SAND2005-7597P

The Center for Integrated Nanotechnologies: Transition to Operations Program Plan

DOE Basic Energy Sciences Review

July 25, 2005

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Neal Shinn, User Program Manager
ndshinn@sandia.gov

Presentation Outline

- Background & Mission
- Organizational Structure
- Science Program / Thrusts
- User Program
- Dedicated Facilities (Core & Gateways)
- Safe Operations
- Facility Commissioning (Lehman Review synopsis)
- Staffing Plan

Center for Integrated Nanotechnologies

Sandia National Laboratories • Los Alamos National Laboratory

- Highly collaborative DOE National User Facility
- Focused on nanoscience and its integration across scientific disciplines and multiple length scales.
- Open access to tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the micro and macro worlds.

"One scientific community focused on nanoscience integration"

CINT Mission

Goals common to all Nanoscale Science Research Centers:

1. **Conduct forefront research in nanoscale science.**

2. **Operate as a user facility for scientific research.**

3. **Provide user access to the relevant BES-supported expertise and capabilities at the host National Laboratory.**

4. **Leverage other relevant National Laboratory capabilities to enhance scientific opportunities for the nanoscience user community.**

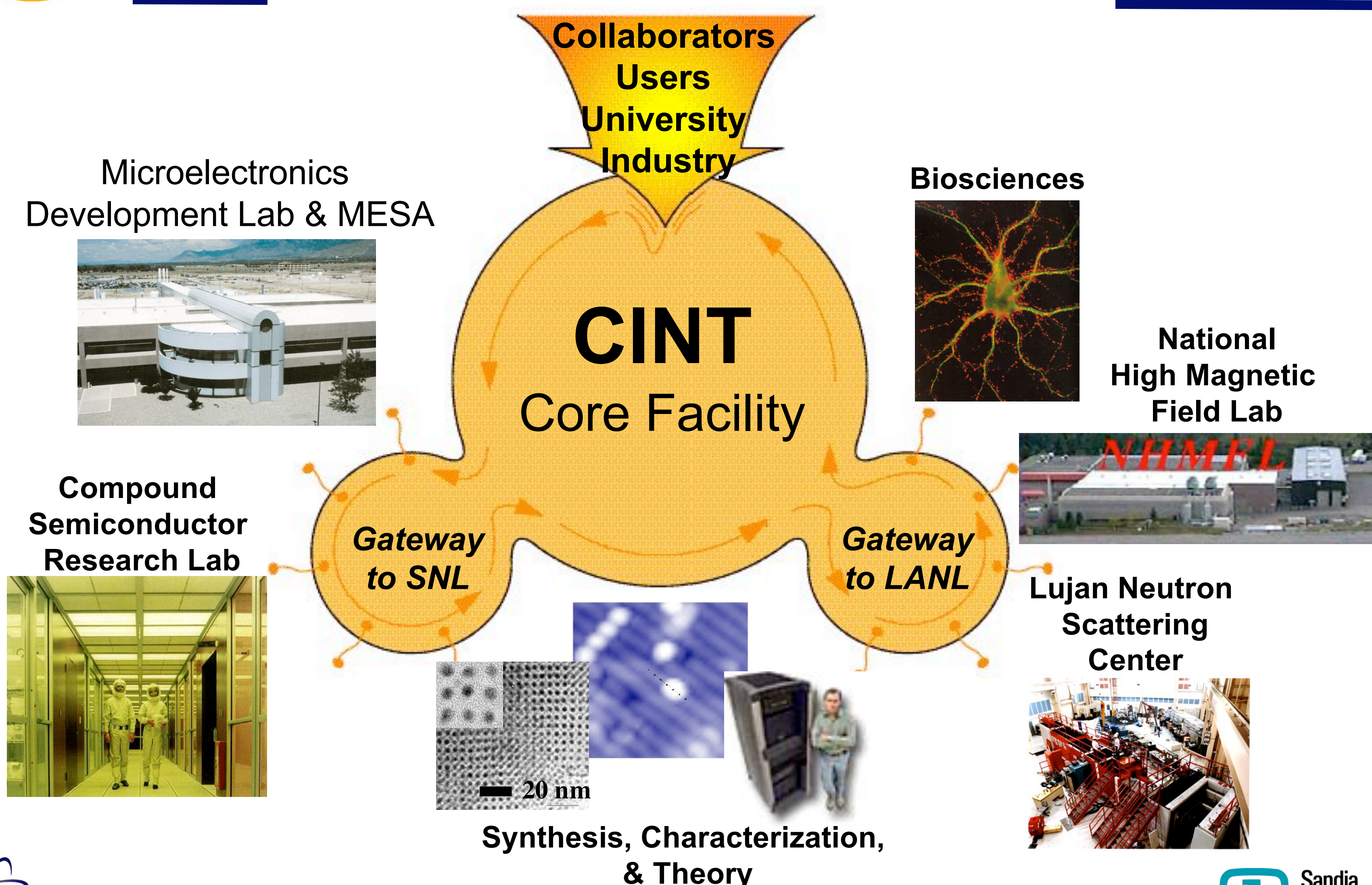
CINT Mission (con't.)

***Additional goals specific to the unique CINT mission*:**

5. **Establish and lead a scientific community dedicated to solving nanoscale science integration challenges.**

6. **Create a unified user facility program that seamlessly combines expertise and facilities at both Los Alamos and Sandia National Laboratories.**

One community focused on nanoscience



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National
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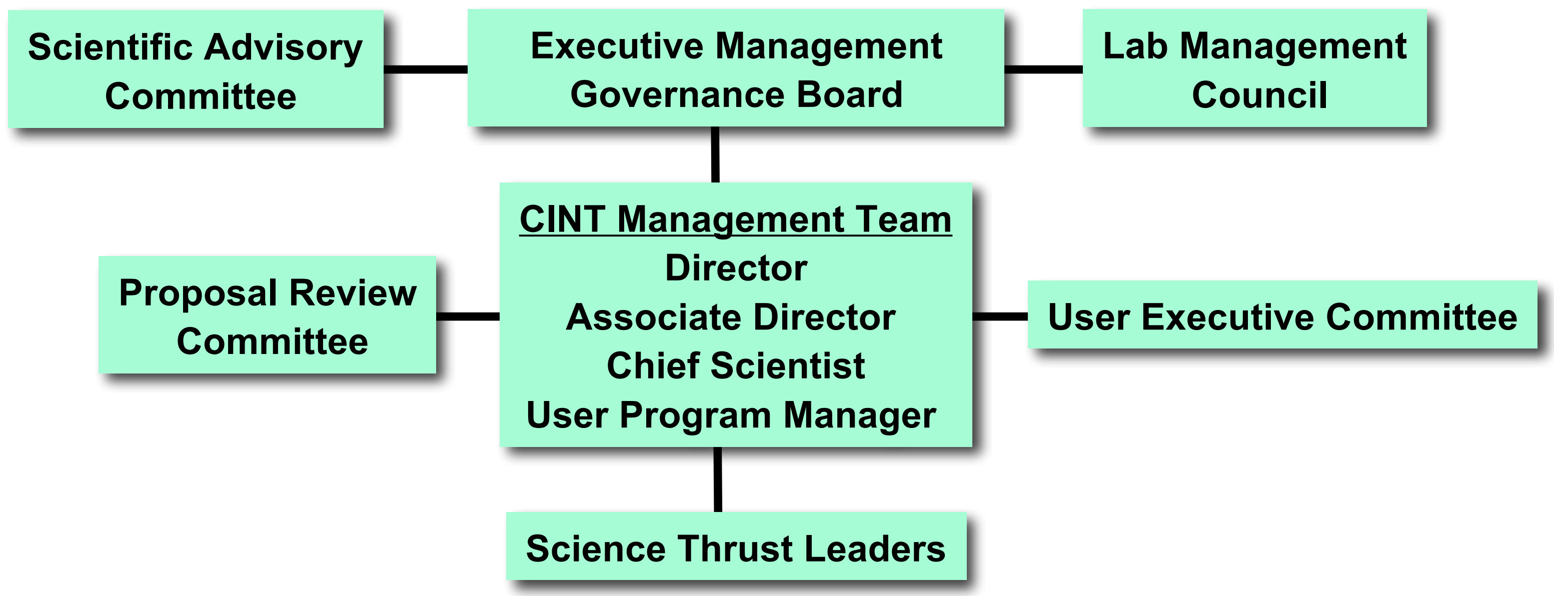
CINT organizational structure

Equal partnership between Los Alamos and Sandia defined by a Memorandum of Understanding



Governance Board
Rick Stulen
Terry Wallace
Clayton Teague
Herb Goronkin
Venkatesh Narayanamurti

Scientific Advisory Committee

Sankar Das Sarma	Julia Weertman
Robert Haddon	Frans Spaepen
Daniel Cox	Mark Reed
Paul Barbara	Harold Craighead
Laura Greene	Steve Brueck
Bob Westervelt	Dawn Bonnell
Antonio Ricco	Eleni Kousvelari

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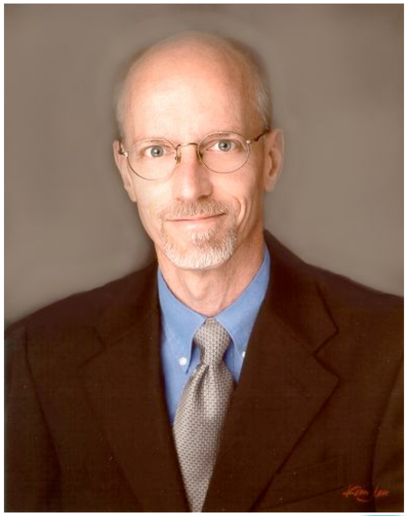
CINT is led by a joint management team

Director
Julia Phillips (SNL)

Associate Director
Toni Taylor (LANL)

Chief Scientist
Tom Picraux (LANL)



User Program Manager
Neal Shinn (SNL)

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Roles and Responsibilities - Part 1

CINT Executive Management Team – The Executive Management Team (EMT) is composed of a Senior Manager from each Laboratory (Terry Wallace, Los Alamos Associate Director for Strategic Research and Rick Stulen, Sandia Vice President for Science and Technology and Partnering). The EMT has full authority to oversee the operation of CINT including the approval of bylaws, appointment of management, user policy, and scientific directions.

CINT Governance Board – The Executive Management Team will form and act as Co-Chairs of a CINT Governance Board in implementing its policy direction and management oversight. The Governance Board (GB) will advise the CINT Executive Management Team regarding the policy direction and management oversight of CINT.

Roles and Responsibilities - Part 2

Scientific Advisory Committee – The Scientific Advisory Committee (SAC) is composed of external scientists and is chartered with evaluating scientific programs, providing advice on future science directions and infrastructure needs, evaluating user facility operations, and assuring that CINT maintains a highly effective user program.

Laboratory Management Council – The Laboratory Management Council (LMC) is made up of Los Alamos and Sandia National Laboratory technical managers whose staff and facilities will be leveraged through the CINT Core and Gateways. As the major internal stakeholders in the success of CINT, the LMC is charged with integrating staff, facilities, and programs in each laboratory with the CINT program.

Roles and Responsibilities - Part 3

- **Proposal Review Committee** – The Proposal Review Committee (PRC) is composed of external (to LANL and SNL) scientists charged with evaluating the technical quality of user proposals. Members of the PRC will serve for rotating three-year terms. The initial composition of this committee will draw heavily from willing reviewers who have served during our jump-start operations.

Roles and Responsibilities - Part 4

- **<u>User Executive Committee</u>** – This committee is formed from CINT users and reports to the CINT Program Management Team concerning effectiveness of CINT user program and facilities and the quality of the on-site user environment. In consultation with the CINT management, this body will develop the formal CINT UEC charter and initiate the election process for expansion of the UEC beyond the initial three appointed members.

Founding UEC Members (from SAC):

Robert Haddon, University of California, Riverside

Sankar Das Sarma, University of Maryland

Julia Weertman, Northwestern University

Roles and Responsibilities - Part 5

- **Scientific Thrust Leaders** – The CINT Thrust Leaders are laboratory scientists at both LANL and SNL whose primary job responsibility is the success of a major scientific thrust pursued by CINT. Thrust Leaders work closely with the Chief Scientist and CINT Scientists to guide scientific directions for CINT and recommend associated infrastructure needs.

At LANL, CINT resides in the Strategic Research Directorate

Strategic Research Directorate
Terry C. Wallace, Jr., Associate Director
Ross Lemons, Deputy Associate Director
Kathleen Alexander, Deputy Associate Director

Materials Science and Technology Division
P. S. Follansbee, Division Leader
John Sarrao, Deputy Division Leader (Acting)
R. R. Sharp-Geiger, Deputy Division Leader

- **Center for Integrated Nanotechnologies (MST-CINT)**
  A. J. Taylor, Ctr Ldr
- National High Magnetic Field Laboratory (MST-NHMFL)
  A. H. Lacerda, Ctr Ldr
- Superconductivity Technology Center (MST-STC)
  D. E. Peterson, Ctr Ldr
- Operational Support (MST-OPS)
  L. Jarvinen, GL (Actg)

- Materials Technology: Metallurgy (MST-6)
  R. A. Patterson, GL
  R. E. Morgart, DGL
  D. Teter, DGL (Actg)
- Polymers & Coatings (MST-7)
  P. Reardon, GL (Actg)
  A. Graham, DGL (Actg)
- Structure/Property Relations (MST-8)
  A. K. Zurek, GL
  M. Bourke, DGL
- Condensed Matter & Thermal Physics (MST-10)
  M. F. Hundley, GL, acting
- Electronic & Electrochemical Materials & Devices (MST-11)
  K. R. Stroh, GL

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CINT Group Structure—
Based on CINT thrusts

Complex Functional Nanomaterials
- Rick Averitt, Thrust Leader
- 6 TSMs+ postdocs

CINT

Associate Director, CL
Deputy Center Leader
Chief Scientist
Operations Manager

Nanomechanics
- Mike Nastasi, TL
- 5 TSMs + postdocs

Nanoelectronics and Photonics
- Victor Klimov's, TL, C-PCS
- 4 TSM's, plus postdocs

Nanoscience theory
- T-11, (Balatsky, et al)

Nano/Bio/Micro Interfaces
- Andy Shreve, Thrust Leader
- 7 TSM's +postdocs

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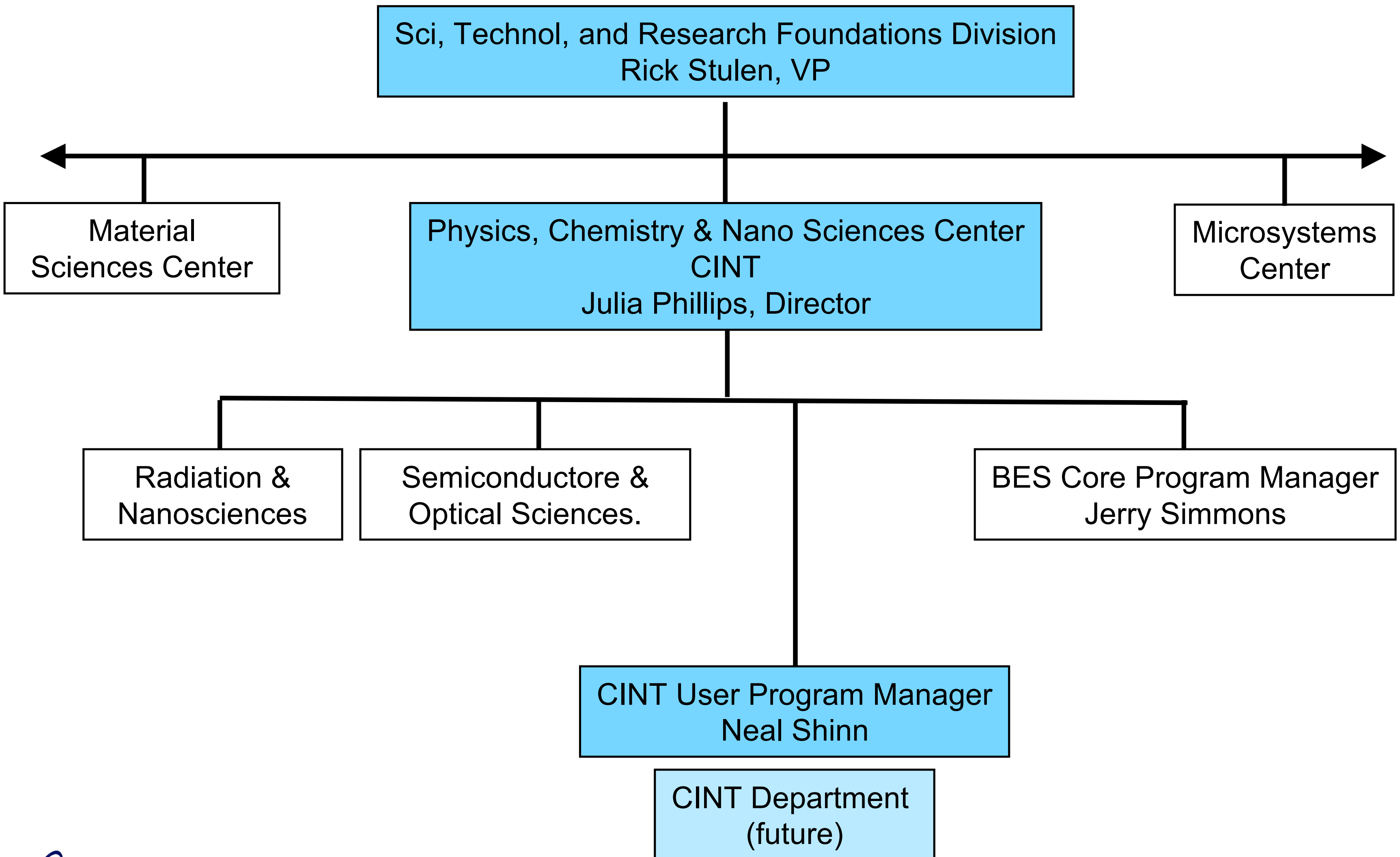
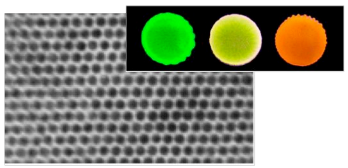
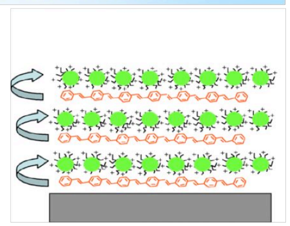
CINT is in Sandia's Science, Technology, and Research Foundations Division



CINT Thrust Areas provide broad base of expertise

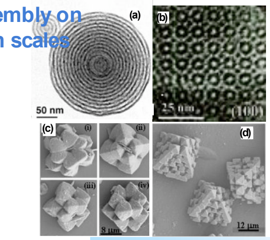
Nanoelectronics & Nanophotonics:
Precise control of electronic and photonic wavefunctions

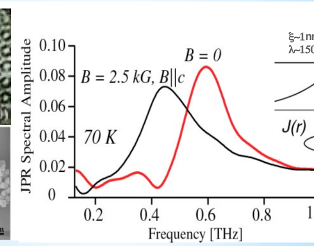


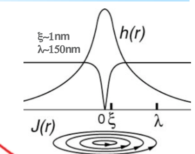


Complex Functional Nanomaterials:
Relationships between synthesis, structure and complex and emergent properties

Self-assembly on all length scales

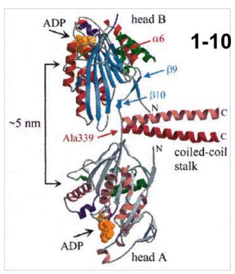




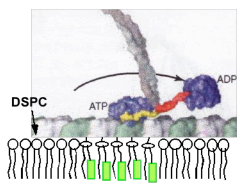


Structure-property relationships

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



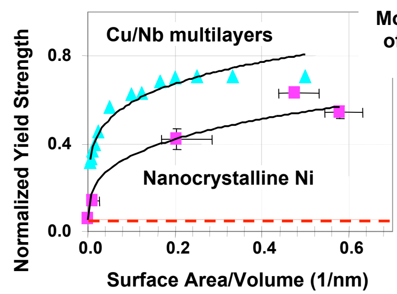
1-10 nm



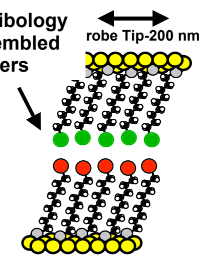
Aggregated receptors

10 -100 nm

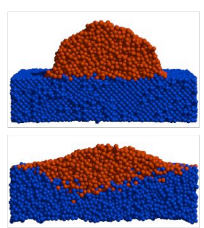
Nanomechanics:
Understanding the mechanical behavior of nanostructured materials

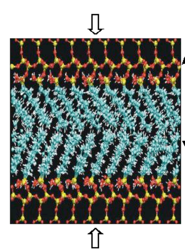


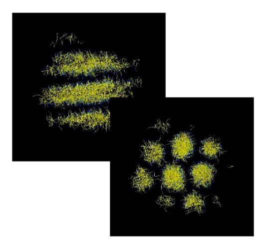
Molecular Tribology of Self-Assembled Monolayers



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







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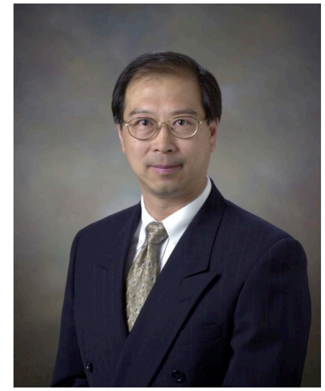
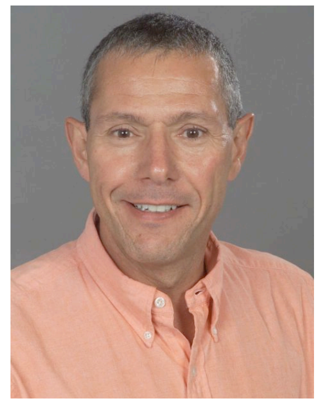
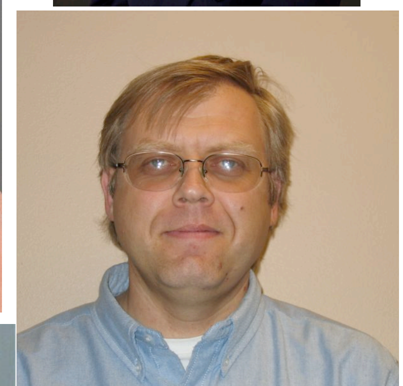
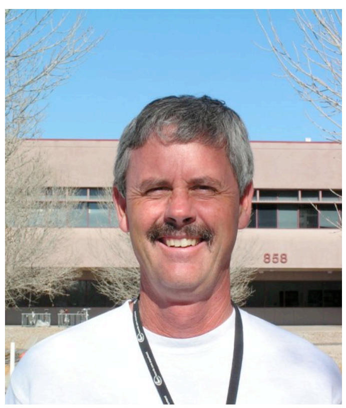
CINT Thrust Leaders provide scientific leadership









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Nanoelectronics and Nanophotonics Thrust:
Understanding and controlling electronic and photonic interactions in nanostructured materials

- Development and comprehensive understanding of novel nanostructured materials comprising multiple constituents, finer length scales, and new 3D architectures for a versatile manipulation of electronic and photonic wavefunctions.

- Understanding and control of charge and energy transfer at nanoscale interfaces: including coherent control and manipulation of electronic wave functions and spin degrees of freedom and control of energy flow using excitonic or plasmonic circuits.

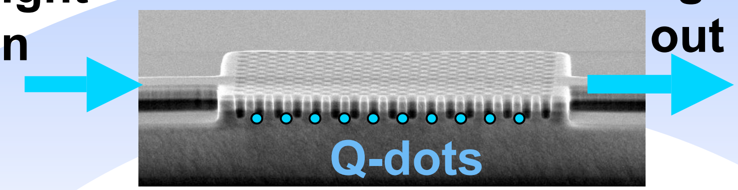
- Targeted areas of application include: defect tolerant architectures for molecular electronics, high efficiency solar energy conversion through novel nanoscale phenomena/architectures, and active photonic nanostructures for optical amplification, ultrafast switching, chem/bio sensing, communications and optical and/or quantum computing.

Nanophotonics and Nanoelectronics Thrust— Current Activities

- Nonlinear optical properties of photonic fibers for photonic and optoelectronic devices
- Transport studies of interacting low dimensional systems including coupled nanostructures and exciton condensation in electron-hole bilayers
- Synthesis and spectroscopy of nanoscale assemblies comprising nanocrystal quantum dots
- Fabrication, purification, and spectroscopic studies of carbon nanotubes
- Broad near-field spectroscopy of metal nanoassemblies
- Ultrafast scanning tunneling microscopy/spectroscopy of nanoscale semiconductors and superconductors
- High efficiency solid state lighting
- High-magnetic-field spectroscopy of nanoscale semiconductors
- Development of sources and detectors for THz frequencies

Integration Science Challenge: Energy transfer across multiple length scales

light in

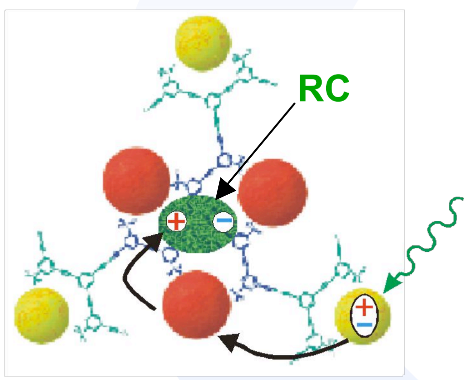


light out

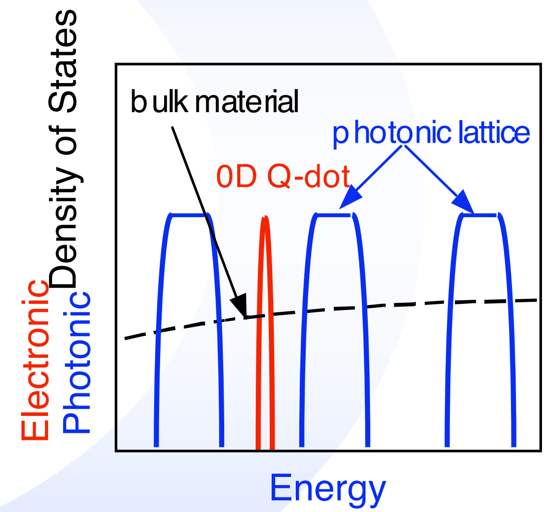
Multi-length scale integration

Nonlinear response: new behaviors for switching and sensing.

Technology Opportunity



Nanoscale synthesis and self-assembly



Theory and simulation

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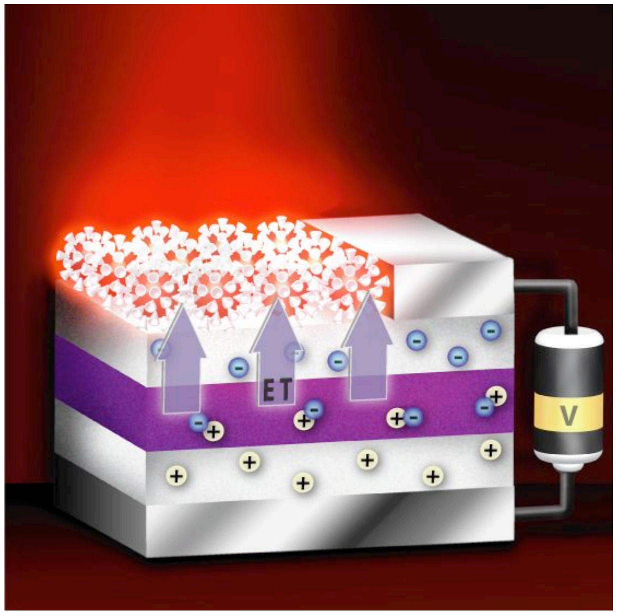
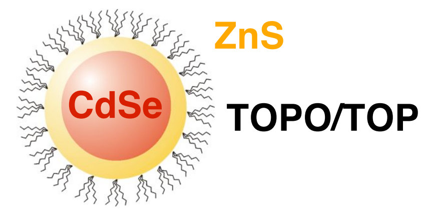
CINT Science: Light Emitting Devices Using Hybrid Colloidal Semiconductor Nanocrystals/Epitaxial GaN Structures

***LANL:* M. Achermann, M. Petruska, S. Kos, D. Smith, and V. Klimov**

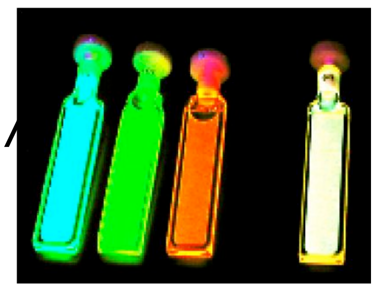
***Sandia:* D. Koleske**



Semiconductor Nanocrystals:



Single color or multicolor / white light emission



	τ_r	τ_{ET}	ET efficiency
QW w/o cap layer	0.6 ns	0.5 ns	**55%**
QW with 3nm cap	0.8 ns	1.4 ns	**36%**

*M. Achermann, M.A. Petruska, S. Kos, D.L. Smith, D.D. Koleske, V.I. Klimov, Nature **429**, 642 (2004).*

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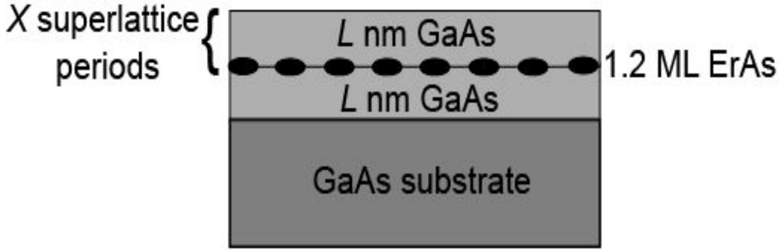
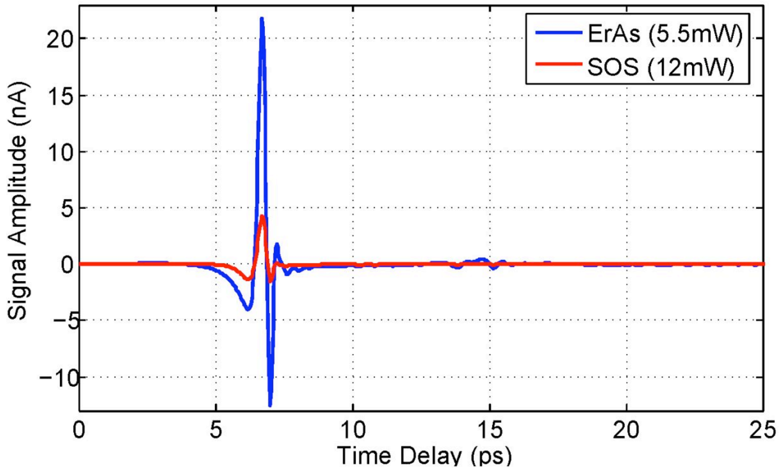
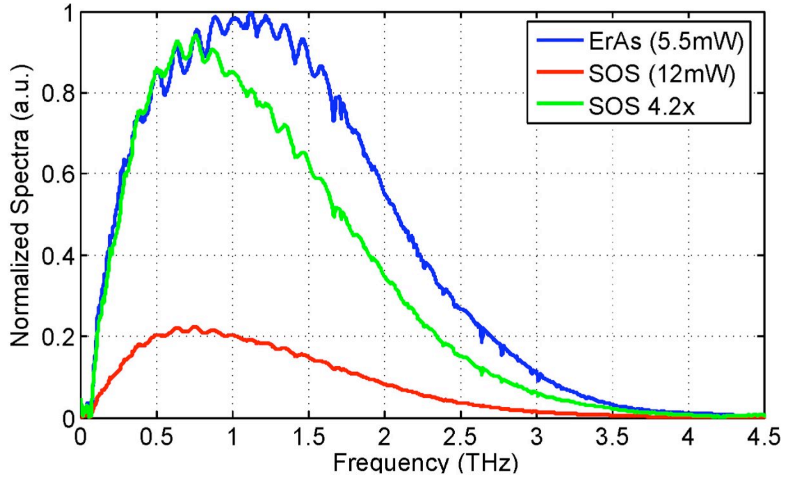
Enhanced THz detection using ErAs:GaAs superlattices



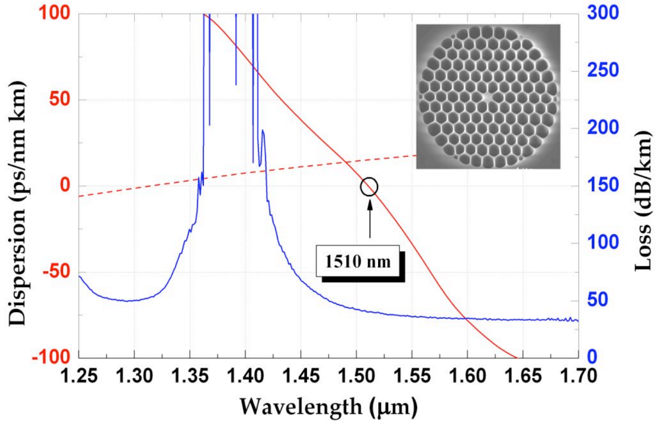




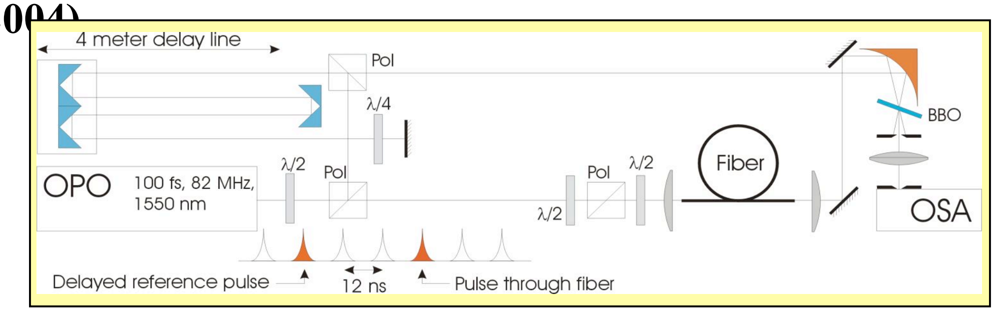
- **Detection bandwidth of ~2 THz estimated from *L*=25 nm samples with 19 μJ/cm^2 pump fluence.**
- **Photoconductive antenna structure patterned on *L*=25 nm ErAs:GaAs superlattices and compared to similarly-designed radiation-damaged silicon-on-sapphire (RD-SOS).**
- **Preliminary results indicate factor of ~10 stronger signal compared to radiation-damaged silicon-on-sapphire (RD-SOS), improved bandwidth.**

R. Prasankumar and R. Averitt, CINT; Art Gossard, UCSB
Applied Physics Letters 86, 201107 (2005)

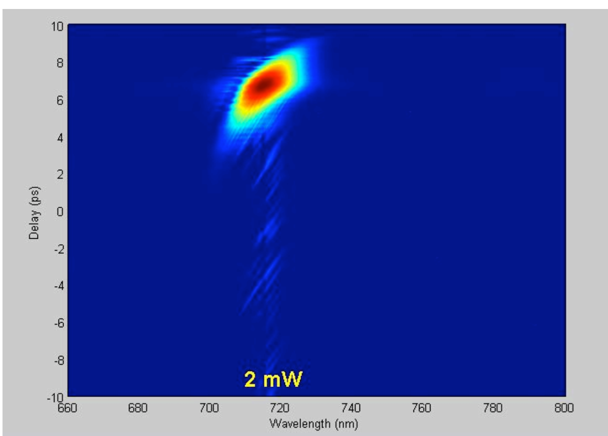
Nonlinear interactions in photonic crystal fibers



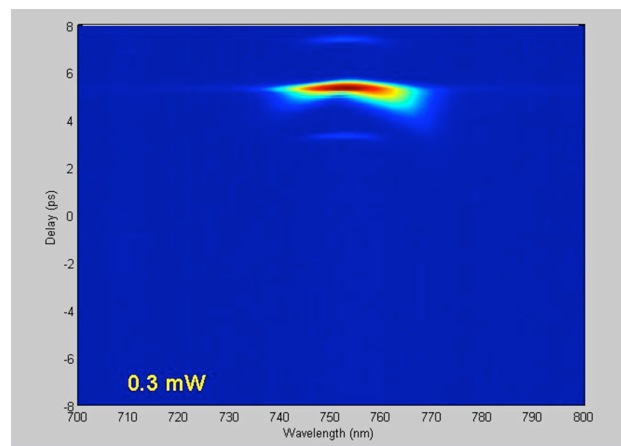
Scattering of solitons and continuous waves in fibers is a novel nonlinear interaction regime predicted by the Bath group and observed at CINT. (Optics Express, 2004)



Pumping in the anomalous dispersion region



Pumping exactly at zero dispersion



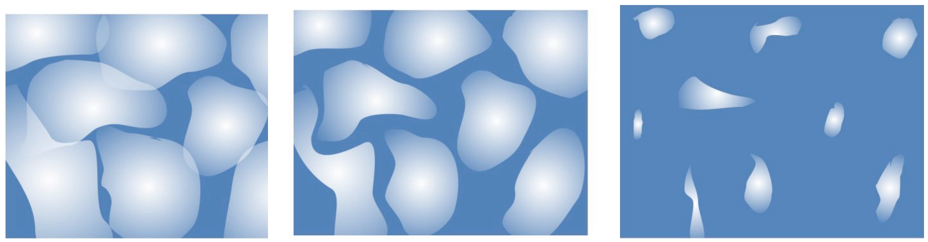
<u>Fiber:</u> ZD=1510 nm, length = 130 cm

A. Efimov, CINT; Dimitri Skyrabin, Jonathan Knight, University of Bath

Transport experiment and calculations of low-dimensional semiconductors

Sankar Das Sarma, *University of Maryland*, Michael Lilly, *CINT*

$n<n_c$ $n\sim n_c$ $n>>n_c$



- 2D metal-insulator transition can be understood using impurity scattering of a homogeneous system at moderate and high density; this cannot be extended to low density.
- Percolation must be considered for *inhomogeneous* 2D electrons at low density.

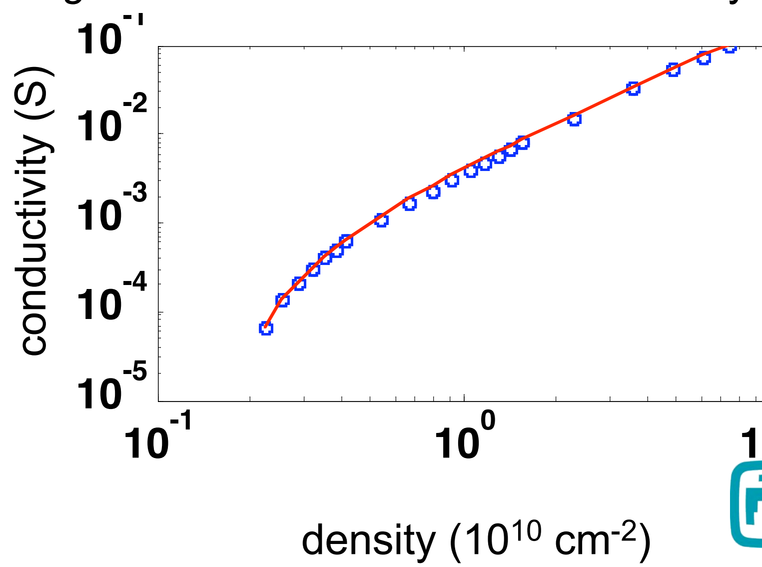
Percolation in 2D

$$\sigma = A(n-n_c)^{\delta}$$

$$A = 0.0050 \pm 0.0010$$

$$n_c = 0.173 \pm 0.008$$

$$\delta = 1.50 \pm 0.10$$



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Nano-bio-micro Interfaces Thrust— The intersection of bioscience with nanoscale materials science.

- Control and understanding the physical interface between biomolecular systems and nanoscale synthetic materials, including the development of patterned biofunctional and biocompatible surfaces, understanding the assembly of biomolecular components at interfaces, and developing biomolecular recognition approaches to assist in the assembly of synthetic nanoscale building blocks.

- Understanding how to bridge between nanoscale biomolecular assemblies and functional microscale and larger devices, for example, the integration of biological components with fluidic, photonic or mechanical fabricated devices.

- Developing new nanoscale materials whose structure, function and assembly are inspired by natural systems.

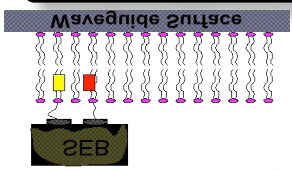
- Developing new approaches to the study of biological systems based on new materials and material characterization tools arising from nanoscale science.

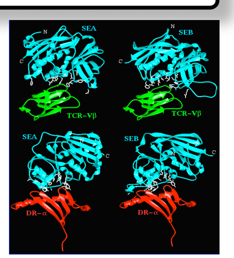
Nano/Bio/Micro Interfaces

a bridge to living systems

Molecular Recognition

Designer Ligands for Toxin Detection

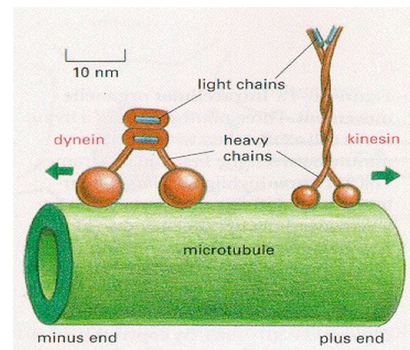




- Molecules designed for high affinity binding to specific toxins

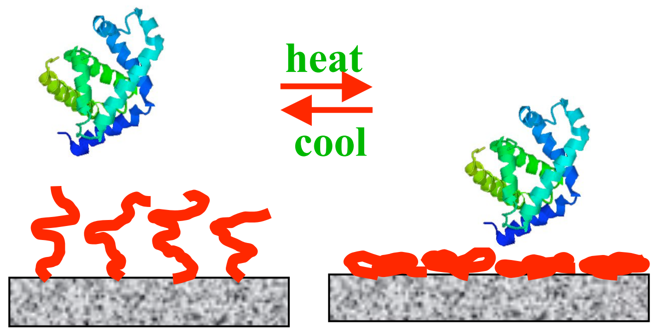
General Theme Areas:
- **Integrated systems for manipulating biomolecules**
- **Integrated systems for exploiting biomolecules**

Active Transport/Assembly Using Microtubules + Motor Proteins

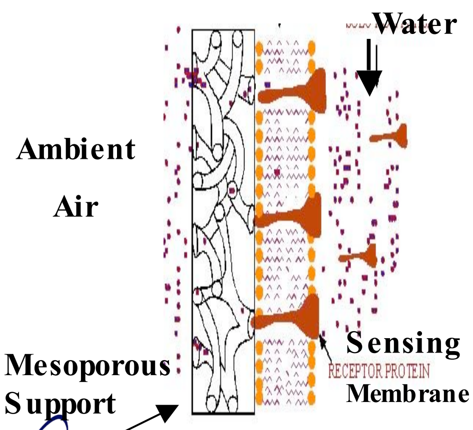


Essential Cell Biology
Alberts et al

Switchable Nano-films Grab/Release Proteins



Sensing



Applications in biosensors, biomedical implants, bio-assisted materials synthesis, and bio-inspired energy/signal transduction processes

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Nano-bio-micro Interfaces Thrust— Current Activities

- The use of self-assembly and biomolecular assembly to create assemblies of synthetic building blocks with emergent optical or electronic properties.
- The use of active biomolecular components such as motor proteins to assist in the assembly of nanostructured electronic and photonic components such as semiconductor quantum dots.
- Studies of the structure and function of nanostructured cooperative and composite assemblies that incorporate biological and biomolecular components together with synthetic materials.
- Studies of passive and active monolayers, lipid bilayers, and membranes that mediate interactions between surfaces and biological species, including proteins and cells.
- Development of sensitive imaging and detection technologies for study of biological systems.
- Studies of patterned model membrane architectures.
- Development of integrated fluidic and analysis technologies in platforms allowing interrogation of biological processes.

Complex Functional Nanomaterials Thrust: ***Understanding & controlling complex, or emergent, functionality that derives from nanoscale interactions***

- Establishing the scientific principles needed to design, synthesize and integrate nanomaterials into robust nanocomposite architectures, systems, and devices with desired functions and performance.

- Developing strategies to integrate top-down, microfabrication techniques with bottom-up, chemical synthesis and self-assembly approaches with a view towards technologically relevant multifunctional nanomaterials.

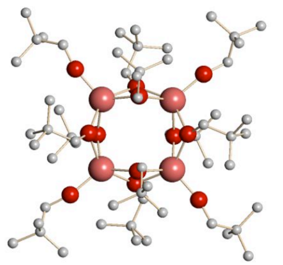
- Understanding emergent phenomena in a broad range of materials. Experimental and theoretical techniques will emphasize investigating structural and dynamic correlations.

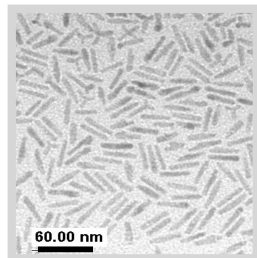
- Developing and exploiting novel properties that are uniquely achieved through nanoscale structure, which will lead to materials with novel electronic and optical properties, mechanical behavior, transport phenomena, and chemical and catalytic responses.

Complex Functional Nanomaterials

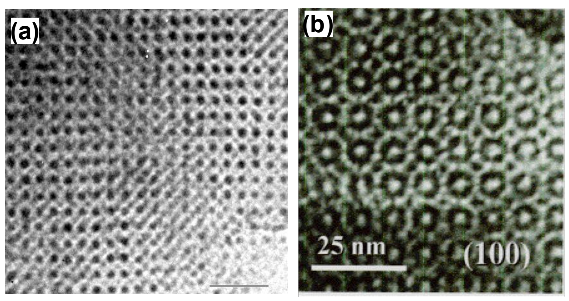
Increasing length scales

Synthesis and structure-property relationships on multiple length scales

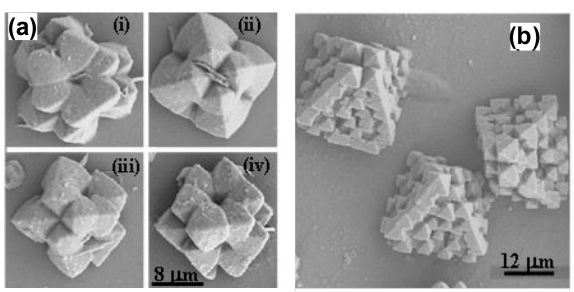




Molecular design and nanoparticle synthesis

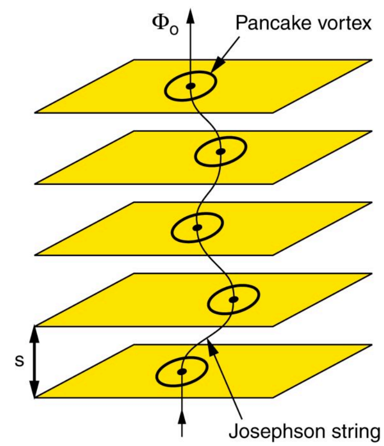


Nanoparticle and nanoscale self-assembly



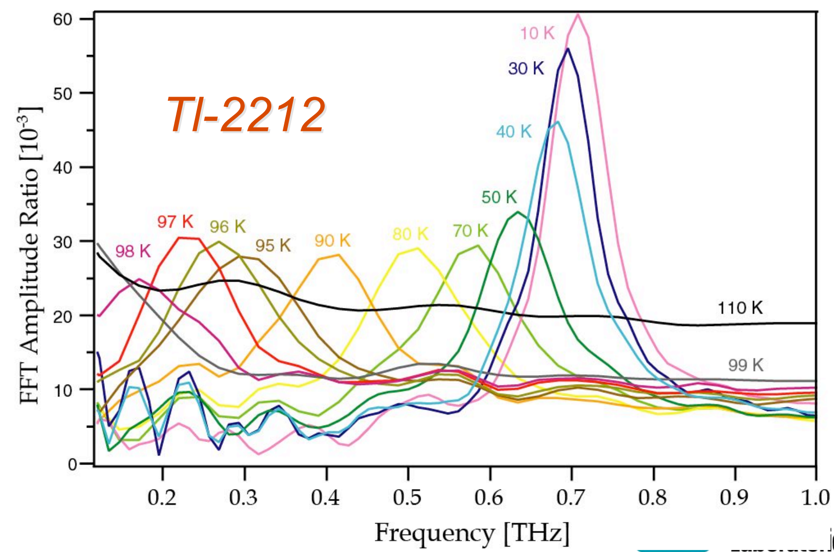
Direct assembly of high order hierarchical structures

Josephson Plasma Resonance in High-T_c Materials (self-assembled magnetic "nanoparticle" arrays)



Cooper Pairs

$$\omega_{pc} = \frac{c}{\lambda_c \sqrt{\varepsilon_\infty^c}} = \left(\frac{4\pi n_s e^2}{\varepsilon_\infty^c m_c} \right)^{1/2}$$



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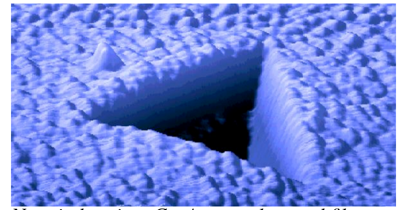
Complex Functional Nanomaterials Thrust—Current Activities

- Nanoparticulate materials synthesis.
- Development of an evaporation-assisted self-assembly process for a wide range of functional nanoscale materials and detailed fundamental understanding of the reaction pathways leading to self-assembly.
- Development of methods to control nucleation and growth on multiple length scales.
- Self-assembly of tunable photonic structures and optical materials with colloidal nanoparticles and quantum dots.
- Time-resolved studies from the far-infrared through the visible in nanomaterials and single crystals to investigate the dynamics deriving from nanoscale interactions.
- Development of novel spatio-temporal probes for investigating CFNs.
- Characterization of correlated electron materials with strong nanoscale fluctuations in the charge, spin, and lattice degrees of freedom.
- Development of chemical, biosensors and other microdevices based on CFNs.

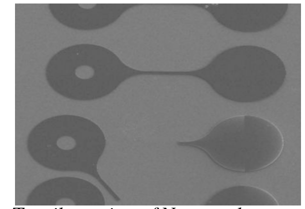
Nanomechanics Thrust: Understanding & controlling mechanical properties on the nanoscale

✓ *Mechanics of Nanoscale Materials*

Exploration of the origins of unusually high strengths and novel mechanical behavior in nanoscale and nanostructured materials, including biological materials.



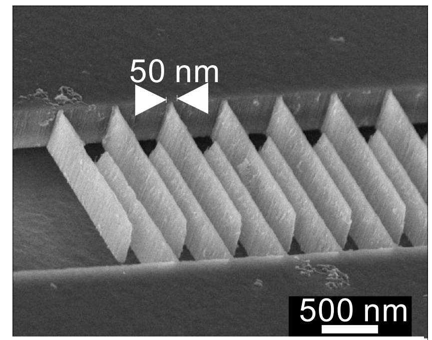
Nanoindent in a Cu-Ag nanolayered film



Tensile testing of Nanoscale amorphous diamond films

✓ *Mechanics of Nanoscale Integrated Devices*

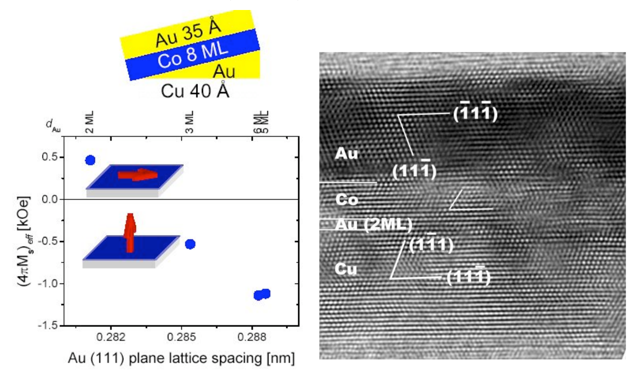
Understanding mechanical responses such as energy dissipation, mechanical coupling between arrays of components, and mechanical non-linearities in devices with nanostructured components.



Amorphous diamond nanoelectromechanical oscillator (NEMO)

✓ *Strain-derived Novel Functionalities*

Surface and interface strain induced novel functionalities (electrical, magnetic, or optical) in nanoscale materials and devices.



Tuning magnetic anisotropy of 8 atomic layer thick Co via interface strain induced electronic structure changes

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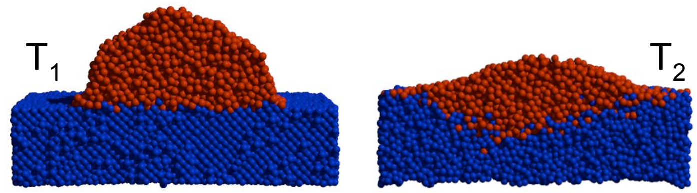
Nanomechanics Thrust—Current Activities

- The study of plastic deformation and strengthening mechanisms in nanostructured materials based on metallic multilayers.
- Mechanisms of stress evolution during island growth and coalescence on surfaces.
- The development of micro-tensile test platforms for in situ TEM investigation of dislocation nucleation and propagation in ultra-thin film materials.
- Studies of the fundamental mechanisms of mechanical dissipation in nanoscale mechanical oscillators and in materials with nanoscale to atomic-scale disorder.
- The development of arrays of coupled mechanical oscillators for studies of collective or emergent behavior in large systems.
- The development and measurement of specialized micromechanical structures for studies of interfacial adhesion and friction.
- The use of interface strain to create novel functionalities in nanoscale materials.

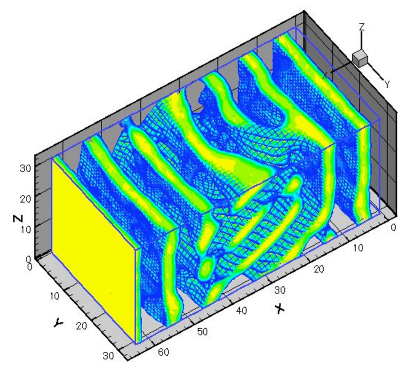
Theory and Simulation Thrust: ***developing novel theoretical, modeling and computational techniques specifically addressing nanoscale challenges***

Scientific Directions:

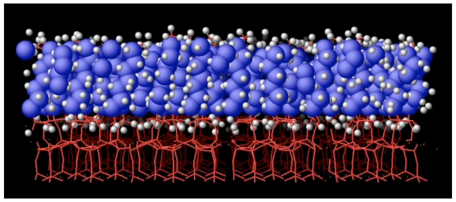
- Advance the complexity of the models currently used to match the complexity of the nanosystems: methods to treat the multiple time scales and multiple interaction types; theory of electronic transport and coupling between electronic, magnetic and mechanical degrees of freedom; force-fields to treat interfaces between dissimilar materials.
- Advance theories of self-assembly, including both directed and active assembly, to predict the self-assembled structure based on the molecular constituents.
- Develop theories of interfaces and surfaces, which are essential for nanoscience.
- Develop visualization capabilities that allow 3D characterization of properties of nanosystems, ranging from live cells, to nanostructures, to macromolecules.



Wetting and spreading of nanodroplets



Self-assembled nanostructures



Reliability of MEMS coating

It provides a cross-cutting theoretical foundation supporting the activities in other experiment-oriented thrust areas in CINT.

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Theory and Simulation Thrust—Current Activities

- Performing simulations on interactions of biomembranes with supporting substrates to understand how biological materials interact with non-biological materials.
- Modeling mechanical and fluidic coupling from nano to micro length scales.
- Investigating the phase segregation of nanoparticles to the substrate and its effect on suppressing dewetting.
- Modeling the elastic and inelastic electronic tunneling processes to investigate local properties of macromolecules (DNA).
- Conducting directly coordinated suite of experimental and modeling tests to elucidate the fundamental mechanisms that control friction between SAM-coated surfaces.
- Modeling the coupling between local scanned probes and mechanical, electronic and magnetic properties in organic and inorganic systems.
- Assessing the dynamic features of semi-flexible, biomimetic cytoskeletal gels through large scale molecular dynamics simulations.
- Modeling nano-indentation to study mechanical responses of nano-materials.
- Modeling electronic structure and excited-state dynamics of nanoscale electronic and photonic components.
- Developing theory of noise spectroscopy as a tool to investigate the dynamical properties on nanoscale systems.

CINT Discovery Platforms™: modular micro-labs for nanoscience

Discovery Platforms = "chips" that allow Users to:

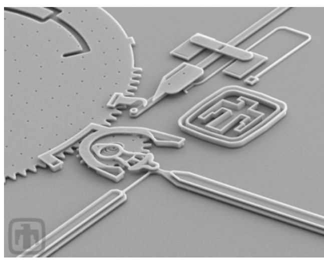
•Stimulate

•Interrogate

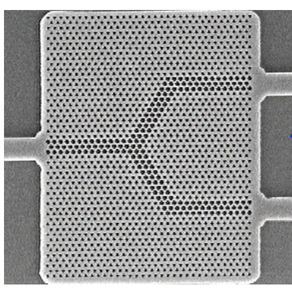
•Exploit

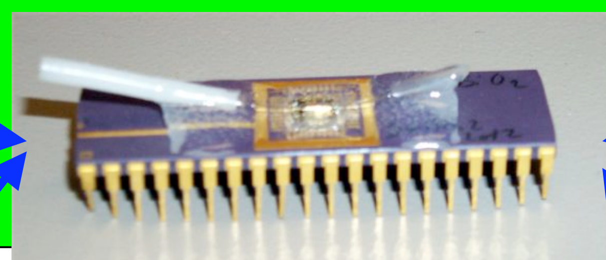
nanomaterials in microsystem environments

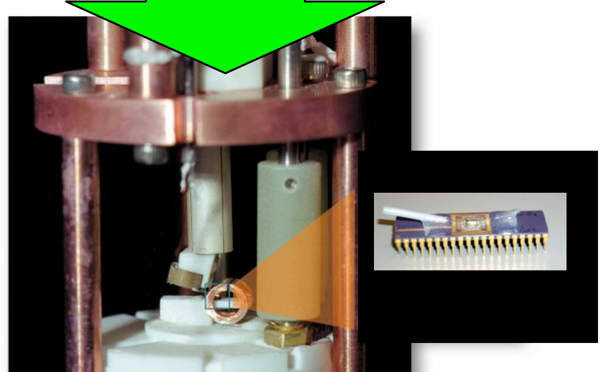
Mechanics



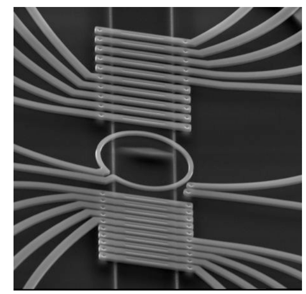
Optics



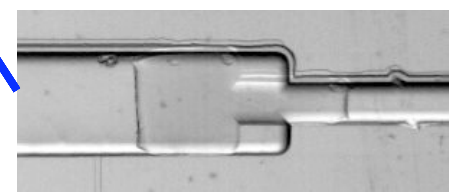




Electronics



Fluidics



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We are developing several prototype Discovery Platforms™

Five designs by internal/external teams

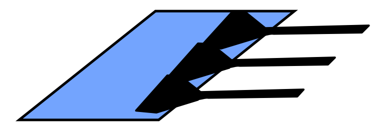
- **Customizable Cantilever**
- **Optical, Transport, and Photoconductor**
- **Microfluidic Synthesis**
- **2D Photonic Lattice**
- **Nanosystems Integration**
  (Common Platform Package)

Criteria for implementation

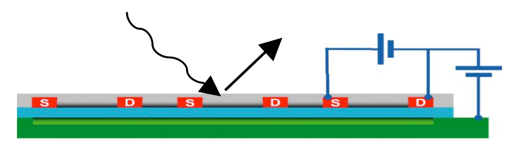
- External user need
- Science impact
- Design readiness

Design Objectives:

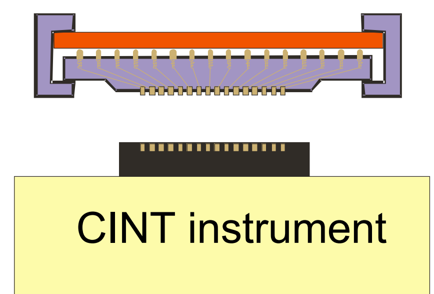
Simple design



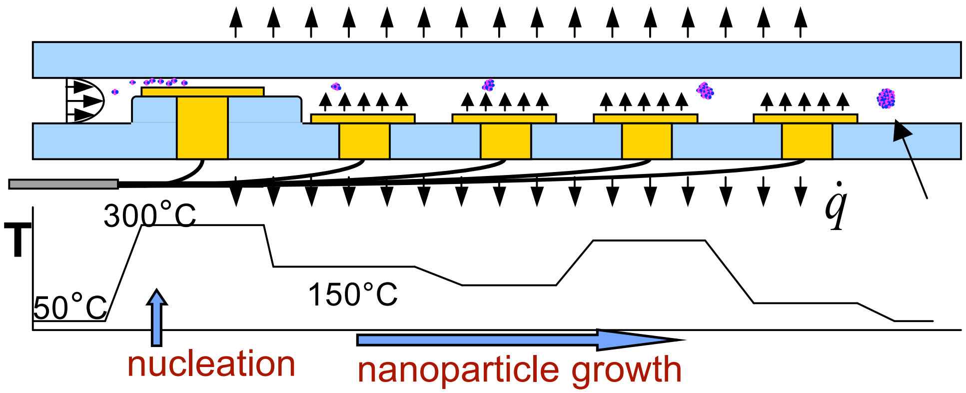
Multiple functions & statistics



Integration & compatibility



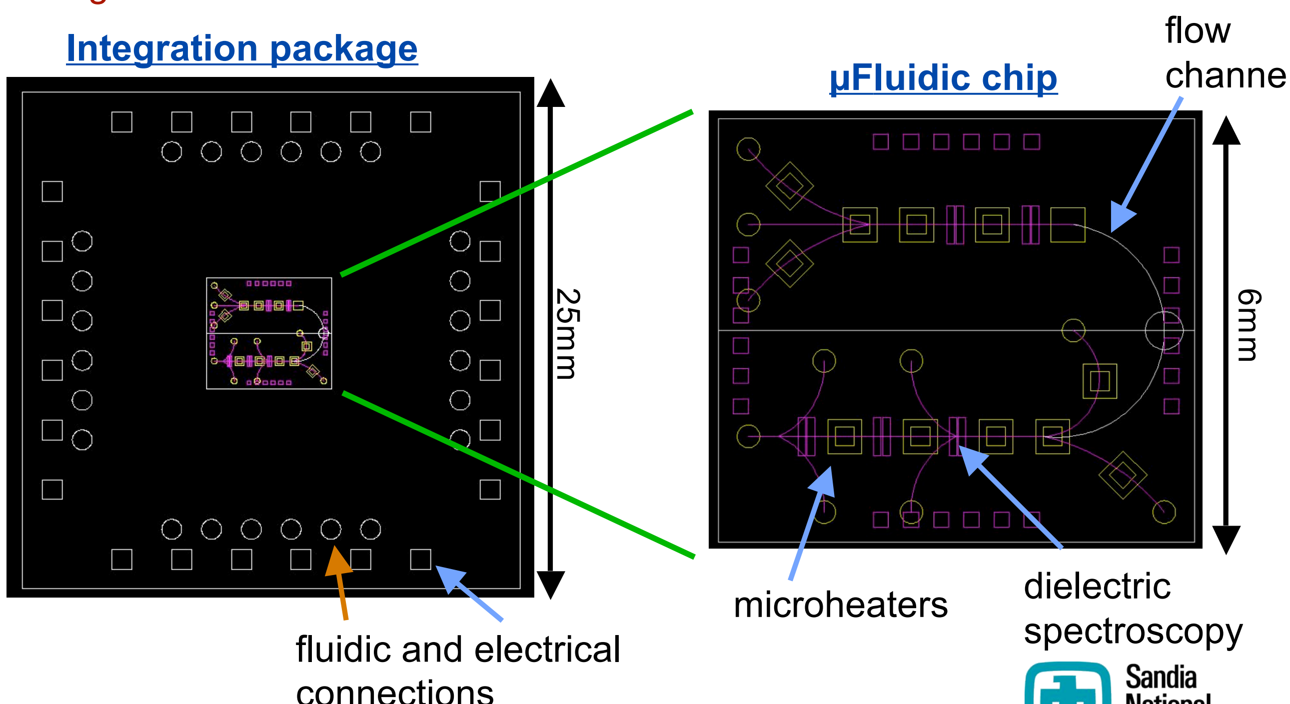
Microfluidic Synthesis Platform: Control Kinetics of Nanomaterial Synthesis



Control of thermal profile allows fundamental studies of synthesis reactions.

Development of basic understanding is needed for future "continuous flow" reactors.

- Microfluidic chip will be integrated within a carrier platform
- Users include synthetic chemists, quantum dot material synthesis.
- Development of chip:
  - 26 electric connections
  - 9 fluidic connections
  - 1 microfluidic cooling network



The Platform Development Cycle

Identify "Jump-Start" Capabilities

Collect Input: User Needs + Scientific Interests

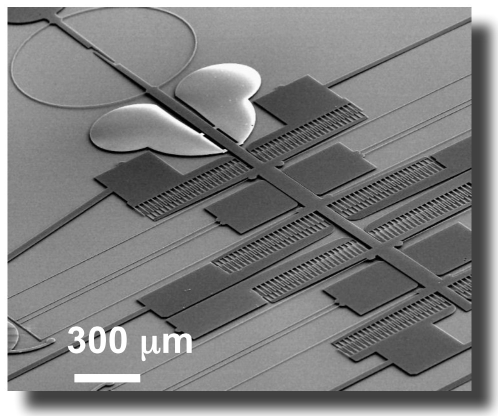
Design Initial Platform Set

Complete Fabrication of Initial Platforms

Test Platforms in User Environments (Shake-Down)

Evaluate Platforms

Generate Ideas For Next Platform Development Cycle



Each step in the development cycle will require active collaborations and input from CINT scientists, platform developers, and the CINT User Community.

We would like to have first versions of platforms ready for users by April 2006

Timeline:

June 2005 – Hold a small workshop of CINT staff, users, and microsystems designers to refine our concepts

July 2005 – Design first version of platforms and package for fabrication

September 2005 – Begin fabrication of platforms in the Microelectronics Development Laboratory and/or Compound Semiconductor Development Laboratory

October 2005 – Call for proposals for full operations

December 2005 – Begin testing of platforms

April 2006 – Platforms are available for users at CD-4a

Review of CINT Science

The highly interdisciplinary nature and rapid growth of nanoscale science research suggests that periodic review of the CINT science thrusts would be beneficial to ensure that they remain the optimally focused, high-level science directions for CINT. The transition period from jump-start to normal operations is an opportune time to conduct the first such internal evaluation prior to making the initial staffing assignments. We will engage our external Scientific Advisory Committee in this process during their next scheduled meeting in August 2005.

Center for Integrated Nanotechnologies
Governance Board/Scientific Advisory Committee Meeting
August 30-31st, 2005
Hilton Santa Fe Hotel

Thursday, August 31st
(Hilton Santa Fe, Aspen Room)

7:30 am	Continental Breakfast
8:00 am	Overview
9:30 am	Jump Start User Program
10:00 am	Break
10:15 am	Transition to Ops
11:30 am	Lunch (Science Highlights Posters)

(Hilton Santa Fe, Ortiz Room)

12:30 pm	SAC/GB Planning
12:45 pm	Progress on Discovery Platforms
2:00 pm	Discussion on CINT Science Thrusts
3:15 pm	Break
3:30 pm	SAC/GB meeting
4:30 pm	SAC and Governance Board caucus separately
5:00 pm	Feedback from Committee
6:30 pm	Off-site Dinner

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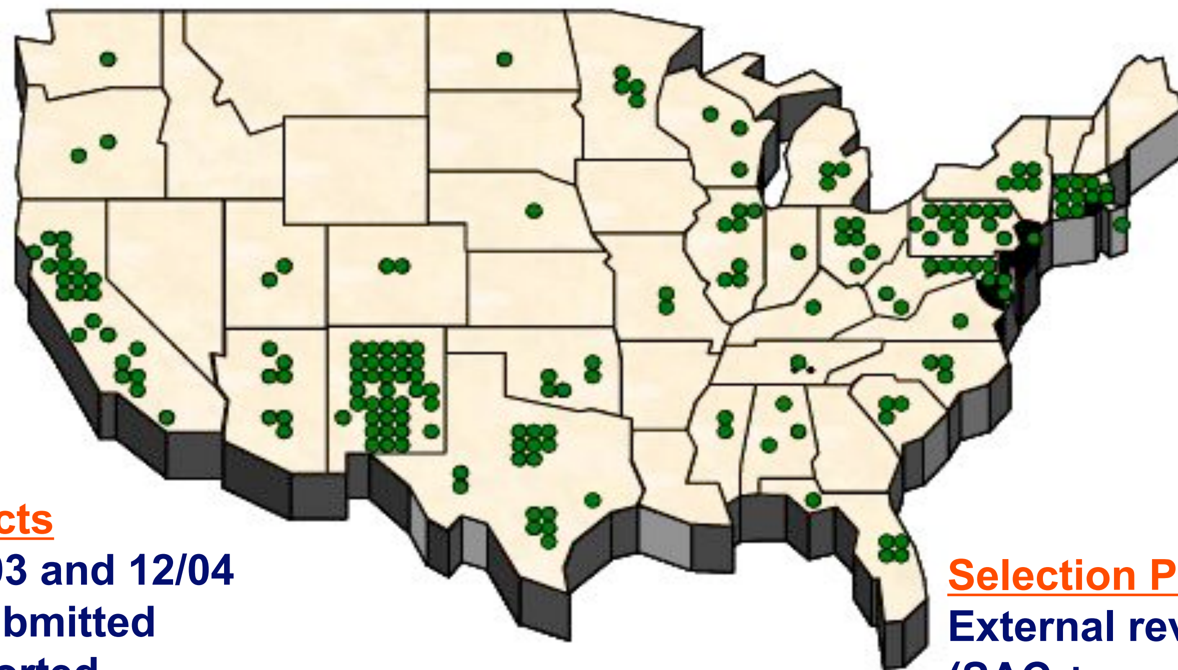
User Program

Jump Start User Program a Success



Jump-start Projects

Two rounds: 12/03 and 12/04

188 proposals submitted

65 projects supported

40 institutions (incl. 3 companies)

22 states

3 foreign countries

Selection Process

External review panel (SAC + current users + external experts)

Resource availability

3rd Jump-start Round

70 proposals received

Currently under review

Approved projects start August 2005

Initial Discovery Platforms available

Jump-start launched nanoscience integration research

The integration of top-down fabrication with bottom-up assembly.

Optical Characterization of Self-Assembled Metallic Nanoislands in Semiconductors

Arthur C. Gossard, University of California-Santa Barbara

Amphipol Aided Anchoring of Cytochrome P450c24 in Synthetic Lipid Bilayers

John Omdahl, University of New Mexico

Energy and charge transport across multiple length scales

Ultrafast Nonlinear Response of Nanostructured Metallodielectric Photonic Crystals

Miriam Deutsch, University of Oregon

Quantum Confinement and Strain Effects in Photonic Nanocrystals

Don A. Lucca, Oklahoma State University

Coupling of mechanical and fluidic forces across multiple length-scales

Phase Formation and Phase Transition of Ferromagnetic Nanoparticles, Pairs and Arrays

Jian-Ping Wang, University of Minnesota

Fatigue and Structural Properties of Engineering Materials Coated with Multiple Nanolayers

Julia Weertman, Northwestern University

Integration of biological and synthetic materials

Assembling Single-Walled Carbon Nanotubes Using Kinesin Based Molecular Motors

Robert Haddon, University of California, Riverside

Biomineralization and Nanostructured Biopolymer Interfaces

Robert J. Asaro, University of California - San Diego

Jump-Start User Program — Lessons Learned Process Underway

- Feedback obtained from CINT Workshop attendees via questionnaires.
- Web survey to be filled out by CINT jumpstart users.
- Internal questionnaire for CINT scientists to suggest improvements based on user interactions.

CINT General User Access

- General Users are individuals or groups who need access to the facility to carry out their research, using existing resources in CINT.
- General Users apply for access by submission of a proposal that is evaluated by the Proposal Review Committee.
- In normal operations, the scope of a General User proposal can vary from a single experiment proposal to a program proposal (valid for multiple visits and substantial access to a range of equipment extended over multiple years) to a "special" proposal (i.e. rapid access, feasibility studies, etc.)
- Individual and group proposals, including collaborative proposals with CINT staff, are encouraged.

CINT Partner User Access

- Partners are individuals or groups who not only carry out research at CINT but also enhance the capabilities or contribute to the operation of the Center..
- These contributions must be made available to the General Users and so benefit them as well as the facility.
- In recognition of their investment of either resources or intellectual capital and in order to facilitate and encourage their involvement, Partners may be allocated limited access to one or more facilities over a period of several years, with the possibility of renewal.
- Partner scientific programs are subject to the same peer review process as General Users.

Proprietary and Non-Proprietary Research

- While the vast majority of user research should be in the public domain, and so must be disseminated by publication in the open literature, there can be access for proprietary research that utilizes these unique facilities to benefit the national economy.
- Users conducting proprietary research may access the facility as either General Users or as Partners.
- Full cost recovery will be obtained for proprietary research, and efforts will be made to secure appropriate intellectual property control for proprietary users to permit them to exploit their experimental results.

Proposal Submission & Evaluation

- The CINT Management Team will allocate the resources of the user program to assure that a full range of user modes is made available to the community.
- Proposal requirements will be kept simple, follow a graded approach related to the type of access proposed, and allow for a rapid turn around.
- Proposals will be accepted at any time and reviewed on a roughly 3 times per year. (Semi-annual Calls in transition)
- The CINT Director will reserve a fraction of the user resources for immediate access needed to address time critical or new developments.

Proposal Submission & Evaluation (con't.)

- Criteria endorsed by the International Union of Pure and Applied Physics will be used to evaluate user proposals: science quality followed by relevance to CINT thrusts and programs will be the principle criteria. Proposals for proprietary use will follow a similar but separate process.
- PRC members will provide a spread in scores between highest and lowest rated proposals, plus brief objective comments to support their ratings, thereby providing the basis for CINT resource allocation.
- The CINT Management Team will balance PRC recommendations against available center resources and CINT science priorities to make final user access award decisions.

User Access Allocation, Scheduling, and Recording

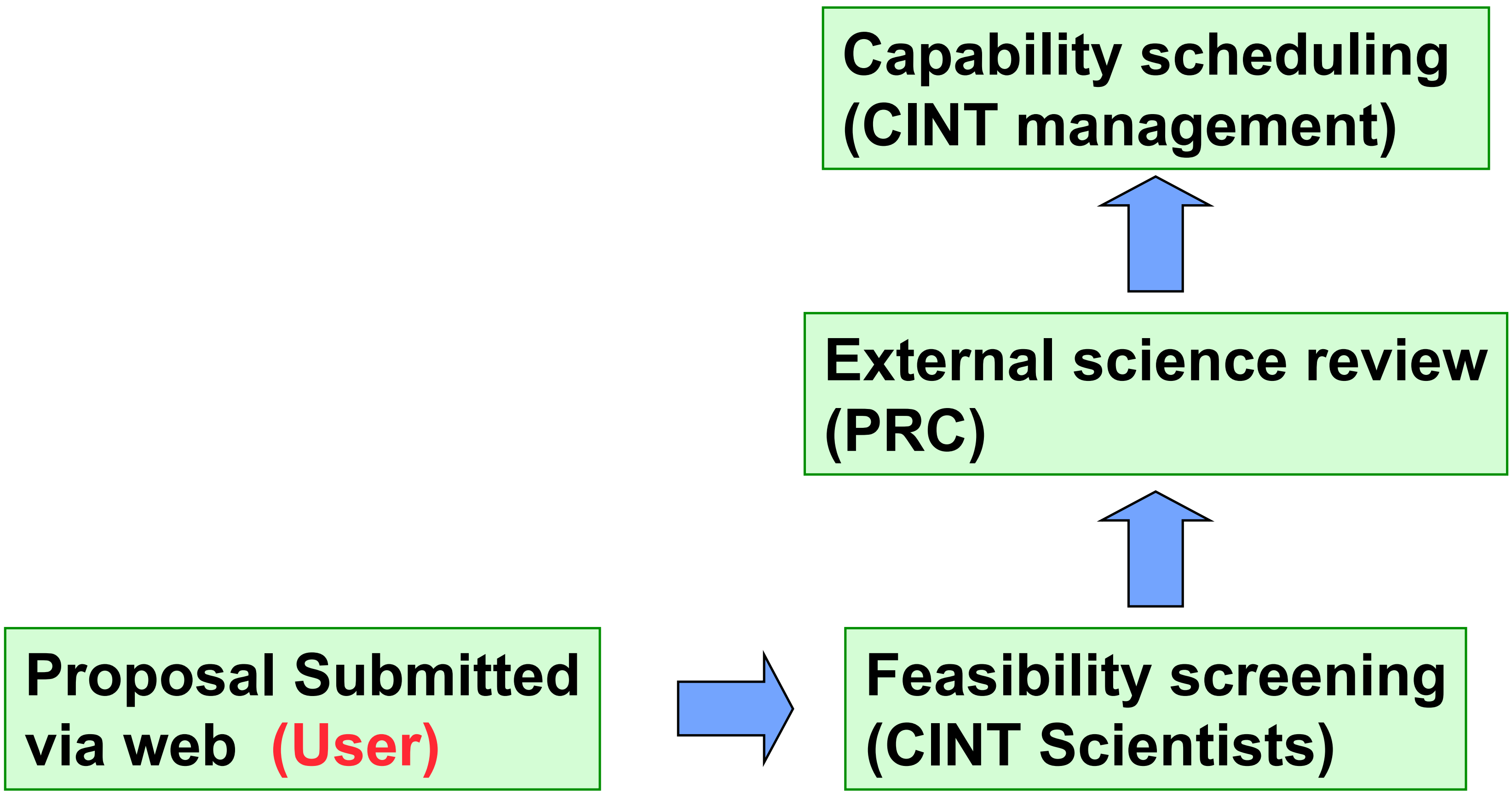
- Allocation of access to equipment and facilities for General Users will be done based on the rankings provided by the PRCs.
- Partners will manage their own scientific programs, subject to PRC review and the terms of the Partner User Agreement in force, and will allocate access among their members.
- Scheduling of user access will be centralized through the CINT User Program Manager working with the CINT User Administrators at SNL and LANL with input from CINT staff and Partner representatives.
- Center management will have ultimate responsibility and accountability for effective and efficient utilization of time on all equipment at the facility

How to become a CINT User

1. Formulate nanoscience integration idea
2. Determine capability & expertise needs
3. Identify appropriate CINT capabilities (web site)
4. Discuss idea with CINT Scientists (optional)
5. Determine appropriate User Access Mode
6. Write short user proposal
   (independent or collaborative)
7. Submit via CINT web site

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

Proposal processing



User Program in Normal Operations

- Implement lessons learned from jump-start
- Multi-year user projects (with annual progress review)
- Integrated-training at SNL/LANL
- Improving Foreign National access
- Focused Calls for User Access
- Discovery Platforms™

User access in transition period

- Continue semi-annual Call for User Proposals until fully operational (CD-4b) in May 2007
- Next Call: November 2005. Projects will begin in April 2006 (CD-4a).
- Offer CD-4a labs in new Facilities, selected leveraged BES core research, Discovery Platforms™, and User Facilities.
- Incrementally add CINT capabilities in new Facilities, integrate relevant core BES expertise into CINT, increase dedicated staff, expand Discovery Platforms™
- Increase private sector user participation
- Develop Partner User criteria

Workshops engage the CINT science community

1st User Workshop (9/28/01) -- 200 attendees

Construction and special equipment planning, science thrust discussions

2nd User Workshop (6/5/03) -- 194 attendees

Nanoscience integration challenges, outreach, jump-start capability Expo

3rd User Workshop (1/19/05) -- 218 attendees

User science talks, Discovery Platforms™, jump-start capability Expo

3rd CINT User Workshop: January 19-21, 2005 Albuquerque, NM

– CINT update
– Invited speakers from user community.
– Plenary: Harold Craighead, Cornell
– Breakout discussion sessions on "Discovery Platforms"
  - Biology/Fluidics (Bonnell, U Penn; Meldrum, UW)
  - Energy Transport (Basov,UCSD; Marcus, Harvard)
  - Nanomechanics (Nix, Stanford; Cleland, UCSB)
  - Electronics and Organic/Inorganic Materials (Reed, Yale; Tanaka, Osaka)
  - Synthesis Assembly (Braun, UIUC; Lu, Tulane)
– CINT capability information/poster session; "User Expo"
– CINT User meeting: User input and feedback

218 attendees

Academia, industry, government

24 states, 20 countries

Discovery Platform Workshop June 29-30 at Sandia

Wed., June 29

8:00 am Opening remarks and introductions
8:15 am Presentations by each team of pre-workshop planning
10:00 am Breakout I
Goal: Define science functions and identify potential users
12:00 pm Working Lunch: Cross cutting issues
1:00 pm Tour MDL Fabrication Facilities – *Linda Cecchi*
1:30 pm Breakout II
Goal: Rough design layout
4:00 pm Progress reports
5:00 pm Break
6:00 pm Dinner (Marriott Hotel)
7:30 pm Informal team & cross team discussions (Marriott Hotel)

Thurs., June 30

8:00 am Cross-design issues
8:15 am Breakout III
Goal: Detailed design plan
11:30 am Lunch & Feedback: Design readiness discussions
1:00 pm Breakout IV:
Goal: Process & test sequence
4:00 pm Closing remarks

Prototype Platform designs created by CINT/external teams

Customizable Cantilever
John Sullivan (lead)
Chris Apblett,
Dave Bahr (WSU)
Charles Barbour
Maarten de Boer
Dustin Carr
Devons Gust (ASU)
Steve Howell
Steve Koch
Amit Misra
Taher Saif (UIUC)
Harold Stewart
Greg Swadener,

2D Photonic Lattice
Victor Klimov (lead)
Anatoli Efimov
Jim Fleming
Mark Hoffbauer
Garry Maskaly
Karlene Maskaly
Greg Nordin (U. Alabama)
Joel Wendt

Nanosystems Integration
Mike Lilly (lead)
Eshan Akhadov
Matt Blain
Joe Bauer
Sean Hearne
Albert Migliori
Ron Renzi

Microfluidic Synthesis
Nelson Bell (lead)
Ron Besser (Stevens I T)
Jenn Hollingsworth
Conrad James
Paul Galambos
Ping Liu (UT Arlington)
Murat Okandan
Chris McGee (Lake Shore Cryo)
Melissa Petruska
Tom Sounart
Andy Shreve
Jim Voigt

Optical, Transport and Photoconductor
Richard Averitt (lead)
Dmitry Basov (UCSD)
Malcolm Carroll
Jim Glownia
Rohit Prasankumar
Mark Reed (Yale)
Alec Talin
Alan Vawter
Dzmitry Yarotski

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Dedicated Facilties

The CINT Core/Gateway model embodied with physical user facilities

Core Facility in Albuquerque

CINT Gateway to Sandia
Nanomaterials/Microfabrication

CINT Gateway to Los Alamos
Nanomaterials/Biosciences

Buildings Complete	**November 2005**
Begin Operations	**April 2006**
Construction Complete	**June 2007**

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The Core Facility

- 95,200 gross square feet
- Sited on 20 acre lot on DOE property outside Kirtland Air Force Base
- 150 Occupants
- 9,400 SF - synthesis labs
- 9,400 SF – low vibration characterization labs
- 10,900 SF - class 1000 clean room

On schedule for completion in November 2005

Core Facility Status

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The Gateway to Los Alamos

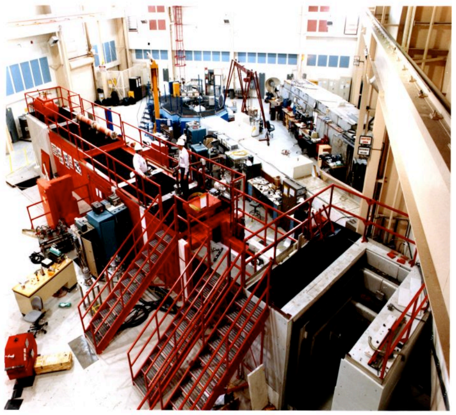
- **36,500 gross square feet**
- **50 Occupants**
- **Synthesis and Characterization labs**
- **Computational Graphics Room**
- **Computer Laboratory**

On schedule for completion in November 2005

Gateway Facility Status

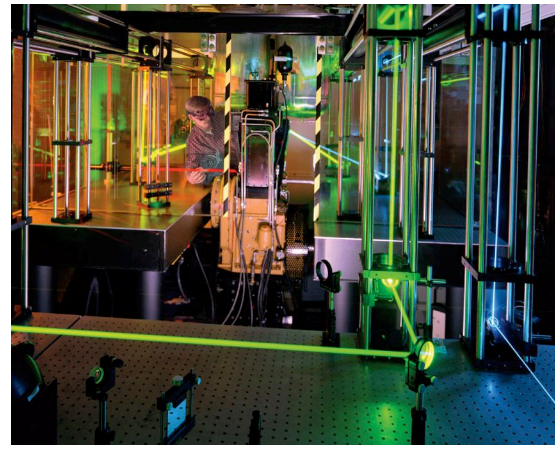
CINT also leverages facilities at SNL and LANL

Los Alamos Neutron Science Center



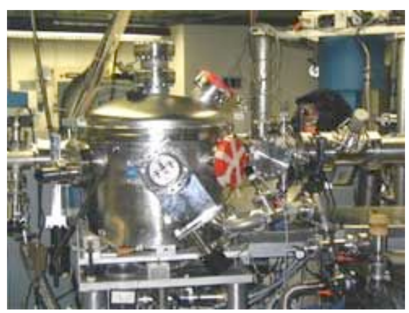
National High Magnetic Field Lab

Combustion Research Facility

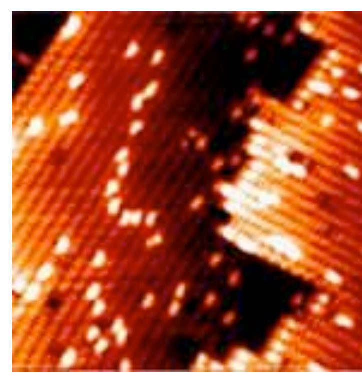


<u>MicroElectroMechanical Systems</u>

<u>Ion Beam Materials Laboratory</u>



<u>Scanning Probe Microscopy Facility</u>



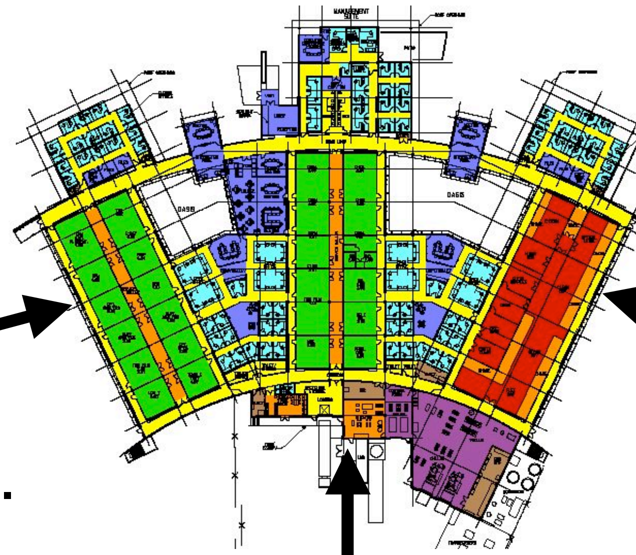
Los Alamos
NATIONAL LABORATORY

Sandia
National
Laboratories

CINT special equipment supports complementary activities in three facilities

Characterization

- TEM, SEM, FE-SEM
- AFM
- FTIR, UV/VIS, X-ray
- Nano-indenter
- Low T Mobility
- Ultra-fast Laser Spec.
- Raman Spec.



Integration

- E-beam lithography
- Photolithography
- Thin Film Depostion
- REI, Plasma Etch

Gateway to Sandia

- AT-STM
- IFM
- Chem prep oxide
- LB Film
- microfluidics

Synthesis

- MBE
- PLD
- P-CVD
- Wet Chem
- Bio

Gateway to Los Alamos

- NSOM, AFM
- SEM
- Nano-indenter
- Ultra-fast Laser
- Comp. Cluster

Los Alamos NATIONAL LABORATORY

Sandia National Laboratories

Special Equipment Process and Status Highlights

- Special equipment team brings together technical, procurement, and ES&H experts from both SNL and LANL.
- Safe installation and operation are explicitly considered early in the procurement process
- Established process for Core/Gateway special equipment decisions is working well.
- Procurement through Sandia creates efficiencies
- Long lead items being fabricated
- Other tool sets on schedule or ahead
- Bundling of Core & Gateway tools is effective
- Opportunities to transfer equipment to CINT to enhance CINT capabilities; maintain project schedule, cost advantages
- Baseline changes include cost basis revisions, tool-specific contingencies (average 15.8%), test & checkout.

Core Facility Special Equipment

Synthesis Tools:

Molecular Beam Epitaxy (MBE)
Pulsed Laser Deposition System (PLD)

Characterization Tools:

Transmission Electron Microscope (TEM)
Atomic Force Microscope (AFM)
Fourier Transform Infrared Spectrometer (FTIR)
Spectroscopic Ellipsometer
Ultraviolet/Visible Spectrometer
Nano-Indenter
Field-Emission Scanning Electron Microscope (FE-SEM)
Top Loading Dilution Refrigerator
Superconducting Magnet
Ultrafast Laser System
Femtosecond Oscillator Pump Laser
CW Laser System for Raman Spectroscopy
Scientific Grade CCD Detector Array
Time Correlated Single Photon Counting System

Core Facility Special Equipment (con't.)

Integration Lab Tools:

- Electron Beam Writer
- Photolithography Mask Aligner
- Reactive Ion Etch tool
- Electron Beam Evaporator tool
- Inductively Coupled Plasma Chemical Vapor Deposition (ICP-CVD)
- Rapid Thermal Annealer
- Profilometer
- Wafer Processing Tools
- Clean Room Benches (Solvent, Acid, Base)
- Inductively Coupled Plasma Reactive Ion Etch (ICP-RIE)

Gateway to Los Alamos Facility Special Equipment

Synthesis Tools:

Langmuir-Blodgett Trough

Characterization Tools:

Near-Field Optical Microscope (NSOM)
Spectroscopic Ellipsometer
Ultraviolet/Visible Spectrometer
Environmental Scanning Electron Microscope (SEM)
Atomic Force Microscope (AFM)
Nano-Indenter
Ultrafast Laser
Oscillator Pump

Other

Computational Cluster

Gateway to Sandia Facility
Existing Special Equipment

Synthesis Tools:

- MBE systems (Si/Ge & Metals)
- Langmuir-Blodgett /Self-assembly
- Biology labs / chem labs

Characterization Tools:

- Near-Field Optical Microscope (NSOM)
- Spectroscopic Ellipsometer
- Ultraviolet/Visible Spectrometer
- Scanning Electron Microscope (SEM)
- Atomic Force Microscope (AFM)
- Interfacial Force Microscope (IFM)
- Atom-Tracking Scanning Tunneling Microscope
- Low Energy Electron Microscope
- Transmission Electron Microscope (TEM)

Special Equipment Status

Combined special equipment for Core and Gateway Facilities: 37 items, $11,519K

Contracts placed:	**7 items**	**$5,615K**
Contracts in progress:	**11**	**2,839K**
Specifications in progress:	**13**	**2,875K**
Transfers:	**6**	**190K**


Project Status Summary

Core Facility Subproject

- **Building is 54% complete at end of April**
- **On schedule**
- **Schedule float prior to CD-4a is 12 weeks**

Gateway Facility Subproject

- **Building is 43% complete at end April**
- **On schedule**
- **Schedule float prior to CD-4a is 12 weeks**

Special Equipment

- **49% of procurements committed**
- **Ahead of schedule**

Overall project: 53% complete
Overall contingency is >20%

Status as of 6/1/05 Lehman review

Safe Operations

ES&H throughout the process…

- Started at functional programming of labs
- Explicitly considered when writing equipment specs
- Included in contracts to vendor for installation
- SNL & LANL ES&H experts are permanent members of CINT project team
- Use established safety and security processes and personnel at both National Labs
- Firm hand-off of responsibility from equipment SME to lab owner during transition to operations process
- Joint management effectively spot-lights ES&H

CINT ES&H Coordinators

- **ES&H Coordinator at each Facility**
  - **Core: Mike Starr** (transfer from Microelectronics)
  - **Gateway to SNL: Wayne Davis**
  - **Gateway to LANL: Betsy Grindstaff**
- **ES&H reporting through CINT line organizations at SNL and LANL**
- **Weekly videoconference with User Program Manager**
- **CINT Scientist will have ES&H authority and responsibility for each laboratory**

User Training

- Training requirements defined during commissioning of each lab/capability/instrument.
- User training checklist generated from capabilities requested in User proposal (automated)
- Exploit web-based pre-training whenever possible
- Coordinate SNL/LANL requirements to avoid duplication
- Access to labs (Core) controlled by card-readers linked to user database / training record
- Common database for all CINT users

CINT ES&H policy follows SNL/LANL integrated safety management systems

- Focus on creating a safe-operations culture
- Use ES&H resources (personnel, web)
- Commissioning and periodic inspections
- Documentation
- Electronic training records
- ES&H subject matter experts

*SECTION 13D - READINESS REVIEW PROCESS - PLANNING, REVIEW, AND APPROVAL

Subject Matter Experts: Nuclear - Dann Ward, Nonnuclear - Tim Stirrup; CA Counterpart: Herman Armijo
Contributors: Warner Talso and Fred March
MN471001, Issue B
Revision Date: July 15, 2003, Replaces Document Dated: October 29, 1999

* Indicates a substantive change

- *Applicability
- *Sandia Readiness Review Process
- *All Sandia Activities
- *Business Occupancy Readiness Review Process
- *Standard Industrial Hazard Readiness Review Process
- *Low-Hazard Nonnuclear Readiness Review Process
- *Moderate- and High-Hazard Nonnuclear Activities Readiness Review Process
- *Accelerator Activities Readiness Review Process
- *Nuclear Activities Readiness Review Process
- *Records
- *Related Hazards and Activities
- *References
- Attachments
  - *13D-1 - Required Readiness Review Documentation by Hazard Classification
  - *13D-2 - Guidelines for Planning Standard Industrial Hazard and Low-Hazard Reviews
  - *13D-3 - Startup/Restart Review for Standard Industrial Hazard and Low-Hazard Nonnuclear Operations
  - *13D-4 - Checklists

M. Wayne Davis
1100 Center ES&H Coordinator

1000 ES&H Homepage

ES&H Vision

Center 1100 ES&H Help Page

- Basic ES&H On-Line Web-Based Corporate Training
- Training
- Interactive Learning Classroom (ILC), Computer-Based Training
- PHS/HA
- Chemical Information System (CIS)
- Standard Operating Procedures
- Operating Procedure
- ES&H Manual
- Pressure Safety
- Electrical Safety Manual
- Radiologicial Protection Procedures Manual (RPPM)
- RGD and Source Registry
- Link to Waste Management Information & Documents
- Cabinet form for Bldg. 897 (Word doc - 11kb)
- Integrated Safety Management
- Center 1100 ISMS Summary

dalapor@sandia.gov
Last Modified on April 29, 2005

Los Alamos NATIONAL LABORATORY

Sandia National Laboratories

Facility Commissioning

Facility commissioning

- Facility commissioning is defined in extensive commissioning plans for each facility, and includes:
  – Inspection and acceptance process
  – Acceptance testing
  – System performance tests
  – Operator training
  – Retention of records
- Operation of the facilities will not begin until completion of life safety systems
- Core & Gateway Facility commissioning scheduled for 11/05; beneficial occupancy 12/05.

Special equipment commissioning

- Commissioning of Special Equipment includes:
  - Installation and fit up of utilities
  - Calibration and verification tests by vendor
  - Checkout by SME
  - Operator training
  - Formal acceptance of equipment from vendor
- Scheduled for 12/05 (buildings completion) to 03/06 for CD-4a labs and through 05/07 for all special equipment (CD-4b).

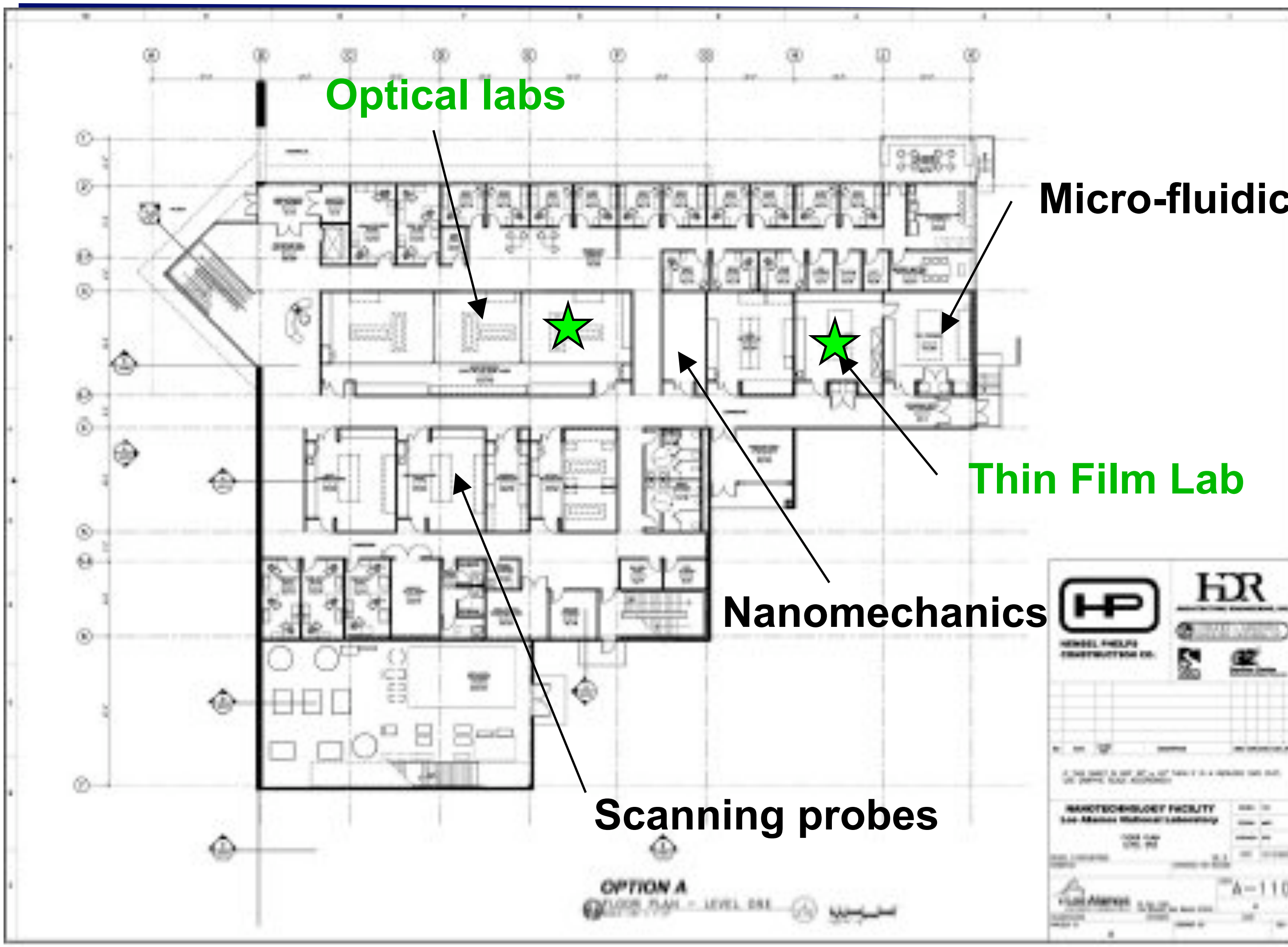
Lab-by-Lab commissioning process

- SME identified for each lab
- Procurement and acceptance of special equipment (lab SME interfaces with equipment SME).
- Temporary IWD generation (LANL) or PHA (SNL)
- [Building commissioning]
- Installation of all necessary administrative and engineering controls for safety considerations
- Installation of the special equipment including lab furniture, utilities, training, acceptance, or other special considerations.
- Completion of the Management Self Assessment (LANL).
- Completion of the Readiness Assessment.
- Acceptance for operation by CINT Project Director, DOE, Laboratory ES&H, Facility, and Line Management.

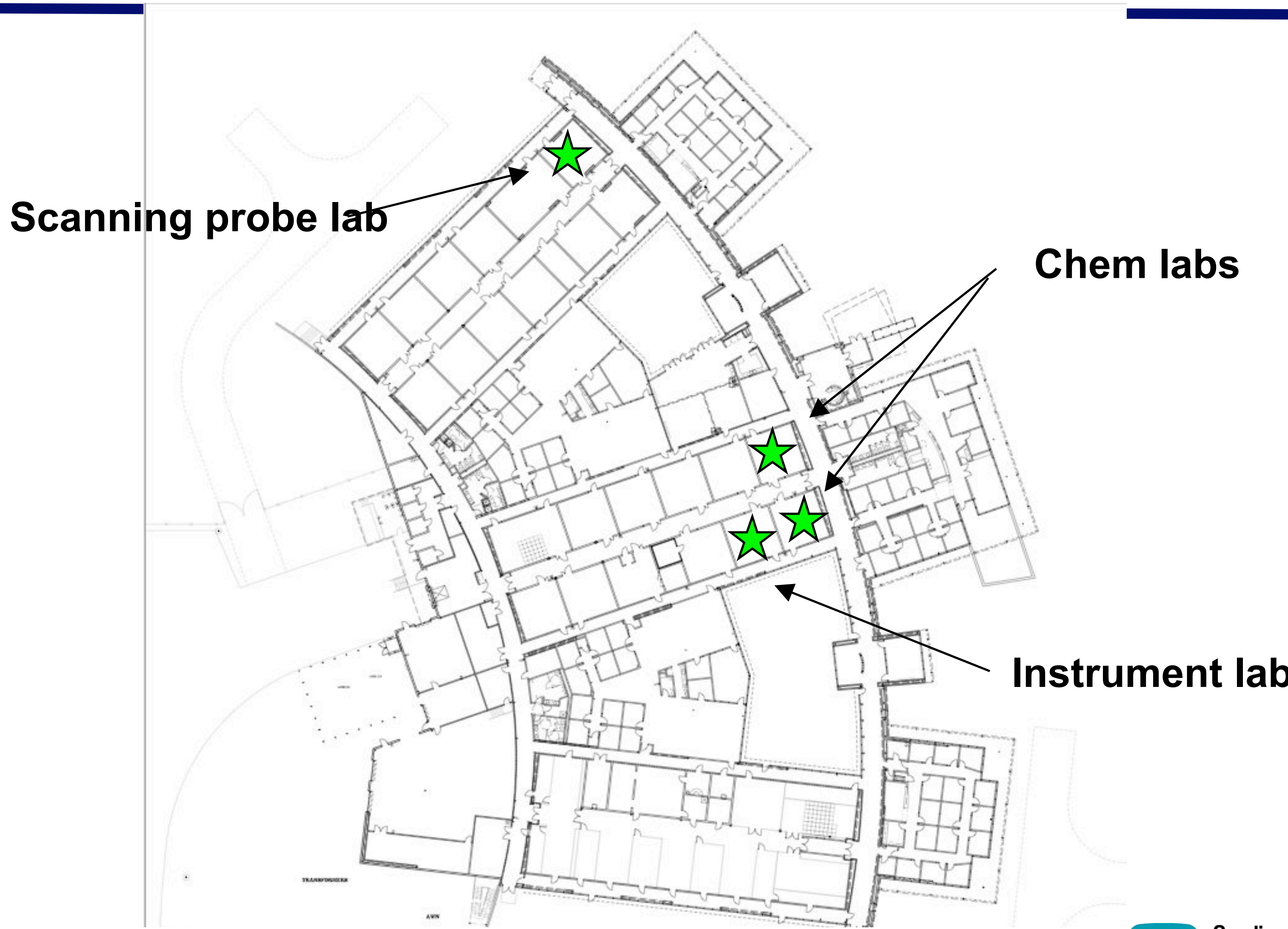
Operational Labs at CD-4a

- Core Facility:
  - 2 Chemistry Labs (Lab SMEs: Jeff Brinker/Timothy Boyle)
  - Chemical Diagnostics Lab with FTIR, Ellipsometer, UV-vis (Lab SMEs: Dale Huber)
  - Scanning Probe Lab with AFM (Lab SMEs: Alan Burns)
- Gateway to Los Alamos Facility:
  - Spectroscopy/Novel Optical Scanning Probe Laboratory with Ultrafast Laser System (Lab SME: Jeff Roberts)
  - Thin Films Laboratory with Spectroscopic Ellipsometer (Lab SME: Andrew Dattelbaum)
- Hazards to be addressed:
  - Class 4 lasers
  - Chemical operations in hoods

LANL Gateway—1st Floor



Core Facility



Phased commissioning of labs after CD-4a

Sequence determined by assignment/hiring of lab SMEs and special equipment commissioning schedule

- **April 2006 —** **CD-4a labs**
- **July 2006 —** **Core: MBE, bio labs, synthesis labs**
  Gateway: Microscopy, nanofluidics, nanomechanics
- **Oct. 2006 —** **Core: SEM, laser labs, nanoindenter**
  Gateway: Chemical synthesis
- **Jan. 2007 —** **Core: E-beam, low-T transport, PLD**
  Gateway: Biology
- **March 2007—** **Core: Integration Lab, TEM**
  Gateway: Scanned probes, computer cluster
- **May 2007 —** **CD-4b granted**

Staffing Plan

CINT Staffing in Normal Operations

- A critical mass of leading laboratory scientists who work with users to advance the state-of-the-art nanoscience for CINT's Scientific Thrust Areas and integrated science directions.
- Technical support staff to operate and maintain experimental and computational capabilities in support of the user community and CINT's integrated science directions.
- A management team to support a user friendly, open and peer-reviewed international user program that meets the safety and security needs of DOE and the laboratories.
- Funding and technical support for maintenance, up-keep, and re-capitalization of CINT's specialized scientific equipment.
- Continued access to selected Gateway capabilities as they become integrated into the science thrusts.

Staffing Plan

- Populates Thrust Leader, CINT Scientist, and technical support staff positions at both SNL and LANL
- Integrated staffing as one NSRC
- Driven by science thrusts; optimized for CINT
- Provides highly desirable career opportunities for LANL and SNL employees (BES+NNSA hybrid)
- Builds on success of BES Core research programs at SNL/LANL (highly leveraged support, NNSA infrastructure, etc.)

Thrust Leaders

- Formal roles and responsibilities (in draft) become primary activity for all Thrust Leaders
- Initially CINT supported LANL and SNL Thrust Leaders (0.5 FTE each)
- Review of Science Thrusts (internal + SAC) will result in guidance for evolution of emphasis
- Some Thrusts will transition to a single Thrust Leader (1.0 FTE) at either LANL or SNL

Initial Thrust Leader Assignments (FY06)

Nano/Bio/Micro Interfaces: Andy Shreve, Bruce Bunker

Nanophotonics and Nanoelectronics: Victor Klimov, Mike Lilly

Nanomechanics: Mike Nastasi, John Sullivan

Complex Functional Nanomaterials: Rick Averitt, Jun Liu

Theory and Simulation: Sasha Balatsky, Eliot Fang

CINT Scientists

- Organized by Thrusts across SNL/LANL.
- Distributed at Core & Gateway Facilities.
- Primary responsibility is to CINT.
- Secondary support possible from aligned research project (BES, LDRD, NNSA).

Technical Support

- **Full time positions at both SNL and LANL.**
- **Assigned to User support at Core and Gateways.**
- **Provide essential role for safe and secure operations of laboratories.**
- **Career interests in technique development and new applications.**

CINT staffing at CD-4a

- **Management team (Director, Associate Director, Chief Scientist, User Program Manager)**
- **Additional support (User Administrators, building, web support, managers, ES&H personnel, administrative support)**
- **Thrust leaders (10)**
- **CINT post-docs (2 hired, more to come)**
- **Approximately 75% of CINT scientific staff will be identified for start of normal operations and will be phased in between CD-4a and CD-4b.**

Nanophotonics and Electronics

- Thrust Leadership: Victor Klimov (LANL); Mike Lilly (SNL)
- Physicist - quantum transport and nanoelectronics
  - TBD (LANL new hire)
- Materials Scientist - MBE materials growth
  - John Reno (SNL)
- Physicist - ultra-fast and NSOM measurements, nano-photonics
  - Han Htoon (LANL new hire)
- Physicist - photonic crystal physics and spectroscopy
  - Anatoly Efimov (LANL new hire)
- Materials Chemist - colloidal synthesis of quantum dots, nanoparticles
  - TBD (LANL new hire)
- Materials Science/Physicist - electron beam lithography, nanostructures
  - Aaron Gin (SNL new hire)
  - Jeff Cederberg (SNL)

Complex Functional Nanomaterials

- Thrust Leadership: Richard Averitt (LANL); Jun Liu (SNL)
- Organic chemist: design and synthesize organic precursors, ligands.
  - Dale Huber (SNL)
- Inorganic materials scientist: inorganic based nanocrystalline materials
  - Sergei Ivanov (LANL new hire)
- Scientist in surface and interfacial chemistry.
  - Julia Hsu (SNL)
- Polymer chemist: develop novel functional polymer materials.
- Materials scientists in self-assembly:.
  - Darryl Sasaki (SNL)
- Physicist—nanoscale characterization, scanned probes
  - Gary Kellogg (SNL)
  - Brian Swartzentruber (SNL)
  - TEM specialist (SNL)
- Physicist – advanced optical spectroscopy of nanomaterials
  - Rohit Prasankumar (LANL new hire)
- Physicist—characterization of electronic properties of nanomaterials
  - TBD (LANL new hire)

Nanomechanics

- Thrust Leaders: Mike Nastasi (LANL); John Sullivan (SNL)
- Materials Science – nanostructure characterization
  - Amit Misra (LANL)
- Materials Science – mechanical deformations in solids
  - Greg Swadener (LANL)
  - Sean Hearne (SNL)
- Biophysics – molecular mechanics of biological structures
  - Steve Koch (SNL)
- Device engineer – design and testing microscale mechanical test platform
  - tbd (SNL new hire)
- Materials Science – thin film deposition
  - Jerry Floro (SNL)

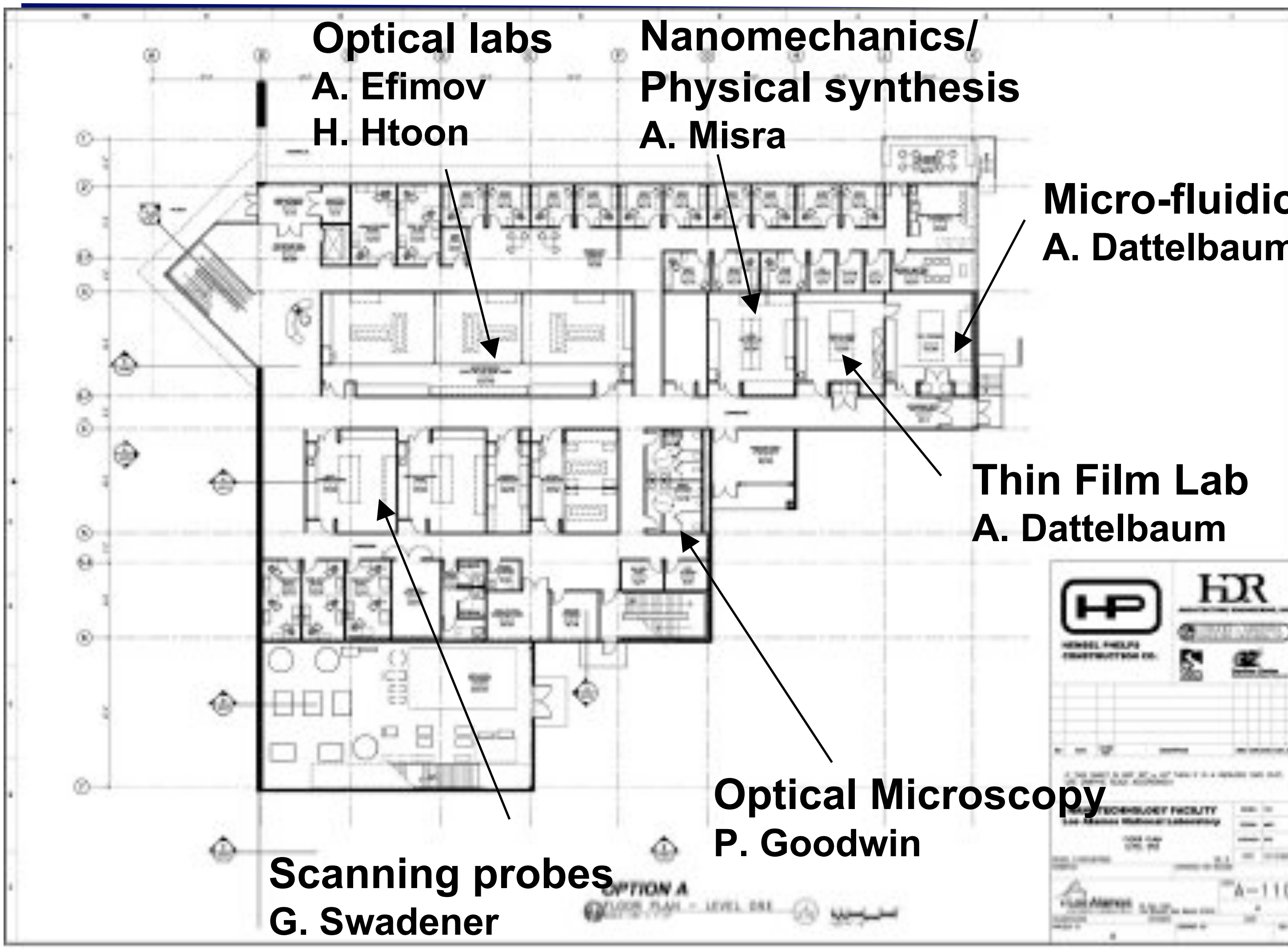
Nano-bio-micro interfaces

- Thrust Leaders: Andy Shreve (LANL); Bruce Bunker (SNL)
- Protein Chemist/Ligand Development - Understand structure-function relationships in proteins.
  - Jennifer Martinez (LANL)
- Microbiologist - Use organisms for the synthesis of biomaterials.
  - Roberto Rebeil (SNL)
- Biomaterials Expert - Understand biomaterials, biomimetic synthesis.
  - Gabriel Montano (LANL new hire)
  - George Bachand (SNL)
- Bio-Characterization Expert - Develop/use scanning probe and optical methods for imaging, manipulating, and characterizing biomaterials.
  - Andrew Dattlebaum (LANL)
  - Alan Burns (SNL)
- Develop new tools for characterizing complex biomaterials and functions
  - Peter Goodwin (LANL)
- Develop characterization "platforms".
  - Elshan Akhadov (LANL new hire)

Theory and Simulation

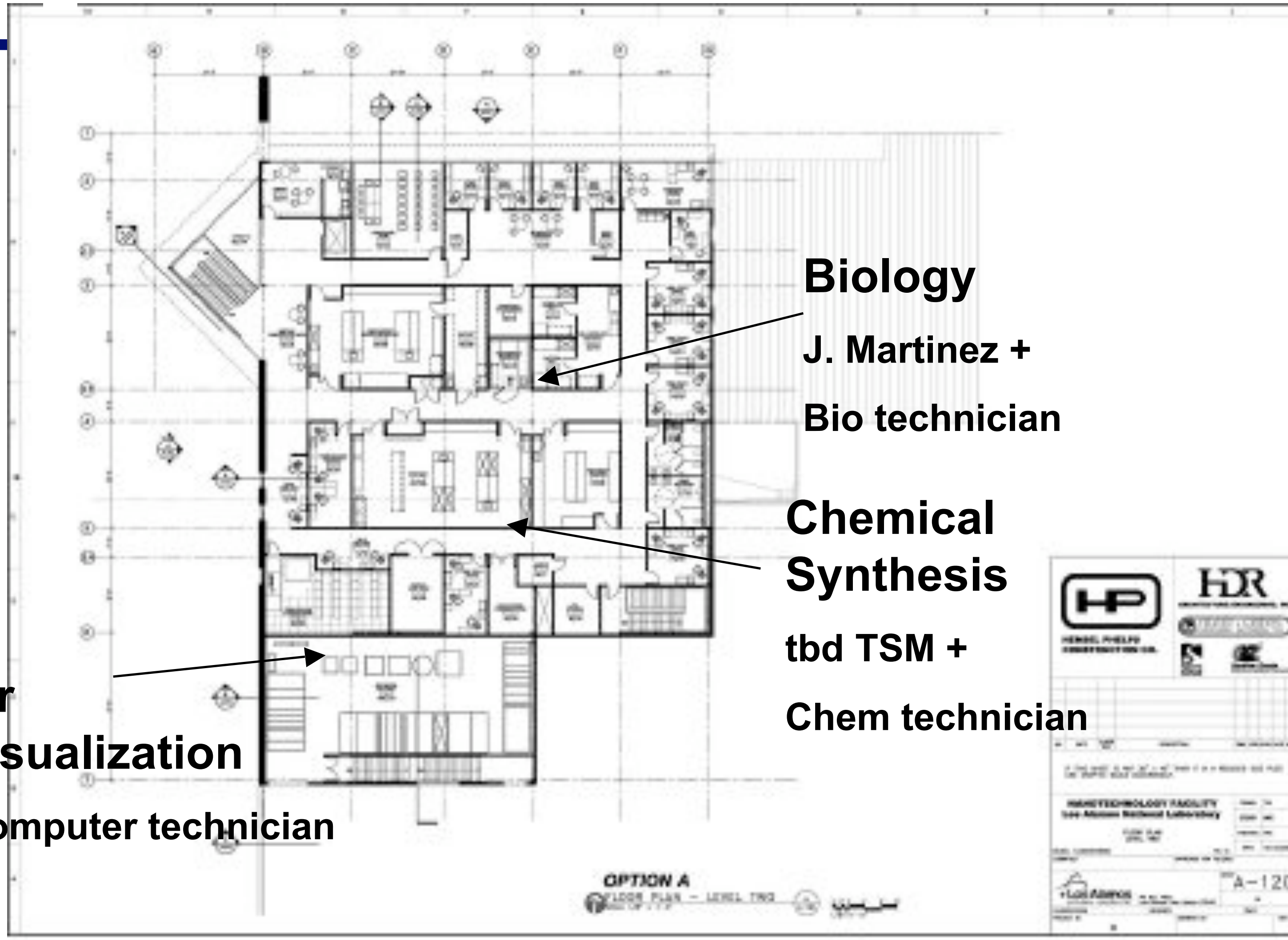
- Thrust Leaders: Sasha Balatsky (LANL); Elliot Fang (SNL)
- Assembly –model both self assembly and active assembly.
  - Gary Grest (SNL)
- Molecular biophysics – predict protein structure; understand and simulate membrane functions; model the integration of biosystems.
  - tbd (LANL)
- Chemistry –bonding and chemical reactions within nano-dimension.
  - Kevin Leung (SNL)
- Nanomechanics – predict strength and stability at material interfaces, strength and toughness of material, and failure initiation.
  - tbd (SNL)
- Optical and electronic properties– perform quantum mechanics calculations of electronic/optical properties of nanoscale materials and devices
  - Sergei Tretiak (LANL)
- Emergent properties of nanomaterials: electronic and magnetic properties of the complex functional nanoscale materials and devices.
  - Stuart Trugman (LANL)
- Visualization-develop and maintain a stereo visualization capability to be used for visualization of numerical simulations and experimental data.
  - Matthias Graf (LANL)

LANL Gateway—1st Floor



2 Technician FTEs (Optical/laser 1 FTE, 0.5 chem FTE, 0.5 probes tec)

LANL Gateway—2nd Floor



Biology

J. Martinez +

Bio technician

Chemical Synthesis

tbd TSM +

Chem technician

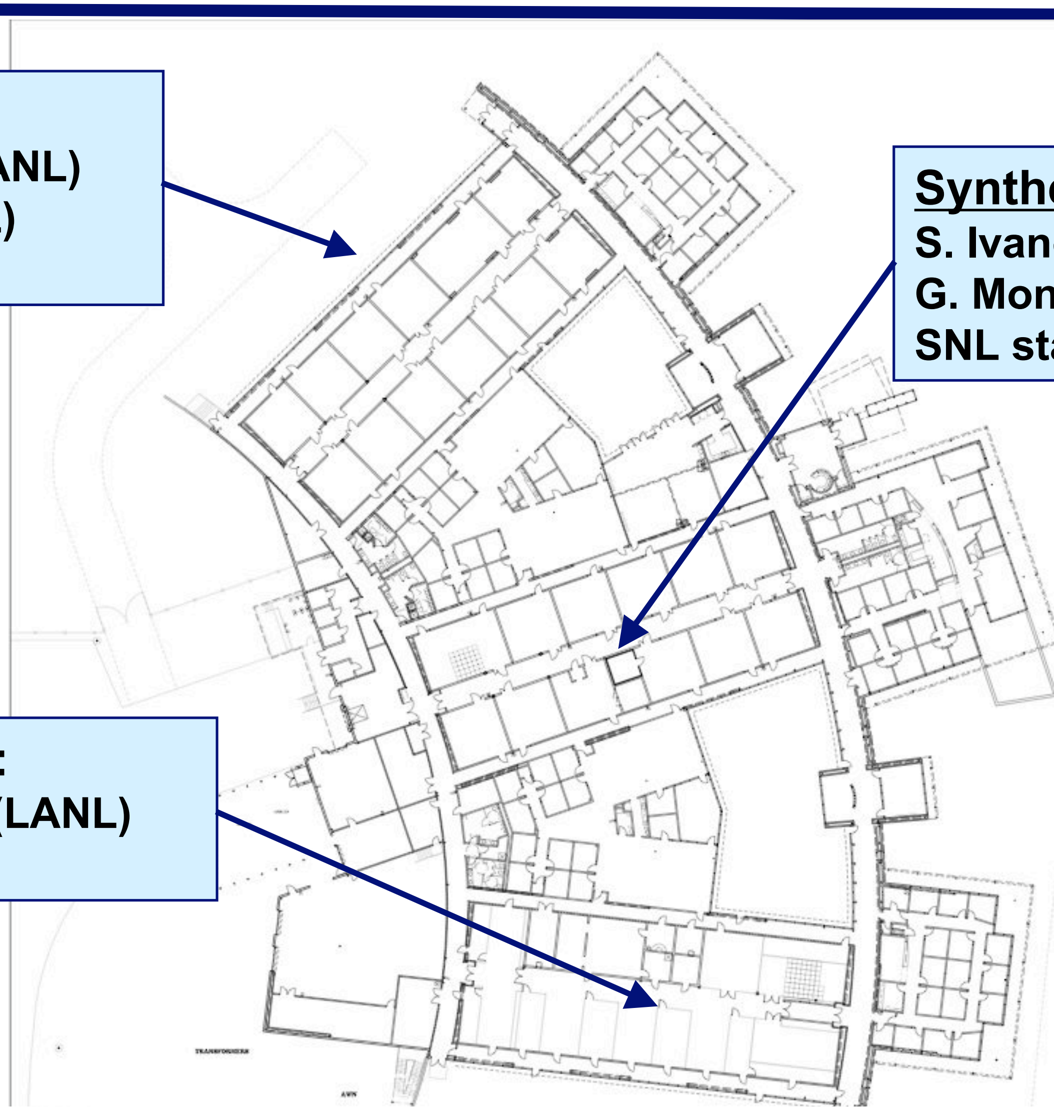
Computer cluster/visualization

M. Graf + computer technician

Core Facility will have LANL and SNL CINT Scientists

<u>Characterization</u>:
R. Prasankumar (LANL)
G. Swadener (LANL)
SNL staff

<u>Synthesis/Bio</u>:
S. Ivanov (LANL)
G. Montano (LANL)
SNL staff



<u>Integration</u>:
E. Akhadov (LANL)
SNL staff

CINT Postdoctoral Fellows

- **Competitive program: modeled after the LANL Directors Fellow Program, but emphasizing SNL/LANL collaborations.**
- **Eleven applicants: top two candidates selected:**
- **Steven J. Koch (Sandia)**
  - **Cornell PhD (physics)**
  - **Nano-bio-micro interfaces (Bunker/Goodwin)**
- **Nanguo Liu (Los Alamos)**
  - **University of New Mexico PhD (Chem Eng)**
  - **Nanophotonics/CFN (Victor Klimov, Melissa Petruska/ Jeff Brinker)**

- ***In normal operations CINT will support ~10 postdocs in steady-state, with 2-year terms, hired through a competitive process.***

New Hires for CINT

- **Sandia hiring externally in specific areas:**
  - **TEM expert.**
  - **Integration Laboratory coordinator.**
  - **Microelectronics integration (Discovery Platforms).**
- **LANL hiring for positions at Core facility:**
  - **Strategy is to hire current postdocs working in nanoscience into staff positions so that there is a real connection to LANL.**

CINT is becoming a reality!

- **Project on budget and on schedule**
  - **CD-4a in April 2006**
- **Management team in place**
- **User program launched by strong "jump-start"**
- **Transitions-to-operations plan underway**
- **Scientific staffing underway**