Welcome to The Joint Workshop on Nanoscience and Nanotechnology Opportunities for Academia & High Tech Industry

James H. Dickerson II

Center for Functional Nanomaterials

BROOKHAVEN NATIONAL LABORATORY

a passion for discovery

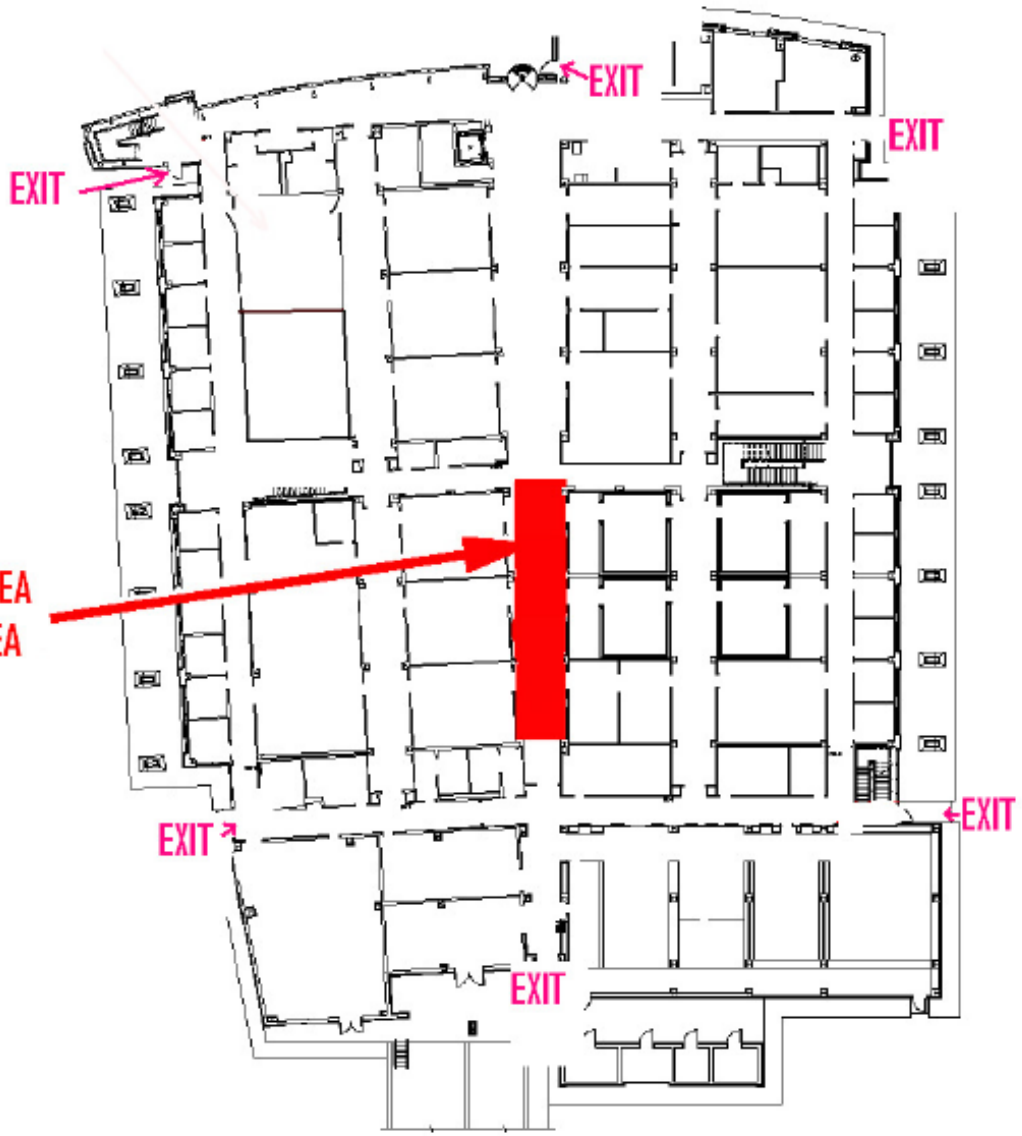
U.S. DEPARTMENT OF ENERGY | Office of Science

Parking Lot

OUTDOOR
ASSEMBLY AREA

recharge
basin

INDOOR ASSEMBLY AREA
SHELTER IN PLACE AREA



Agenda

Welcome to Participants (09:00-09:20)
- Dr. John HILL

The CFN: A User-Oriented Research Center (09:20-09:40)
- Dr. Emilio MENDEZ

The CFN's Facilities and Capabilities (09:40-10:00)
- Dr. James DICKERSON

Control of Light-Matter Interaction Using Dispersion Engineered Structures (10:00-10:40)
- Dr. Vinod MENON

in-situ TEM Observation of Nanobubbles in Supersaturated Solutions (10:40-11:20)
- Dr. Christopher PERREY

Patents, Commercial Licensing, Intellectual Property (11:40-12:10)
- Mrs. Connie CLEARY

Research Partnerships with CFN (12:10-12:30)
- Mr. Michael FUREY

Agenda

How to Become a CFN User (12:30-12:50)
- Ms. Grace WEBSTER

Lunch (12:50-1:30)

Open Discussions with CFN Scientists and BNL Tech Transfer & Tours of the CFN (1:30-3:00)
- BNL STAFF

Recommendations for Writing an Effective User Proposal (3:00-3:45)
- Dr. James DICKERSON

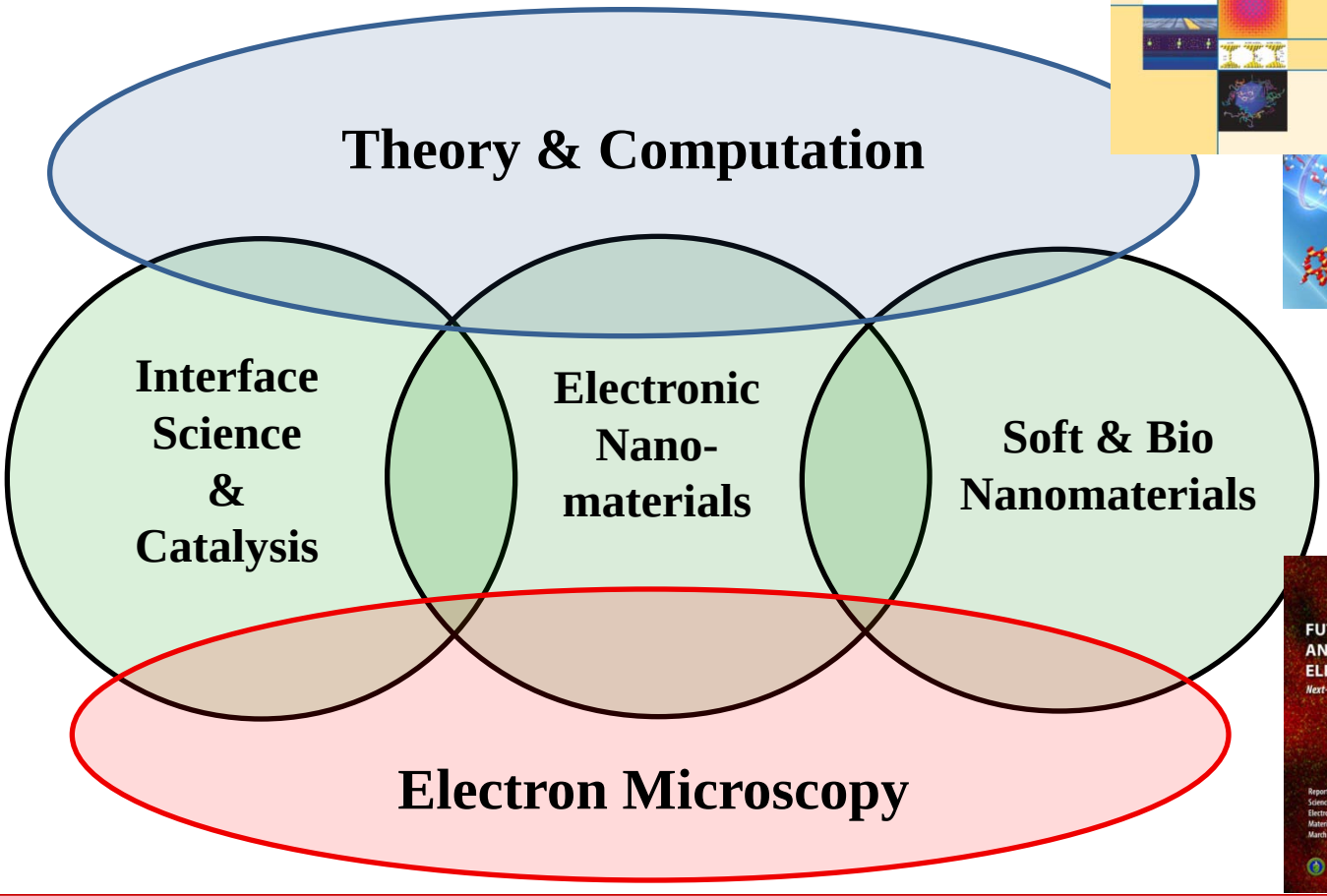
Closing Remarks - Seminar Room (3:45-4:00)
- Dr. James DICKERSON

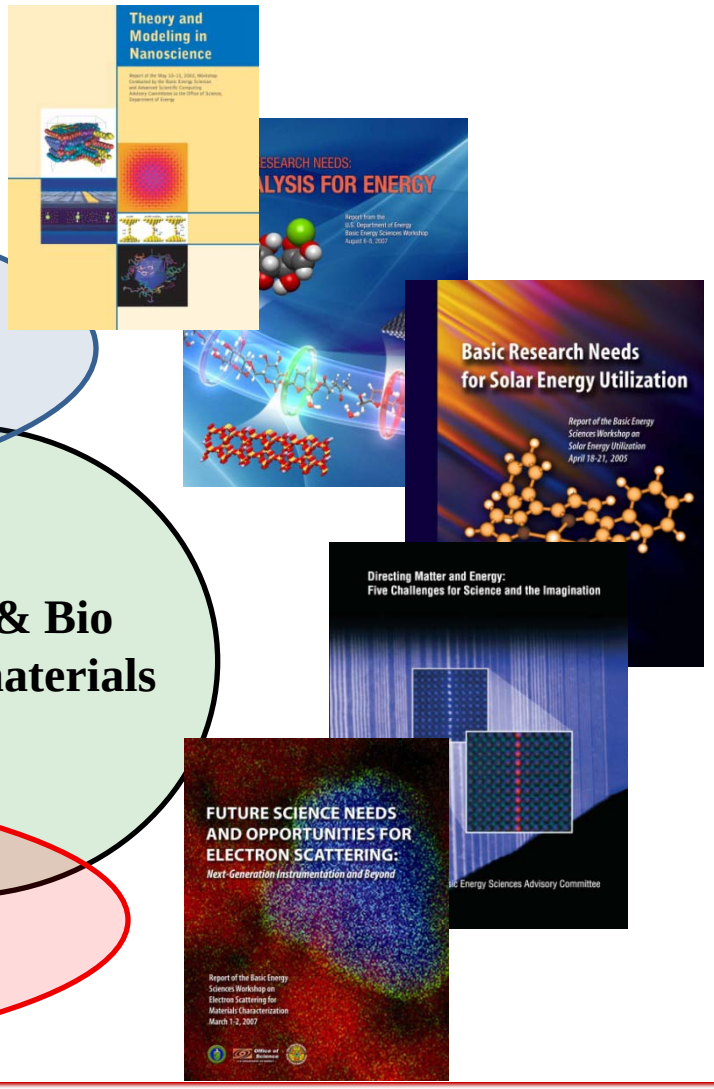
CFN's Facilities and Capabilities

James H. Dickerson II
Assistant Director of CFN

In-House Scientific Program

Aligned with the missions of the Department of Energy and Brookhaven National Laboratory





CFN Facilities: Creating, Characterizing, Understanding

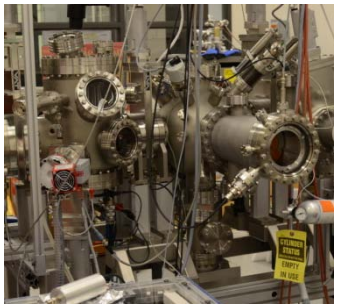
Distinct Multifaceted Competencies and Capabilities

- Block copolymers for energy-related materials
- DNA-mediated nanostructure self-assembly
- Comprehensive suite of *in operando* probes
- Aberration-corrected electron microscopy
- Specialized set of endstations at NSLS -II

Materials Synthesis

Nanofabrication

Reactor STM

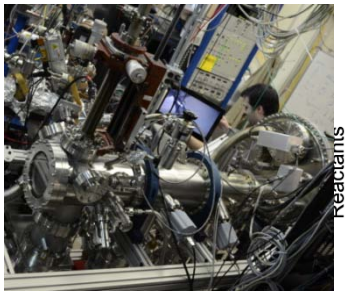


Proximal Probes

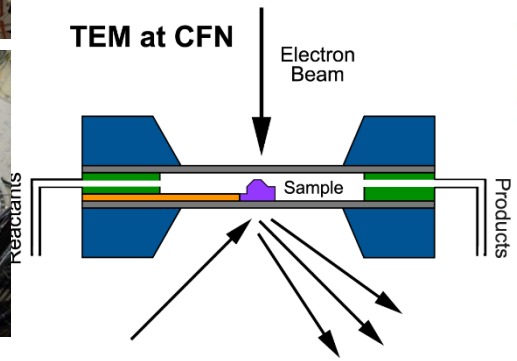
Electron Microscopy

Aberration Corrected ETEM

Advanced Optical Spectroscopy & Microscopy



AP XPS



X-ray nanoprobe at NSLS-II

Advanced X-ray and UV Probes

Computer Cluster

CFN Organization Chart

Nanoscience Safety Advisory Committee

Associate Laboratory Director
Basic Energy Sciences
J. Misewich

Science Advisory Committee (SAC)

Approx. 30 Scientists
15 Support & Technical Staff
20 Postdocs

CFN Director
E. Mendez

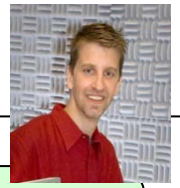
Users' Executive Committee (UEC)

Admin. Support
D. Storan

Assistant Director
James Dickerson

Safety and Operations
R. Sabatini

User Program Administration
G. Webster



Electron Microscopy
E. Stach

Interface Science & Catalysis
P. Sutter

Electronic Nanomaterials
C. Black

Soft & Bio Nanomaterials
O. Gang

Theory & Computation
M. Hybertsen

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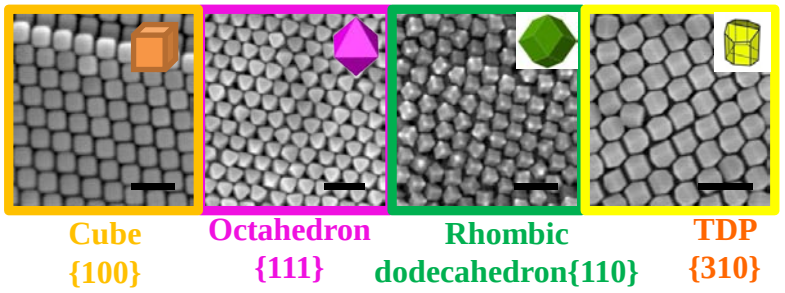
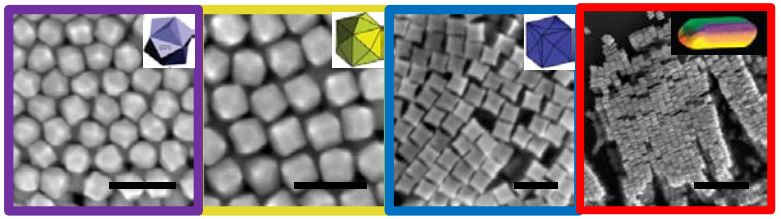
Nanomaterial Synthesis

Unique aspects of new nanomaterial synthesis program:

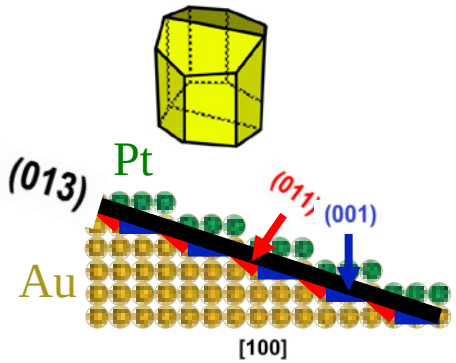
- Shape controlled metallic particles
- Surface functionalization
- Atomically smooth facets

- Scientific Impact:
  - Self-assembly
  - Optical (plasmonics, chirality)
  - Catalytic properties
- New materials are available for users





Scale bar: 500nm for rods and 100nm for the others



- High-index nanoparticle surfaces for catalysis: activation of Pt monolayer (20x activity) on Au(013) was observed
- *Proposed*: Systematic studies on shaped particle Imaging of particle/catalyst surfaces (TEM, E. Stach, D. Su; STM, P. Sutter; Theory, D.Lu)

Electron Microscopy Facilities

JEOL 1400
Low voltage TEM
(new in 2011 – ARRA)

Soft & biological materials through cryo-microscopy

JEOL 2100F
Analytical electron microscope

Versatile analytical & in-situ experimentation

Hitachi HD2700C STEM
Probe corrector

Forefront analytical instrument

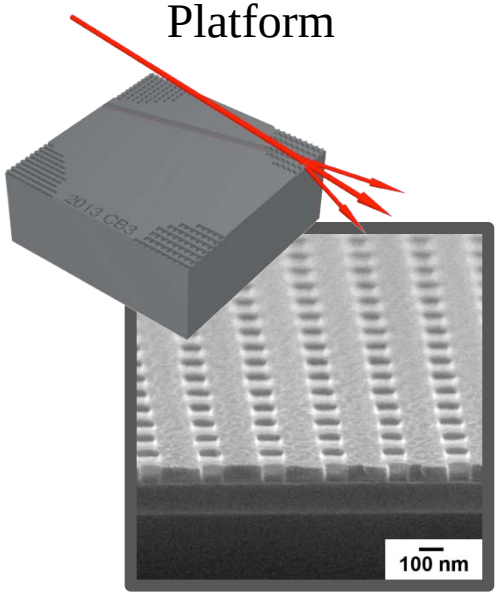
Titan 80-300 - ETEM
Image corrector

Environmental & in-situ studies

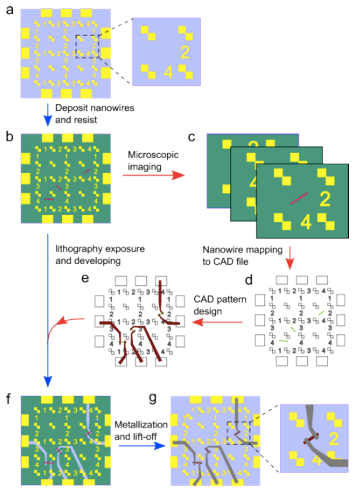
New Scientific Capabilities

Goal: Combine state-of-the art scientific capabilities to create new/unique processes for Users and Staff

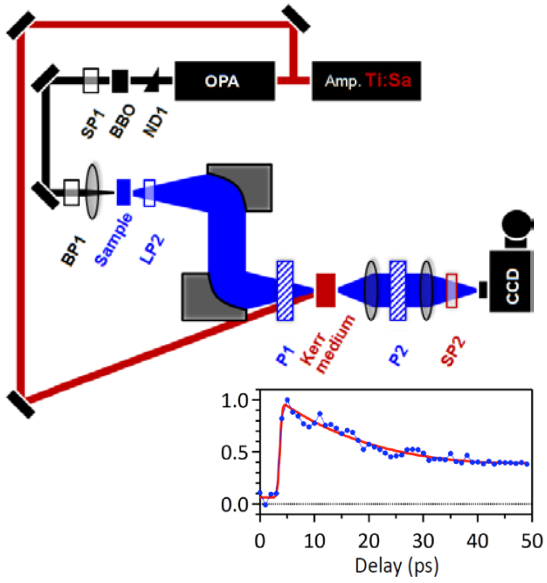
Nanofabricated GTSAXS Platform



1-Day Nanowire/Nanomaterial FET Fabrication Platform



Ultrafast Optical Measurements in Electrochemical Environments



Theory & Computation Facilities

Staff Expertise

- Phenomena, theory & method development
- Support for widely used packages
- Outreach: workshops
- One third of open user projects include staff collaboration

Future Development

- New techniques: e.g. accurate energetics for heterogeneous catalysis
- Computer refresh: $250k/yr on ave.
- Adopt new approaches: GPUs
- Leverage BNL Comp. Sci. Ctr: Robert Harrison, head

Hardware:

Aggregate > 2200 cores
Infiniband networks
Supporting storage

Software & Packages:

VASP, QE, Gaussian, …
LAMMPS, Reactive MD, …

Computer

BNL ITD machine room & system admin.

Resource Allocation:

60% Peer reviewed users
(12 million core-hrs, F2013)

15% Internal research
15% Facility development

10% Downtime, friction, …

(Relative to 24x7)

Connection with other BNL Programs and Facilities

- Synergy with NSLS/NSLS-II
- Close interaction with BNL's core programs in
  - Chemistry
  - Condensed Matter Physics/Materials Science
  - Sustainable Energy Technologies
- Strong interaction on Big Data with RHIC-ATLAS Computing Facility
  - Coordination with NSLS-II on solutions to User needs
- Important participation in Stony Brook-BNL's EFRC on "Molecular to Mesoscale"
- Key role in BNL's Integrated Centers for Energy Science

NSLS-II

BES Core Programs

m2m
molecular to mesoscale

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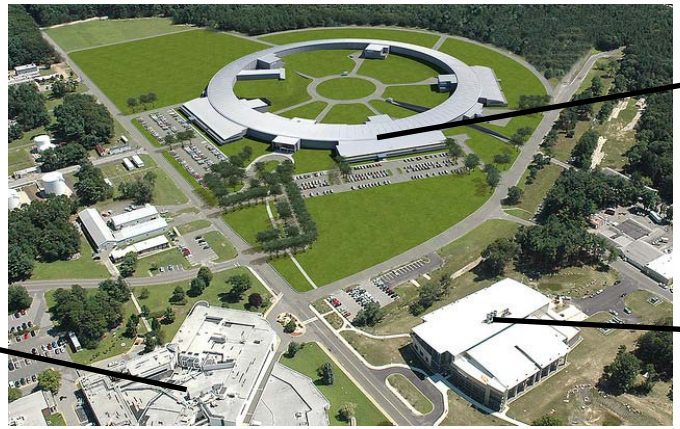
A Key Partnership with NSLS / NSLS II

Tool/Technique	Application	NSLS	NSLS II	Operational	Mitigation
AP-XPS	Catalysis CO_2 capture	X1A1	CSX-2	2015	
LEEM/PEEM	Electronic structure	U5UA	ESM	2017	Intense table-top UV source
GISAXS	Structure & dynamics of soft matter	X9	CSM IXS SMI	2015 2015 2017	Intense table-top X-ray source



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