UEC business meeting notes 09/01/2015

Location: SNS CLO, Room C-156

UEC Members attending: Nazanin Bassiri-Gharb (Chair), Milan Buncick, Eric Formo, Zheng Gai, Molly Kennedy, Vivek Prabhu, Ray Unocic, Rafael Verduzco
Invited guests: Hans Christen, Bobby Sumpter, Tony Haynes, Brad Lokitz

Meeting convened 18:30

- Introduction of all the UEC members present at the business meeting
- Presentation of the meeting agenda by Nazanin (see slides on pp. 2-11 of this document)
- Presentation by Hans on the state of the CNMS and discussion of the presentation (see slides on pp. 12-20 of this document)
- There was some discussion of the need for slides that show the results of the roundtable discussions from each group at the end of the user meeting on Sept 2. The ability of the afternoon sessions to get the slides prepared would be difficult due to time constraints. These could be presented as-is and then updated with more complete info later.
- Short discussion of the UEC roles and priorities. We discussed the user meeting, user newsletter and the NUFO meeting. There was also some discussion about making it clear to UEC members that they should be committed to attendance at monthly meetings and at the user meeting.
- We discussed the triennial review and how or whether UEC members should attend. The answer is yes. The last review led to a discussion and development of a revised mission statement for the UEC and thus the UEC roles.
- There was discussion about ways to enhance interaction with SNS. One way would be to include SNS work on CNMS rapid access.
- There was also discussion on how to increase outside interest in CNMS.
- There was a discussion of proposals, reviewers, journals and proposal scores. Hans made the point that CNMS staff only rate proposals on feasibility and that the reviewer scores are the final determination of whether a proposal is accepted or not.

Meeting adjourned 21:15

CNMS UEC on-site meeting September 2015

Nazanin Bassiri-Gharb

Agenda

- UEC Chair welcome and introductions (5 min, Nazanin)
- State of the CNMS- Hans Christen (10 minutes)
- UEC Roles: Implementation of Roles document (20 min)
- How to evaluate CNMS proposal process (20 min)
- Strategic Planning Meeting / Town Hall preview (20 min)
- Election Nominations (10 min)
- Student Poster Competition (5 min, Milan)
- Other business and future directions (open floor)

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Nazanin Bassiri-Gharb

WELCOME AND INTRODUCTIONS

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Hans Christen

STATE OF THE CNMS

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Discussion

UEC ROLES: IMPLEMENTATION OF ROLES DOCUMENT

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UEC Roles

CNMS UEC Roles
(prioritized by Hans, Tony from list compiled by UEC during 10/29/14 telecon)

Highest priorities, Tier I

- **Identify issues for users at CNMS and make recommendations for improvement.** Includes reviewing User Satisfaction Survey, Suggestion Box, and conducting other surveys at discretion of UEC and involving non-users as much as possible.
- **Contribute to planning for CNMS future by advising on strategic plan updates** (annually), including capital equipment planning, which is a key part of the strategic plan.
- **Make annual Town Hall meeting into more effective forum for user feedback**, for example by publishing an engaging agenda before the meeting to encourage users to bring ideas and want to attend; show it's important and results in action; consider controversial topics that may boost interest.

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UEC Roles-continued

Additional responsibilities, Tier II

- **Organize technical program for CNMS User meeting** so that it is truly the Users' meeting
- **"Produce" user newsletter**: identify content of most interest to users, including UEC activities that should be reported
- **Recommend proposal reviewers and evaluate the proposal process and results, including success rates and demographics** – to recommend improvements, assure fairness, and identify underrepresented populations of users.
- **Arrange UEC elections, particularly through recruiting** a diverse pool of candidates to represent all user constituencies and ensuring election is open and fair.
- **Represent facility at annual NUFO meeting**

UEC Roles-continued

Residual items from the 10/29/14 list, less important than all above

(item numbers refer to 10/29/14 list)

- Take part in monthly telecons
  Comment: not a job to be completed but a means to accomplish the goals above.
- Representation for BES On site review by CNMS invitation (in 2013, Nazanin, Molly and Tony Hm/Chair attended)
  Comment: not truly a UEC responsibility. BES requires a sampling of users to attend the triennual review and it's natural to engage the UEC to help identify those users who would best represent the facility's user community (and bearing in mind that the UEC is a well-defined body of such representatives that is elected by the user community).
- Help with targeting new users through outreach to industry and institutions
  Comment: this is a CNMS responsibility and it's not clear how UEC can accomplish this, although ideas and recommendations are welcome.
- Identify opportunities to enhance CNMS interactions with SNS/HFIR
  Comment: suggestions to help are welcome and CNMS needs to work on this but it's not what we most need UEC to work on
- Grow the user community to support the long-term mission
  Comment: similar to item (8) above; also addressed by "involving non-users as much as possible" in surveys

Tony Haynes – group discussion

HOW TO EVALUATE CNMS PROPOSAL PROCESS

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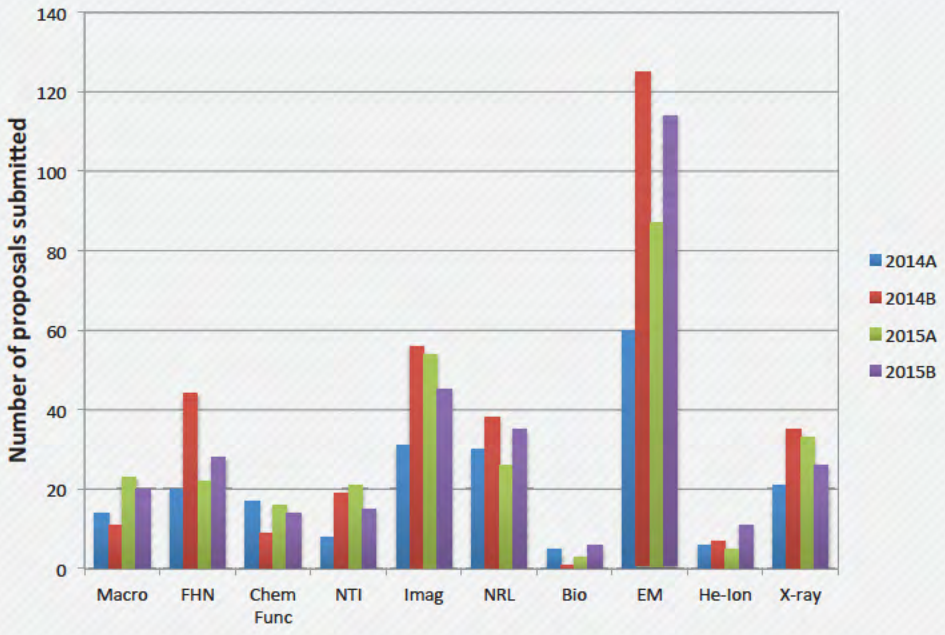
Outside Interest



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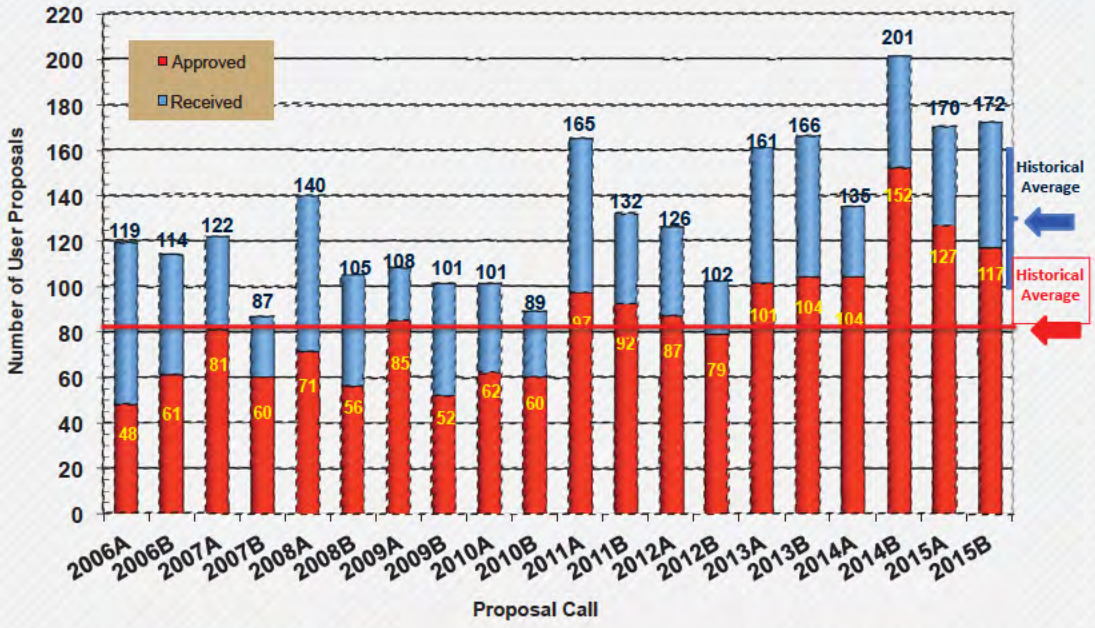
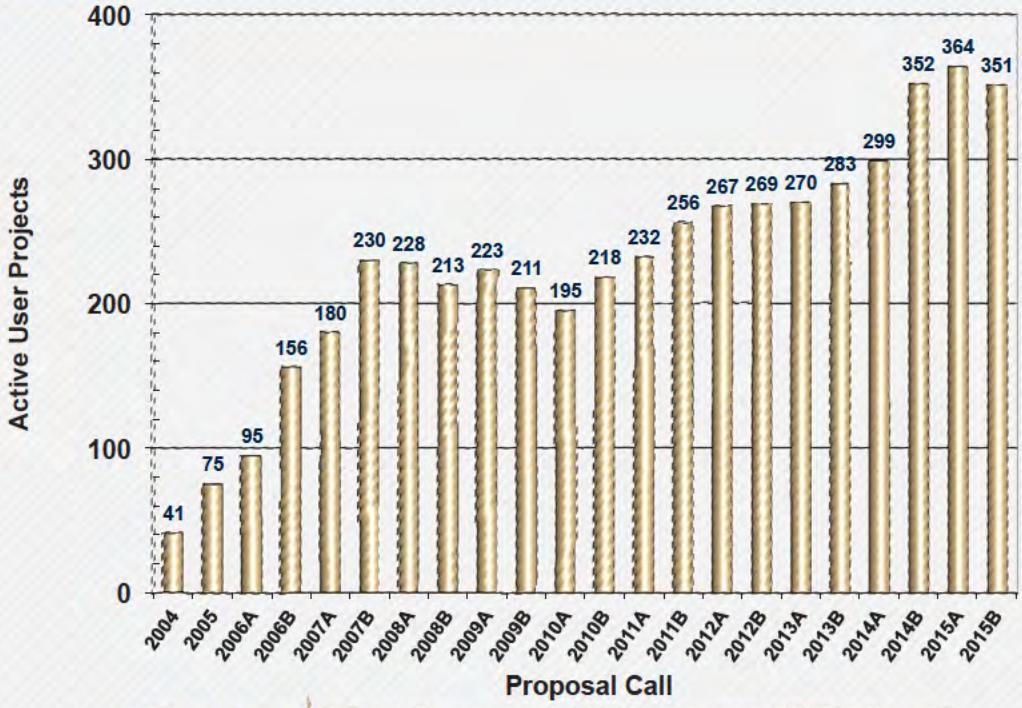
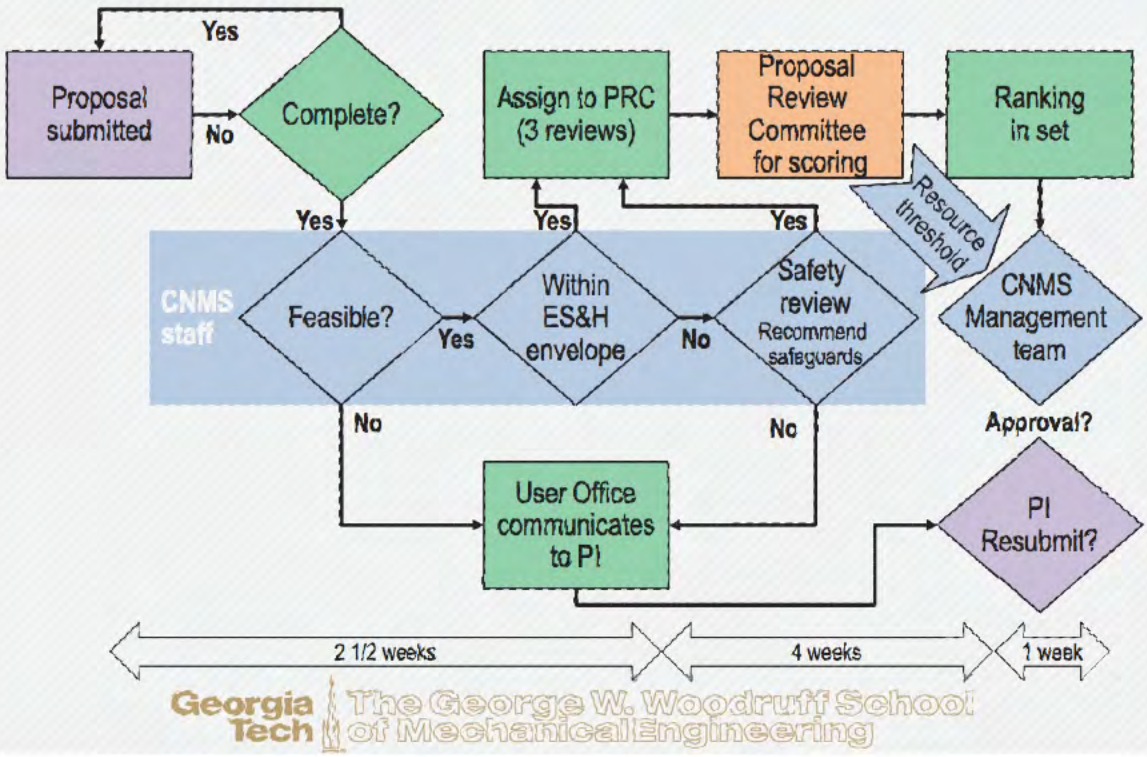
Proposal submitted and Approved



Current Active Proposals



How to evaluate CNMS proposals



STRATEGIC PLANNING MEETING / TOWN HALL PREVIEW

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type the name of your roundtable here

Emerging Research Opportunities

- Opportunity #1
- Opportunity #2
- Opportunity #3 (maximum)

Key Resources Available Elsewhere

- Resource #1; where available?
- Resource #2; where available?
- Resource #3; where available?

Key Resources Available at CNMS

- Resource #1; how is CNMS resource unique?
- Resource #2; what's unique about CNMS resource?
- Resource #3; how is CNMS unique?

Resource Needs for CNMS Users

- Need #1: expected scientific impact?
- Need #2: expected impact?
- Need #3: expected impact?

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Roundtable and workshop attendees

Roundtable Topic	# expressing interest	Room
Materials Genome	93	Auditorium PM
Buried Interfaces	93	Auditorium AM
Soft Materials	68	C-156 AM+PM
Operando characterization	75	C-152 A
Scanning Probe Data	36	C-152 PM
Soft Matter Scattering Workshop	70	Tuesday Auditorium
IR Workshop	30	Tuesday C-156

Overall attendees: 210-220 range

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ELECTION NOMINATIONS

2016 UEC Nominations

At-Large (* need to confirm interest)

- Alex Belianinov- ORNL/CNMS
- Kathrin Dörr- Martin-Luther U., Halle
- *Ryan Hansen- Kansas State
- Brian Long- U. Tennessee
- Yayoi Takamura- U. California, Davis
- *Yang Zhang- U. Illinois (possibly Secretary)
- Milan Buncick, AEgis Technologies

Vice Chair

- None

Secretary

- *Yang Zhang?

Milan Buncick

STUDENT POSTER COMPETITION

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Student Poster Competition

Gold Medal:

- Sanjib Das (University of Tennessee)

Silver Medal:

- Tyler Cosby (University of Tennessee)

Bronze Medal:

- Tony Nelson (Virginia Tech)

Honorable Mention:

- Maximillian Heres (University of Tennessee)
- Gongwang Zhang (University of Kentucky)
- Annette Farah (University of Tennessee)

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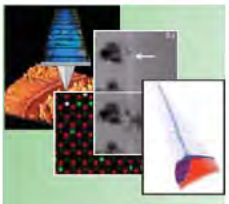
State of the **Center for Nanophase Materials Sciences**

Hans Christen, Director, CNMS

2015 CNMS User Meeting
Presentation to the UEC
Sept. 1, 2015

The research environment at CNMS



Imaging

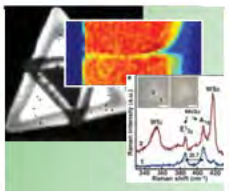
- Comprehensive suite of techniques (STEM, SPM, HIM, APT)
- Close connection to data sciences
- Operando imaging

Soft matter research

- Selective deuteration
- Precision synthesis
- Strong ties to neutron sciences
- Key activity at ORNL

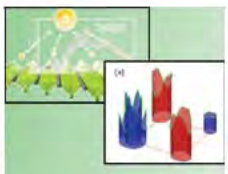
Synthesis and fabrication

- Controlled synthesis including soft matter, 2D materials
- Multiple approaches to direct-write nanofabrication
- Multiscale fluidics



Functional Properties

- Optical characterization and laser spectroscopy
- Electrical and optoelectronic characterization



Theory and modeling

- Integrated across CNMS
- Transport, reactivity, electronic structure
- Soft matter theory and simulation
- Correlated electron materials

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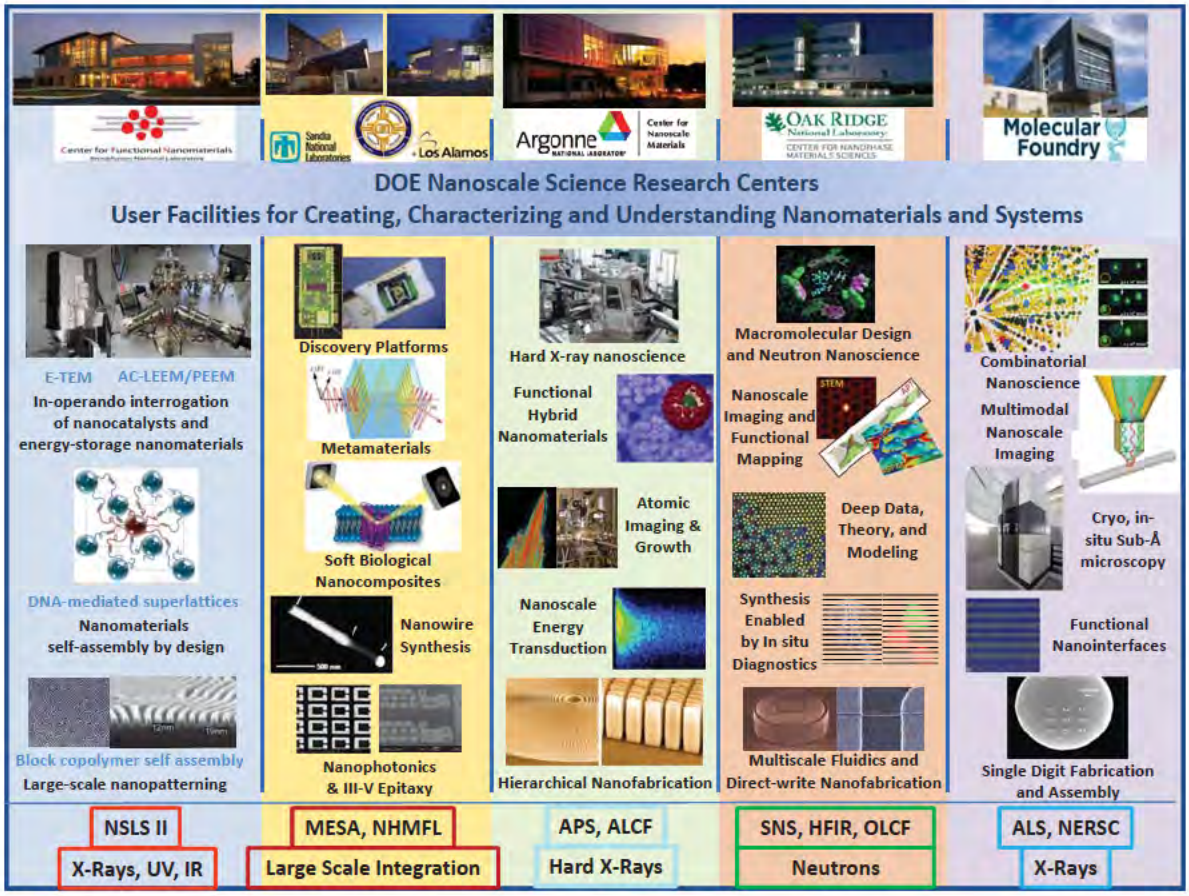
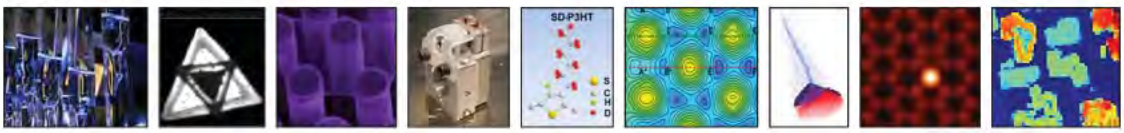


Changes at CNMS since last year

- Staffing, re-structuring of groups
- Equipment purchases
- Budget review
- Institute for Functional Imaging of Materials (IFIM), Workshop



In-house research: reviewed every three years

- Next "Triennial Review": April 2016
- Process of planning has begun in January with "Theme Thinking Time (T^3)" sessions

The ORNL Institute for Functional Imaging of Materials (IFIM) is developing unique approaches to integrate data analytics into imaging

- Imaging has evolved from "observing where atoms sit" to locally (actively) interrogating the behavior of a material; truly multidisciplinary
- Data sets are multi-dimensional and can't simply be plotted
- The goal of IFIM is to make modern data analytics tools available to imaging scientists.
- Examples: Extracting information; Distinguishing between noise and data; Merging data streams (e.g. STEM and APT)

- June 8-10: Joint NSRC workshop "Big, Deep, and Smart Data Analytics in Materials Imaging" (opportunities and future needs in the integration of advanced data analytics and theory into imaging science"
  - 140 participants from 9 National Laboratories and 16 universities
  - 33 talks, 47 posters

Strategic Plan and Budget Review

Discussed in the 2015-2019 Strategic Plan

- Integration into ORNL Missions:
  - Neutron Sciences
  - Materials by Design
  - Imaging
- Priority Areas
  - Studies of ultrafast phenomena at interfaces ← See below
  - Fabrication strategies for 3D structures ← See below
  - Monochromated, aberration-corrected STEM

Discussed in the FY2014 Budget Review

- Key instrumentation (not within reach of our operating budget)
  - Next-generation STEM ($4-5M)
  - Atom-probe tomography ($4-6M)
  - Enhanced scanning probe capabilities (4-probe; low-T STM) ($2-3M)

Equipment plans as proposed at Budget Review

(black: proposed; blue: added; red: postponed. Underlined: FY14 user survey)

- FY15
  - **PPMS** (ordered FY14) FY15
  - 3D Lithography (Nanoscribe) FY15
  - Gas-cell reaction holder and EDS detector (FEI Titan S TEM/STEM) FY16
    - Atmosphere 200 Gas E-cell System (1atm., 1000°C)
    - EDAX 60 mm^2 EDS detector
    - Gata OneView camera (16 Mpix, 25 fps) – direct-funded from SUFD
  - Nion UltraSTEM 100 upgrade FY16
    - Ultra-fast Scientific CMOS camera (4 Mpix, 100 fps) [in-situ; ptychography]
  - Atom Probe Tomography upgrade FY16
    - Ion beam sputter/deposition system (for specimen preparation)
  - Compute Cluster (Cray CS400; 32 nodes) [from FY16 plan] FY15
  - miBot Probes [from FY16 plan] FY15
    - For in-situ biasing experiments in SEM, HIM; simultaneous optical and electrical probing of 2D materials)
  - Contact Mask Aligner (replacement) FY15

Equipment plans as proposed at Budget Review

(black: proposed; blue: added; red: postponed. Underlined: FY14 user survey)

- FY16
  - Nanoscale SIMS capabilities
    - Not yet available
  - ~~Compute Cluster~~ (moved to FY15)
  - ~~miBot Probes~~ (moved to FY15)
- FY17
  - Ultrafast spectroscopy
  - PIXcel detector for 4-circle XRD
    - 4-circle XRD currently not critically oversubscribed
  - GISAXS Detector
    - Possible change of plans – new instrument rather than upgrade?

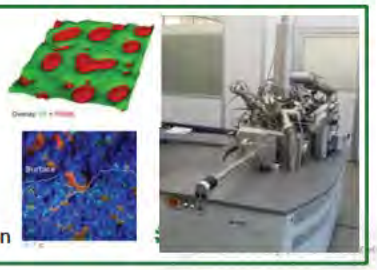
Possible additions to the list:
- Dielectric spectroscopy (soft matter)
- Anasys nano-IR
- …

ionTOF TOF.SIMS 5

Chemical imaging at <50 nm lateral resolution,
1nm depth resolution

Instrument purchased by ORNL funds; accessible via hourly charge

- SPM for coregistered multimodal physical and chemical imaging
- FIB tomography / Ga ion
- 30 keV BiMn cluster ion gun
- 20 keV Ar gas cluster source for dual beam depth profiling, 3D analysis
- Dual source O and Cs ion guns for low energy sputtering and thermal ionization



Staffing changes

- Mike Hickner (previously Assoc. Prof. at Penn State) – group leader of Macromolecular Nanomaterials
- Yangyang Wang (PhD: Akron) – junior staff member in Macromolecular Nanomaterials
- Olga Ovchinnikova (previously staff in Chem. Sciences Division) – imaging, mass spectrometry (Chemical Imaging Team)
- Alex Belianinov (previously CNMS postdoc) – strategic hire (HIM)

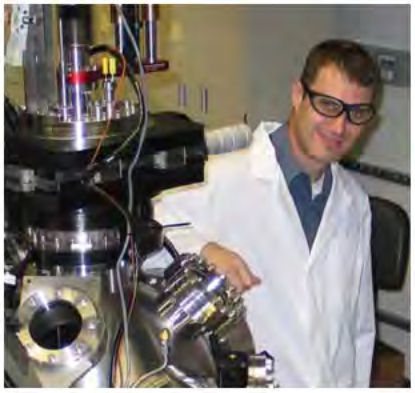
- Mike Miller (APT "guru") retired
- Viviane Schwartz moved to DOE
- Chengdu Liang moved to Amperex Technology Ltd.

Mike Biegalski

10/24/76 – 12/20/14

- A loving husband and father
- An outstanding scientist
- An accomplished athlete

- … and our friend.



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Click on individual names to link to Curriculum Vitae.

Updated: 8/21/2015

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Theme Leads
Sergei Kalinin*
Electronic and Ionic Functionality on the Nanoscale
Bobby Sumpter*
Functional Polymer and Hybrid Architectures
Mike Simpson*(1)
Collective Phenomena in Nanophases

Division Office
Hans Christen, Director
Bobby Sumpter,* Deputy Director
Amanda Zetans, Division Administrative Support

Tony Haynes, User Program Manager
Brad Lokitz,* User Program Staff
*Sandy Lowe,** User Program Administrative Assistant

Adam Rondinone,* Outreach Coordinator

Operations/Support
Kara Clayton, Finance
Joshua Scull, HR Manager
Scott Hollenbeck, Operations Manager
*Liz Lee**
Jason Taylor, Lab Waste Services
Kevin Harman, Operations

*Multiple Capacity
(1) Joint Faculty
(2) Technician
(3) Subcontractor
(4) Chemical Imaging Team Lead
(5) Wigner Fellow
(6) Nanofabrication Research Lab Operations Lead
(7) Office of Admin. Serv.

(a) Biosciences Division
(b) Materials Science & Technology Division
(c) Chemical Sciences Division
(d) Computer Science & Mathematics Division
(e) Instrument & Source Division, SNS

Scanning Probe Microscopy

Art Baddorf
*Liz Lee**

Zheng Gai
Ilia Ivanov*
Stephen Jesse
Sergei Kalinin*
Nouamane Laanait[3]
An-Ping Li
Peter Maksymovych
Alexander Tselev[1]
Nina Wisinger
Sangmo Yang[3]

Postdocs: Jennifer Black, Ye Cao, **Maryus Chyasnavichyus**, Jeremy Coma, Corentin Durand, Saban Hus, Anton Ievlev, Seokmin Jeon, Qian Li, **Chuanxu Ma**, Jewook Park, Suhas Somnath, Evgheni Strelcov, Rama Vasudevan, Jun Wang, **Maxim Ziatdinov**

Electron Microscopy & Atom Probe Tomography

Karren More
Tracy Whitaker(7)*

Albina Borisevich[b]
Jihua Chen*
Dorothy Coffey[2](b)
Miaofang Chi
David Cullen[(b)]
Juan Carlos Idrobo
Donovan Leonard[(b)]
Jonathan Poplawsky
Kathy Powers[(2)]
Kimberly Reeves[2](b)
Ray Unocic

Postdocs: Wei Guo, **Cheng Ma**, Balishakti Mazumder, Brian Sneed

Macromolecular Nanomaterials

Mike Hickner
*Erica Lohman**

Peter Bonnesen
Jihua Chen*
Kunlun Hong
Brad Lokitz*
David Uhrig
Yangyang Wang

Postdocs: Balaka Barkakaty, Yuewen Xu, Henghai Zhang,

Functional Hybrid Nanomaterials

Dave Geohegan[(b)]
Tracy Whitaker(7)*

Ilia Ivanov*
Jong Keum[(c)]
Steve Overbury[(c)]
Michelle Paranthaman[(2)]
Alex Puretzky
Adam Rondinone*
Chris Rouleau
Zili Wu[(c)]
Kai Xiao

Postdocs: Abdelaziz Boulesbaa, **Yan Chen**, Christopher Jacobs, Xufan Li, Ming-Wei Lin, Zhiqi Liu, **Amaresh Samuthira Pandian**, Rui Peng, Masoud Mahjouri-Samani, **Yang Song**, Hui Wang, Kai Wang, Bin Yang, Jihua Zhu

Nanofabrication Research Laboratory

Mike Simpson*(1)
Lisa Goins

Pat Collier
Mitch Doktycz[(d)]
Jason Fowlkes
Ivan Kravchenko
Nick Lavrik
Philip Rack[(1)]
Scott Retterer[(d)]
Dayrl Briggs[(b)]
Dale Hensley[(2)]
Kevin Lester
Benadeta Srijanto
Adam Rondinone*(d)
Alex Belianinov
David Joy[(1)]
Olga Ovchinnikova

Postdocs: Yighin Ben, Fangjie Liu

Nanomaterials Theory Institute

Bobby Sumpter*
*Erica Lohman**

Gonzalo Alvarez-Campos[(b)]
Ariana Beste[(b)(d)]
Tom Berlijn[(b)(d)]
Miguel Fuentes-Cabrera[(2)]
Jan-Michael Carrillo[(2)(b)]
Panchapakesan Ganesh
Monojoy Goswami[(2)(c)]
Jingsong Huang[(c)]
Jacek Jakowski[(c)(d)]
Paul Kent[(d)]
Jaron Krogel[(b)]
Rajeev Kumar[(c)]
Liangbo Liang[(c)]
Thomas Maier[(d)]
Michael Summers[(c)]
Mina Yoon

Postdocs: Janakiraman Balachandran, Peter Doak, Jyoti Mahatik[(e)], **Vivek Mishra**, Alberto Nocera, Changwon Park, Yu Xie

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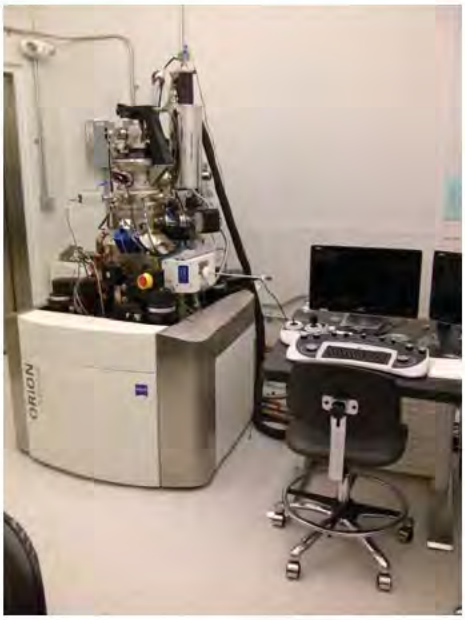
Zeiss Orion NanoFab: the first He+ microscope dedicated to nanofabrication

- High-resolution scanning ion microscope
- Highest resolution ion-milling tool available
- Two ion choices: He+ and Ne+
- Built-in patterning capability
  - Resist patterning
  - Ion milling
  - Located in CNMS cleanroom
- Future opportunity: Combination with mass spectrometry

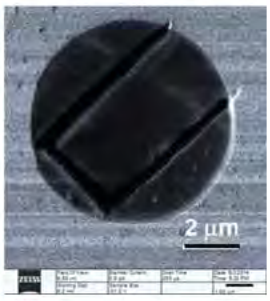


He+ microscope – user examples:

Ne+ milling of a single-layer graphene cantilever

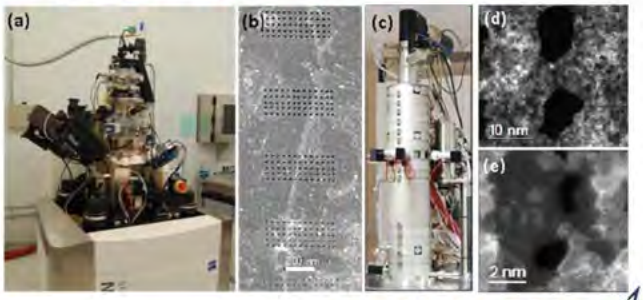
VANDERBILT

Courtesy:
Kirill Bolotin



- Free-standing, 5 µm cantilever
- Ne+ milled (no resist, no Ga)

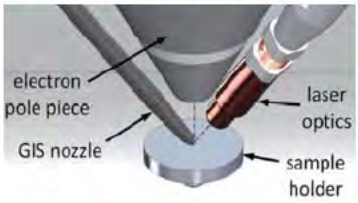
Creating pores in graphene using He+ microscopy; imaging using Nion UltraSTEM



LOCKHEED MARTIN

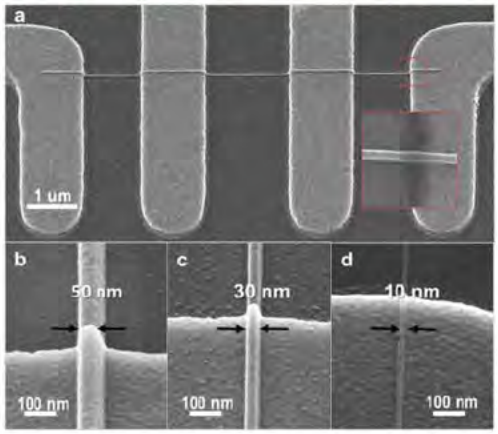
Towards direct-write nanofabrication

- **Established expertise in Electron Beam Induced Deposition (EBID):**

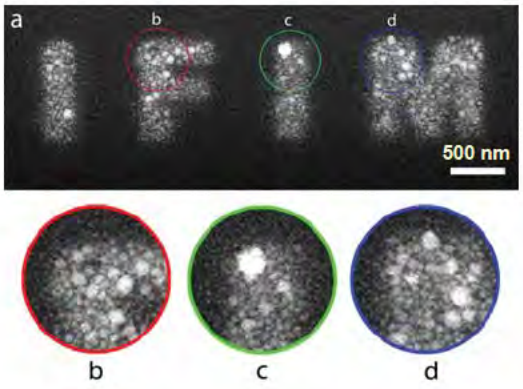


J.D. Fowlkes, N.A. Roberts and P.D. Rack,
Nanoscale 5, 408 (2013)

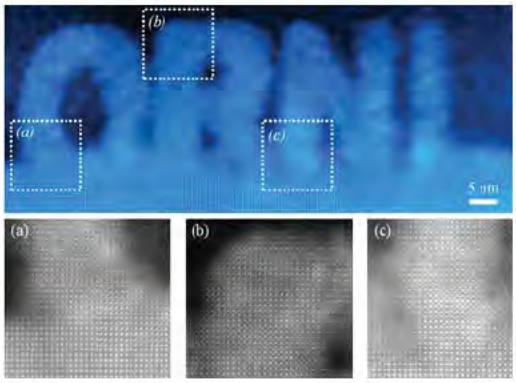
- **Using the He^+ ion microscope for direct-write fabrication**



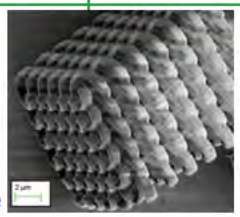
Direct-write nanofabrication using STEM



Electron beam deposited Pd features (from H_2PdCl_4 precursor)



Epitaxial re-crystallization of amorphous $SrTiO_3$ in STEM



First results from Nanoscribe

The input of users is needed more than ever…