The DOE Center for Integrated Nanotechnologies (CINT)

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DOE EPSCOR Annual Program Review
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DOE Center for Integrated Nanotechnologies
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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.

CINT is one of five U.S. Dept. of Energy Nanoscale Science Research Centers

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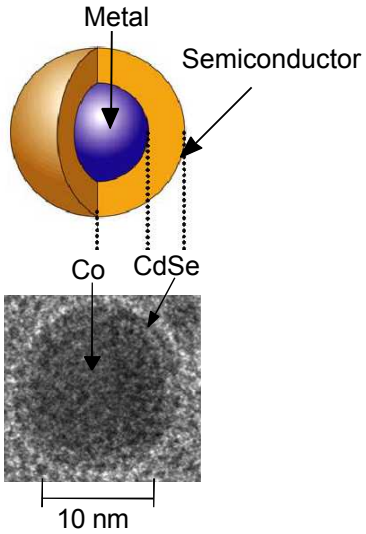
What is "Nanoscience Integration"?

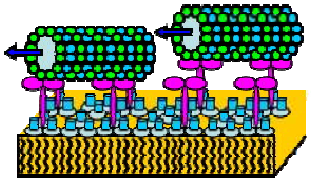
Incorporating nanostructured materials in composite structures to discover, understand, and design new properties and performance.

Bifunctional materials



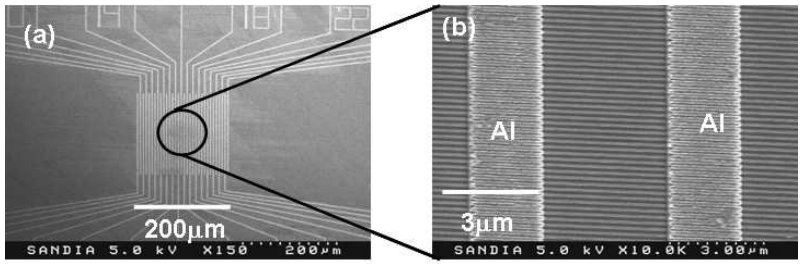
Combining ferromagnetic & semiconducting behavior

Directed assembly



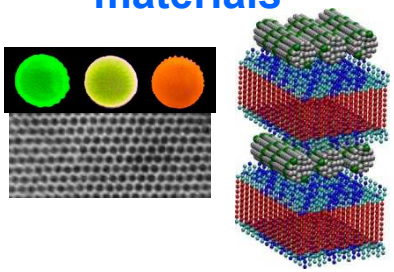
Microtubules + Motor Proteins

Active nanosystems

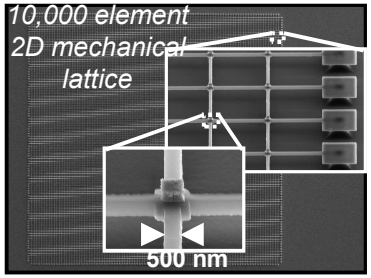


Nanowire arrays

Nanocomposite materials



Switchable metamaterials



Nanomechanical arrays

Length scale

Nano **Micro**

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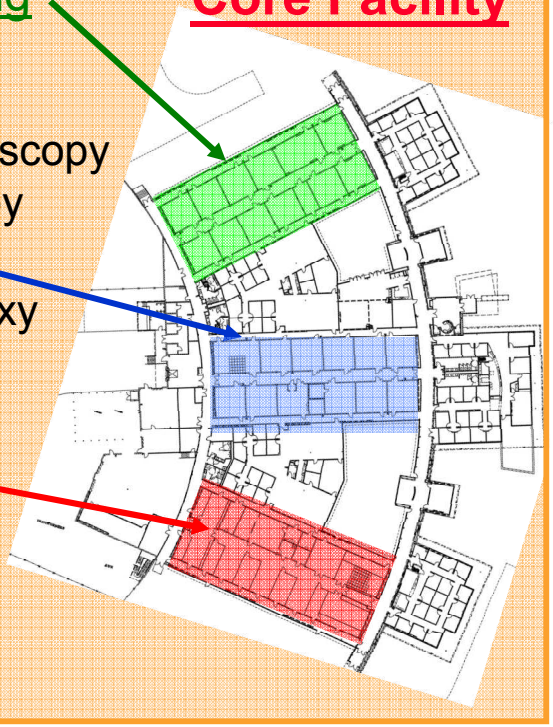
CINT has two facilities with extensive capabilities

Core Facility

Characterization Wing
- TEM, SEM
- Low Temp Transport
- Scanning Probe Microscopy
- Ultra-fast Spectroscopy

Synthesis Wing
- Molecular Beam Epitaxy
- Chem & Bio labs
- Molecular films

Integration Lab
- E-beam lithography
- Photolithography
- Deposition & Etch
- SEM / FIB



Gateway to Los Alamos Facility
- Biomaterials & Chem synthesis
- XRD, SEM
- UV-vis, ellipsometry
- Nano-indentation
- Nanoscale optical probes
- Microscopies
- Physical Synthesis
- Pulsed Laser Deposition
- Ultra-fast Spectroscopy
- Computer Cluster
- Visualization Lab

CINT users can access other specialized capabilities

Microsystems Engineering & Science Applications Complex

Lujan Neutron Scattering Center

National High Magnetic Field Lab

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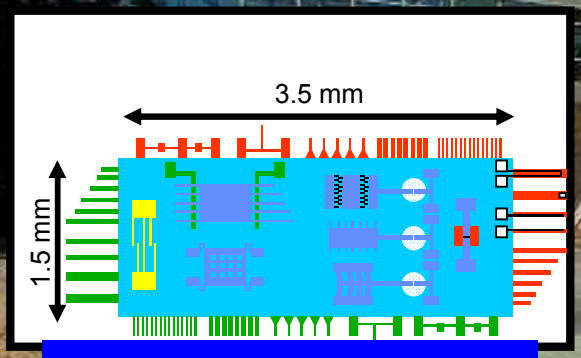
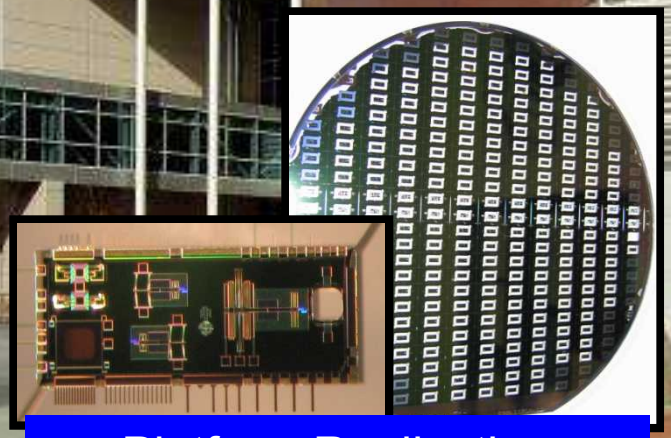
CINT Discovery Platforms™: micro-labs for nanoscience exploration

- Microsystems to stimulate, interrogate and exploit nanoscale materials
- CINT develops platforms…for user-inspired problems.

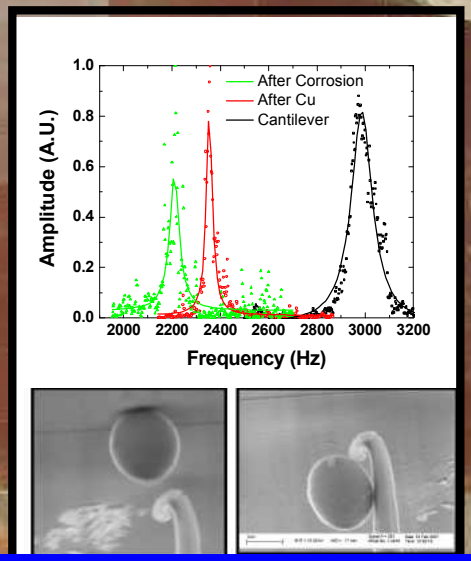
Cantilever Array Discovery Platform™



Concept



Platform Realization



Science Results

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CINT + MESA → Discovery Platforms™!

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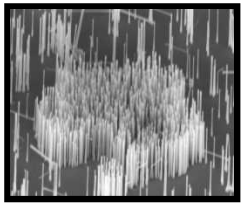
CINT Science Thrusts

Nanophotonics & Optical Nanomaterials

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

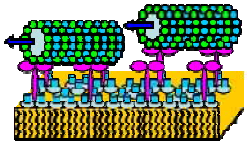
Nanoscale Electronics and Mechanics

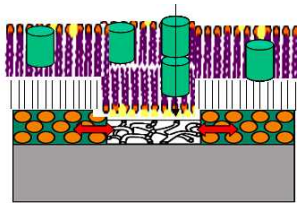
Control of electronic transport and wavefunctions, and mechanical coupling and properties using nanomaterials and integrated nanosystems



Soft, Biological, & Composite Nanomaterials

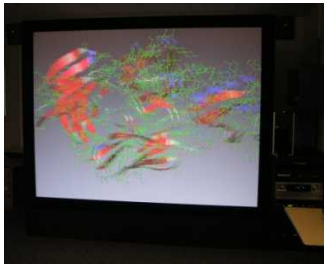
Solution-based materials synthesis and assembly of soft, composite and artificial bio-mimetic nanosystems





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 is a DOE/BES National User Facility

- Access via competitive system based on scientific quality
- No-fee for pre-competitive research (Jointly owned IP)
- Full-cost recovery required for proprietary research (User owns IP)
- Collaborative research or just access equipment
- Flexible project duration, 18 month maximum, renewable
- Semi-Annual *Call for User Proposals* (Spring/Fall)
- Rapid Access Proposals for off-cycle, urgent research
- CINT cannot provide funding to users

http://CINT.lanl.gov

User Proposal Submission

CINT issues a Call for User Proposals…

Prospective User response…

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 mode
5. Submit via CINT web site before deadline!

Capability descriptions and associated scientists are listed on the website

Optical spectroscopy

Optical spectroscopy is an essential tool for the characterization of many nanomaterials. Although these techniques are not capable of directly resolving individual nanostructures they can be used for investigating important nanoscale processes such as energy transfer and plasmonic transport. The available capabilities include:

* Optical spectroscopy, UV-Vis, Fluorescence Spectroscopy, FTIR
* Raman and Infrared Spectroscopy
* Ellipsometry
* Attenuated total reflection (ATR) spectroscopy;
* Thin-film waveguide characterization;
* Light scattering
* Interferometry
* Cryogenic and magnetic fields in combination with optical spectroscopy

Associated CINT Scientists:
Dr. Igal Brener, ibrener@sandia.gov, (505) 844-8097
Dr. Andrew Shreve, shreve@lanl.gov, (505) 667-6933
Dr. Rohit Prasankumar, rpprasan@lanl.gov, (505) 665-2993
Dr. Han Htoon, htoon@lanl.gov, (505) 667-9777

http://CINT.lanl.gov

CINT Scientist summaries are also available on the website

George Bachand, CINT, SNL

Primary research interests are in the area of nano-bio interfaces, materials, and systems, with emphasis on understanding and exploiting active biological molecules as structural and functional components of integrated nanosystems. Interests also include smart materials, bio-mimetic and -inspired manufacturing strategies, biological materials from extremophilic sources, and stochastic, non-equilibrium assembly processes. Current research activities are focused on engineering in vitro biological transport systems for (1) driving the active assembly of composite nanomaterials, and (2) transporting biological and synthetic materials in nanofluidic systems and devices. Research includes isolation, modification, and characterization of structural/functional proteins, functionalization strategies to interface synthetic and biological materials, dynamic surface chemistry to regulate biomolecule functionality, and biological molecules as nanoscale scaffolds for hybrid materials assembly. Research skills include gene isolation and cloning, recombinant protein expression and characterization, site-directed mutagenesis, genetic engineering, protein engineering and modification, prokaryotic/eukaryotic cell culture, surface functionalization, and a variety of biochemical and immunological techniques. The primary CINT capabilities utilized include molecular biosynthesis of proteins and DNA-based materials, biochemical/biophysical characterization of proteins, cell culture, and brightfield and epifluorescence microscopy.

Contact: gdbacha@sandia.gov, (505) 844-5164
Thrust: Soft, Biological and Composite Nanomaterials

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CINT Proposal Evaluation Process

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

When your User Proposal is accepted…

1. Execute appropriate User Agreement.
2. Schedule research
   (CINT Scientists & User Administrators)
3. User conducts research at CINT
   (18 month maximum duration)
4. Report publications & presentations to CINT
5. Approved proposals are eligible to continue upon submission of annual Renewal Proposals.

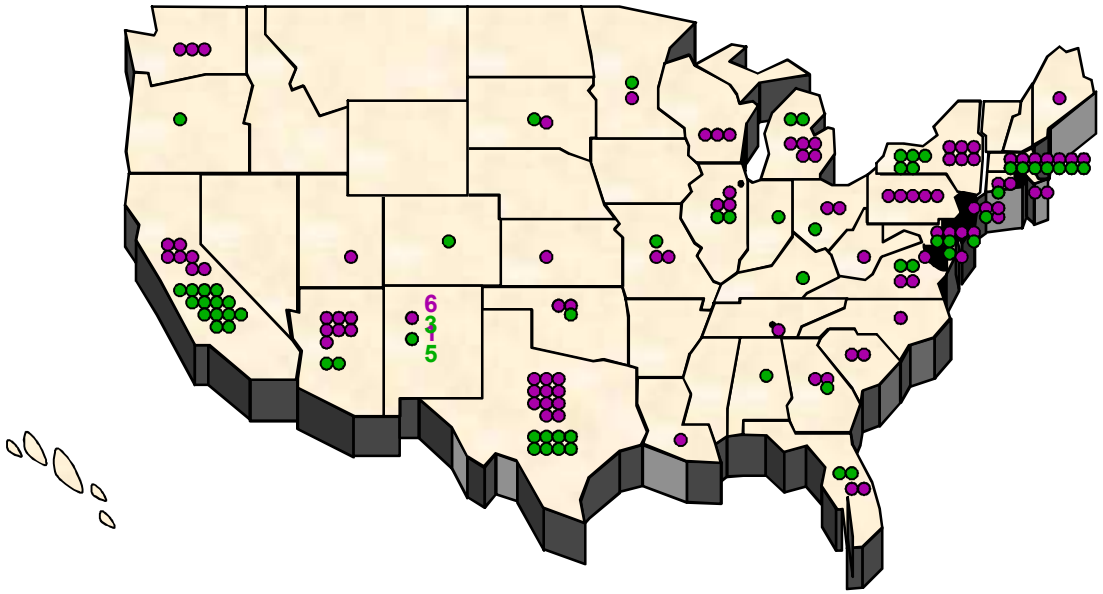
Rapid Access *User Proposals*

- Access to CINT between regular proposal submission cycles for time-critical, focused, high-impact research.
- User submits two-page proposal via CINT web-site.
- Expedited feasibility screening & proposal review.
- Approval by CINT Director / Co-Director.
- Execute appropriate User Agreement
- Rapid-Access user projects expire at next available regular proposal submission cycle.
- All regular reporting requirements apply.

CINT has attracted widespread interest

User Proposal Cycles:

2006: 175 submitted; 130 accepted (74%)
2007: 101 submitted; 79 accepted (78%) +13 Rapid Access
Spring 2008: 172 submitted; 160 accepted (93%)
Fall 2008: 119 submitted; 107 accepted (90%) +13 Rapid Access
Spring 2009: 109 submitted; 95 accepted (87%)



Over 425 researchers involved in 362 approved projects, representing 36 States and 14 Foreign Countries

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