San Diego Nanotechnology Infrastructure

http://sdni.ucsd.edu

National Nanotechnology Coordinated Infrastructure

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Vision

1. Provide infrastructure that enables and facilitates transformative research and education, with emphasis in the areas of ***NanoBioMedicine, NanoPhotonics****, and* ***NanoMagnetism***.

2. Integration of UCSD nanotechnology resources, management and operation into the ***national network***.

3. Accelerate the ***translation*** of discoveries and new nanotechnologies to the ***marketplace***, thus increasing economic growths, competitiveness, and high-quality jobs for the nation.

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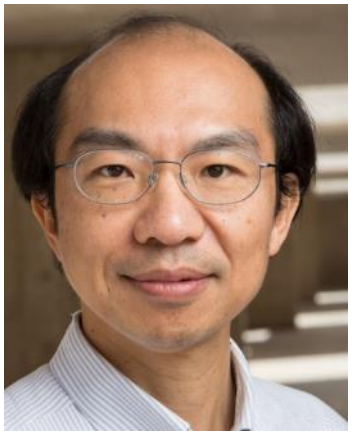
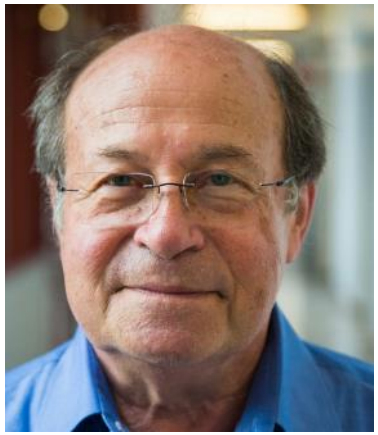
SDNI Management Team



Yuhwa Lo
Director



Shaya Fainman
Deputy Director

Bernd Fruhberger
Assoc. Director
Operation

Boubacar Kante
Assoc. Director
Education/Outreach

Eric Fullerton
Thrust Leader
(Nanomagnetics)

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Thrust Leader
(Nanobiomedicine)

Alberto Vasquez
Coordinator
Education/Outreach

Jeff Sandubrae
Business Development

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SDNI User Data

Yearly User Data Comparison			
	Year 1	**Year 2**	**Year 3 (6 months)**
Total Users	650	644	533
Internal Users	495	478	408
External Users	155 (24%)	166 (26%)	125 (23%)
External Academic	12	12	12
External Industry	128	145	107
External Government	12	7	6
External Foreign	3	2	0
Total Hours	47,893	50,343	23,401
Internal Hours	40,890	38,736	18,105
External Hours	7,003 (15%)	11,607 (23%)	5,296 (23%)
Average Monthly Users	290	285	293
Average Ext. Monthly Users	49 (17%)	56 (20%)	55 (19%)
New Users Trained	183	210	112
New External Users Trained	35 (19%)	50 (24%)	17 (15%)

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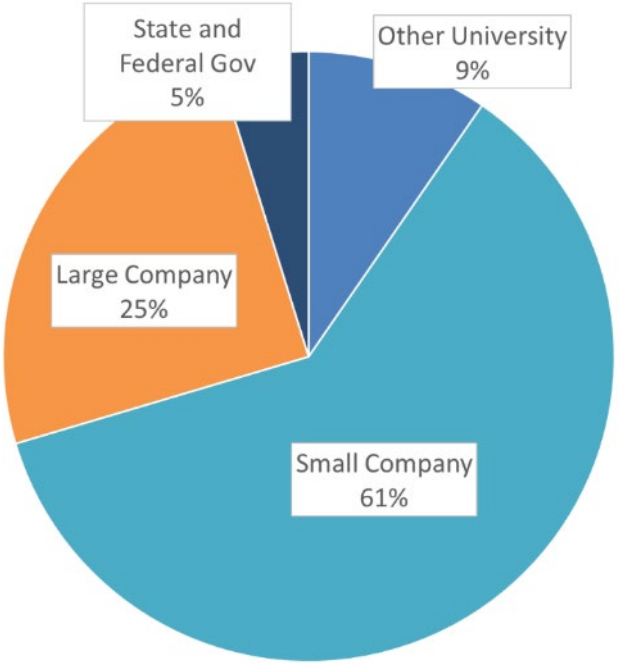
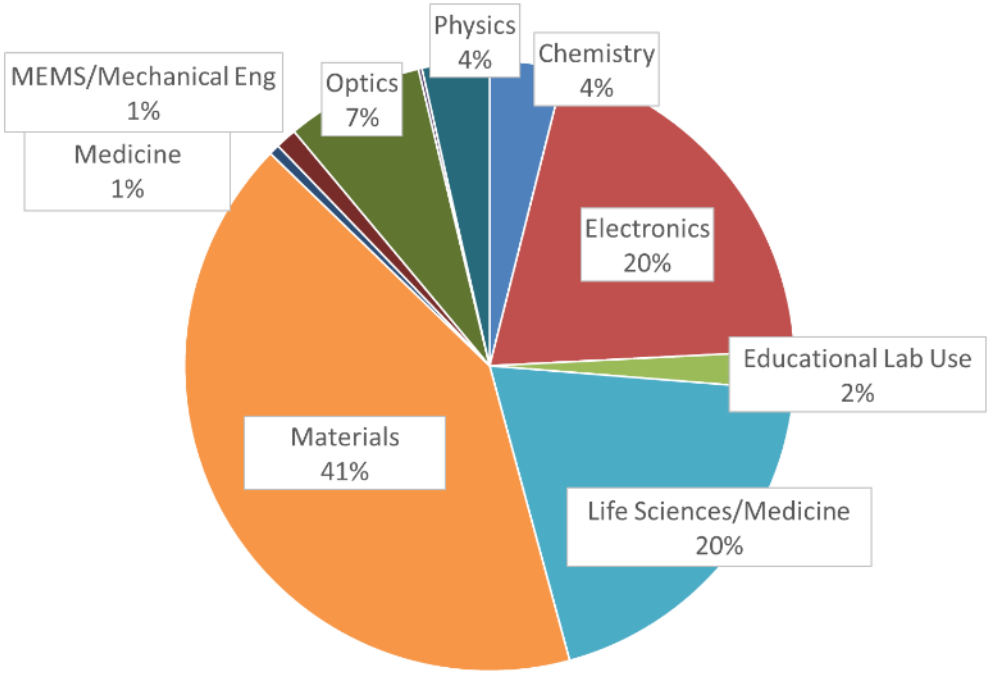
SDNI User Data

External User Affiliations



All User Disciplines



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SDNI User Data

Data for 6 months (October 17 – March 18) :

No.	**User Groups**
86	Local Academic Groups
10	Outside US Academic Groups
39	Small Companies
16	Large Companies
2	State/Federal
149	Total User Groups
63	External Groups

During the equivalent 6 month period of Year 2, we reported 141 total user groups and 57 external user groups (from 5 academic institutions not affiliated with UCSD, 33 small companies, 15 large companies, 2 government labs, and 2 international labs).

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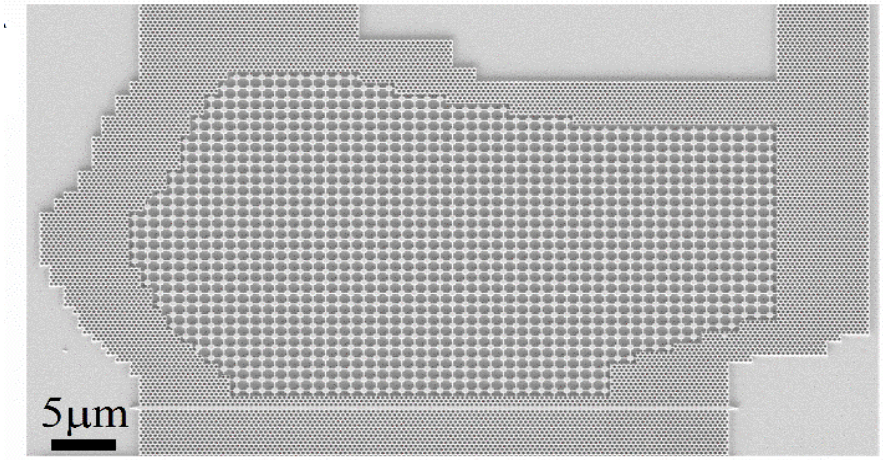
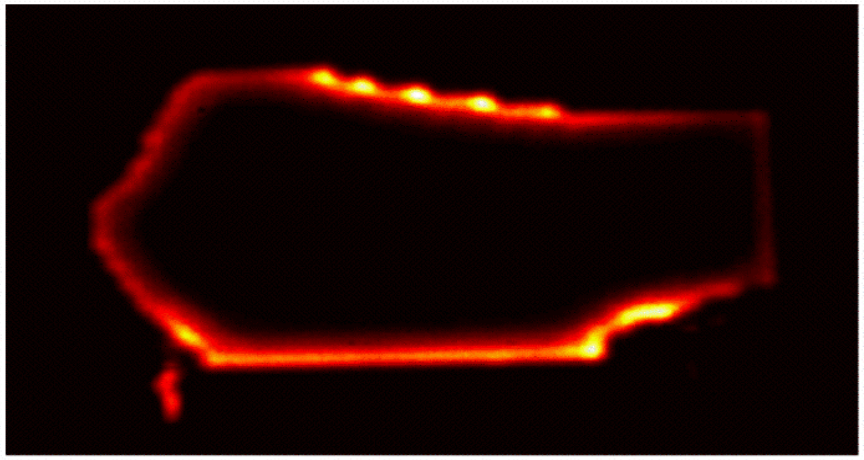
Fueling Scientific Breakthrough

World's First Photonic Topological Laser





Science 358, 636-640, 2017

Prof. Boubacar Kante group

The top ten breakthrough of physics world in 2017

Scientific and engineering significance:

- Demonstration of the topological invariance for photonics as it is for condensed matters.
- Invention of new methods to design and fabricate semiconductor lasers suitable for photonic integration.

Contributions of SDNI Facility:

- Provide sophisticated material processing tools to realize the topological photonic cavities.
- Offer extensive nanophotonic fabrication expertise by SDNI staff to help develop working prototypes.

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NNCI Cooperative Network Activities

Network-Wide

- Participated in Photolithography, Dry Etching, Electron Beam Lithography, Technical Content Working Groups and the Subcommittee on Research Needs and Trends
- Participated in Nano Day activities by creating a social media campaign on Facebook and Twitter to highlight work being performed at SDNI

Multi-Site

- SDNI team participated in the TechConnect/NanoTech 2018 World Innovation Conference, Anaheim, CA
- User project support and staff technical interactions with University of Washington, University of Pennsylvania, Stanford University, Montana State University

On Behalf of the Network

- Generated in-depth analysis of tool investments since the inception of NNCI for the Subcommittee on Research Needs and Trends

Impact of Education & Outreach Activities

Numbers Served

Throughout the year SDNI had the opportunity to serve close to 4,000 individuals ranging from elementary school to professional roles. SDNI hosted several presentations & tours and led several events, workshops and science clubs underscoring nanoscience connections in everyday interactions.

SDNI 2017-2018		
	# SERVED	%
K-12 Students	2785	71%
Community College / Undergraduates	885	23%
Professional Staff (academic & industry)	220	1%
REU/RET	11	<1%
TOTAL	3901	

This year we:

- Boosted K-12 engagement
- Revamped REU Program
- Coordinated Large-Scale events
- Bolstered program partnerships
- Increased community engagement
- Built Community College collaborations

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Remote Hands-on Nanotechnology Laboratory

Goals:

- Bring nanotechnology STEM education to 2-yr colleges and grade school science/technology classes nationwide with ***hands-on experience from remote site***.

- Allow students in class ***real time access*** and ***personal control and experiment*** with nanoscaled samples in top-of-the-line scanning electron microscopes.

Capabilities

- Access through web browser – ***no software installation***
- Live microscope access with ***subsecond latency***
- Intuitive ***student control*** of microscope (navigation, magnification, focus, brightness, and contrast)
- Real-time conferencing with on-site scientists for ***live lecturing, Q&As, and discussions***.
- Sections to be offered nationwide to all grade schools in the US.

Partnership

- High school science teachers through our RET program to develop science contents relevant to and of interest high school and middle school students.
- UCSD Qualcomm Institute to develop low latency video capture and streaming capabilities.
- Zeiss (Instrument Division and Outreach Office).

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Remote Hands-on Nanotechnology Laboratory

Tests and Evaluation in past 6 months:

- ❑ Collaboration with Zeiss Outreach:
  - Periwinkle science night
  - STEM mentoring café at Oregon Stage University
- ❑ Big Brothers Big Sisters of San Diego UCSD tour
- ❑ Integrated Kearny High, Miramar College, and Southwestern College classroom sessions

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Resource Allocation and New Equipment

- Fund is needed to replace workhorse tools (evaporators, sputtering machine, PECVD, etc.) to achieve efficient and smooth operation. This is critical for any sustainable facility. The 80/20 rule applies to most users (i.e. 80% of work is done with conventional tools and 20% work requires fancy, cutting edge tools.

- Advanced tools can be expensive, beyond the budget limit of regular equipment grants (DURIP) or even MRIs. So far most high priced tools (e.g. cryoEMs) were acquired from non-federal sources. This can limit the growth and quality of facilities in less well funded universities and create inequality.

- Advanced microscopy and metrology tools appear to be “hot items” for future research in life and medical sciences, physical sciences, and engineering.

- Revitalizing manufacturing capabilities for photonics and electronics becomes a national priority. Should NNCI put more emphasis on manufacturing tools?