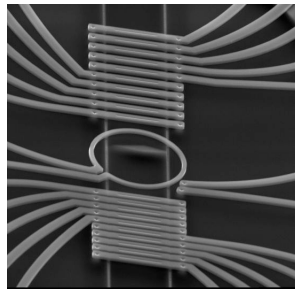
Future vision: Discovery Platforms™ as sophisticated sample holders

Mechanics

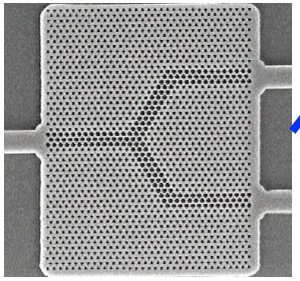


Electronics

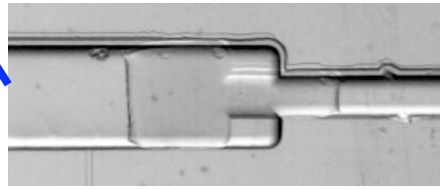


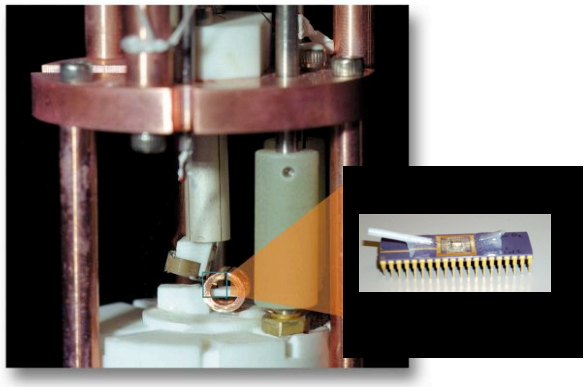
Discovery Platform™

Optics



Fluidics





Discovery Platform™ measurements within a scanning probe, TEM, SEM, laser system…

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Researchers access CINT via the 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**
- **External user proposal review**
- **No-fee access for pre-competitive research**
- **Proprietary work with full cost recovery**

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

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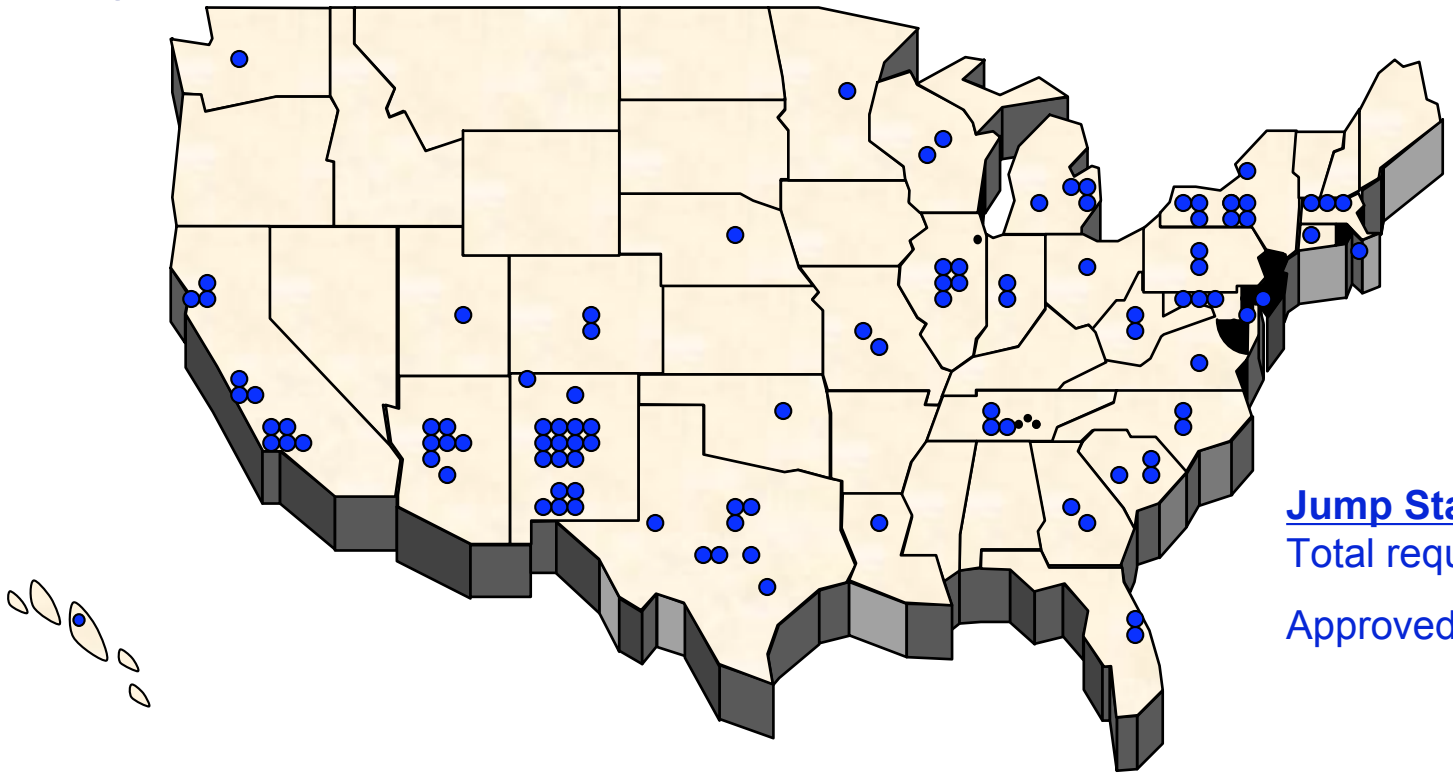
The first regular user call attracted widespread interest

2006 Call for User Proposals

178 proposals (130 accepted, 73%)

32 States

10 Foreign Countries



Jump Start Program

Total requests: 257

Approved: 36 (2003)
32 (2004)
21 (2005)

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2007 Spring Call for User Proposals

Announced: *February 15, 2007*

Focus:

- *R*esearch related to CINT Science Thrusts and/or CINT Nanoscience Integration Challenges
- Proposals that make use of CINT Discovery Platforms™

Submission Deadline: **April 6, 2007**

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

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General User Access Modes

- Users who request access to capabilities that are in the CINT user program. (Independent)

- Users who would like to access technical expertise and capabilities that are part of CINT's scientific thrusts. (Collaborative)

Each capability has a brief description and associated scientists

Bio-inspired and bio-compatible materials

The biomaterials synthesis capabilities will enable researchers to isolate, engineer, and integrate biological molecules with nanoscale synthetic materials and systems. Because native biological molecules are, in general, poorly suited for integration with synthetic systems, we focus upon engineering biomaterials specifically designed to function in synthetic nanosystems. Additionally, functionalization of biological molecules will be studied with respect to developing strategies for integrating living and non-living components that have a common interface. The capabilities that are available to CINT Users include:

- Isolation of genomic DNA, RNA, and plasmids from a variety of sources such as bacteria, viruses, and eukaryotic cells
- Growth and maintenance of a range of organisms (e.g., thermophiles, halophiles, etc.)
- Recombinant DNA cloning and expression in prokaryotic and eukaryotic systems
- Genetic engineering using reverse transcription, the polymerase chain reaction (PCR) and site-directed mutagenesis (SDM)
- Expression, purification, characterization, and functionalization of native and recombinant proteins
- Synthesis and functionalization of bio-compatible nanocrystal optical and magnetic tags (semiconductor and metal nanocrystals)
- Design of heterfunctional biomolecules for materials assembly
- Mammalian cell culture (nanoparticle interactions, cell/sub-cellular targeting of nanoparticles, etc.)

Associated CINT Scientists:

Dr. George Bachand, gdbacha@sandia.gov, (505) 844-516
Dr. Jennifer Hollingsworth, jenn@lanl.gov, (505) 665-1246
Dr. Gabriel Montaño, gbmon@lanl.gov, (505) 667-6776
Dr. Jennifer S. Martinez, jenm@lanl.gov, (505) 665-0045

CINT Thrust Leaders & Scientists

Jennifer S. Martinez, CINT, LANL

Primary research interests are in biomaterials synthesis and biosensors, with emphasis on producing and utilizing molecular recognition molecules for the hierarchical assembly of materials. Current research activities are focused on producing nano- and macro-scale biosensors that are reagent free and field deployable; the use of combinatorial libraries to synthesize small monodisperse gold and silver nanoclusters; and the study and predictive control of nanoparticle interactions with mammalian cells. Additional research interests include the production of unique phage display libraries for biocompatible materials generation; the study of colligative properties of lipid assemblies produced by molecular recognition; and the production of heterobifunctional ligands for materials assembly. Research skills include characterization of ligand organized lipid assemblies by light scattering, microscopy, and langmuir-blodgett films; natural product structure determination (NMR, MS-MS); chemical conjugation methods; biosensor development; biosynthesis of nanomaterials; and recombinant biology and biochemistry (cloning and protein chemistry). Primary CINT capabilities utilized include large standard molecular biology and biochemistry laboratories for recombinant protein generation; phage display of custom peptide and scFv libraries; peptide-synthesis and characterization; mammalian cell culture and interaction of such with nanoparticles.

Contact: jenm@lanl.gov, (505) 665-0045

Thrusts: Nano-bio-Micro Interfaces and Nanophotonics and Nanoelectronics

Download the complete CINT Scientist list from…

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

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Step-by-Step User Proposal Submission

CINT issues a Call for User Proposals…

1. Identify appropriate CINT scientist(s) & capabilities
2. Discuss idea with CINT scientists (optional)
3. Write 2-page User proposal
4. Choose open access or proprietary
   (a) NSRC Pre-competitive User Agreement, or
   (b) CRADA (full cost recovery)
5. Submit via CINT web site before deadline!

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CINT Proposal Evaluation Process

1. CINT conducts an internal feasibility screening (pass, fix, or fail)
2. Feasible proposals are assigned to one of six Proposal Review Panels for external peer review.
3. Panel returns a priority score (High, Medium, Low) with feedback comments.
4. CINT approves proposals based upon priority score, comments, and capability availability.
5. User notified; brief feedback provided

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When your User Proposal is accepted…

1. Execute User Agreement or negotiate CRADA
2. Research scheduled
   (CINT Scientists & User Administrators)
3. User conducts research at CINT
   (1 year maximum duration)
4. Report publications & presentations to CINT
5. Approved proposals are eligible to continue upon submission of annual Renewal Proposals.

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Working at CINT

Travel:	**Not paid by CINT; some support possible via other Lab programs**
Funding:	**CINT cannot fund Users**
Housing:	**Local options on web site**
Training:	**As required by LANL & SNL**
Badges:	**Initiated when proposal is accepted. Additional lead time required for Foreign Nationals**

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The nanotechnology future is taking shape in New Mexico!

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