UC San Diego

Electrical and Computer Engineering

JACOBS SCHOOL OF ENGINEERING

UCSD ECE Department

30+ faculty groups are performing semiconductor related research.

Research Centers

- Qualcomm Institute
- Center for Energy Research (CER)
- Center for Information Theory and Applications (ITA)
- Center for Memory Recording Research (CMRR)
- Center for Networked Systems (CNS)
- Center for Wireless Communication (CWC)
- Cymer Center for Control Systems and Dynamics (CCSD)
- Center for Wearable Sensors
- Center for Machine Integrated Computing & Security (MICS)
- Center for Multiscale Imaging for Brain Function
- DARPA Center for RF MEMS Reliability and Design Fundamentals
- Center for Integrated Access Networks
- Contextual Robotics Institute

ECE Semiconductor Research Areas and Infrastructure

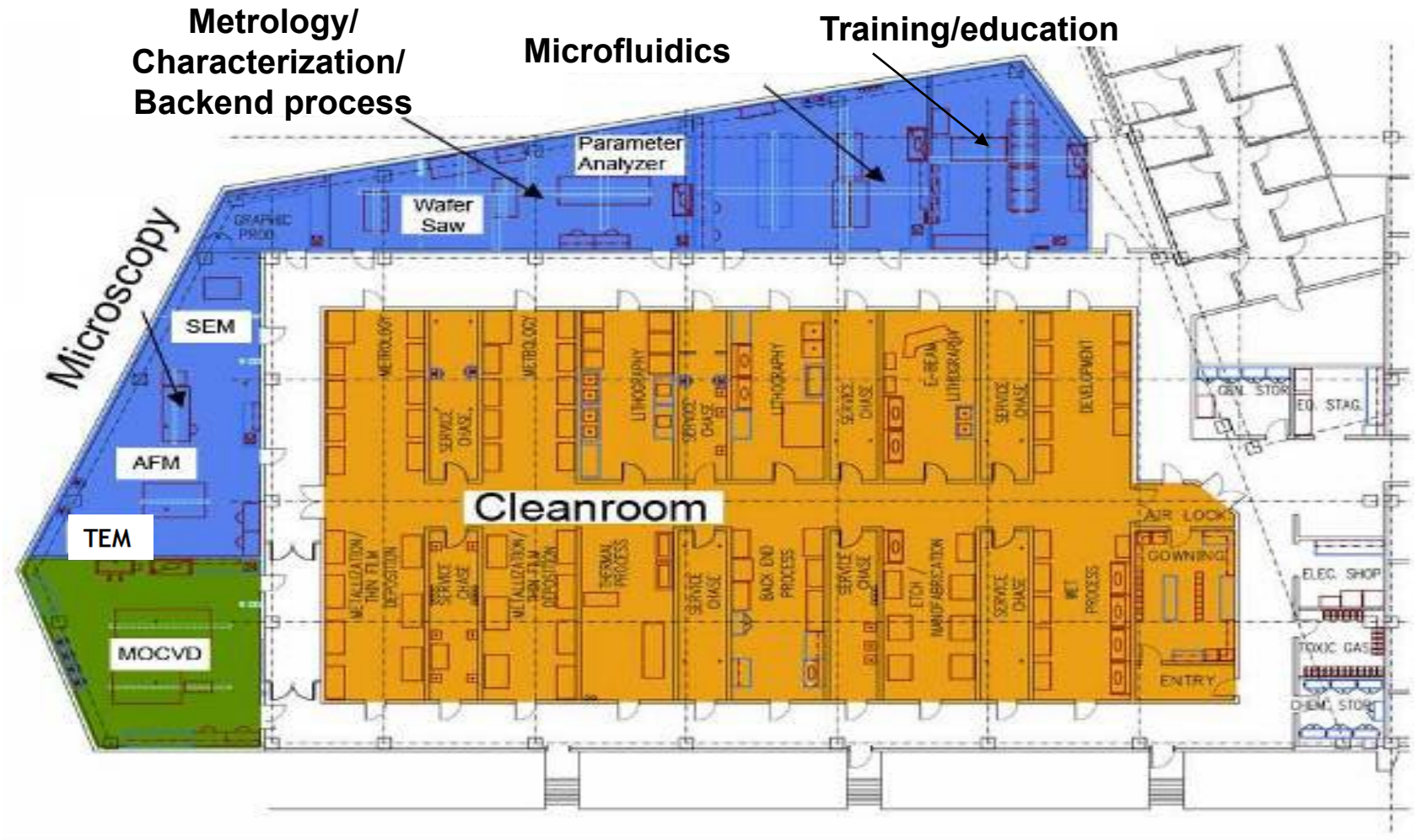
applied physics, condensed matter physics	electronic materials and devices	heterogeneous integration
Nanotechnologies	wearable/flexible electronics	bioelectronics
nanophotonics	quantum materials and devices	electronic design automation (EDA)
photonic integrated circuits	integrated circuit design	power electronics
Edge AI computing	RF/mm wave circuits	neuromorphic computing
San Diego Nanotechnology Infrastructure (SDNI)		

San Diego Nanotechnology Infrastructure (SDNI)

- One of 16 sites for NSF National Nanotechnology Coordinated Infrastructure (NNCI).
- UCSD and Stanford are two sites in California.
- SDNI is led by 2 ECE faculty: Professors Yuhwa Lo and Shaya Fainman.

- SDNI supports academic and industrial research, STEM education, workforce development and diversity.
- SDNI houses state-of-the-art nanofabrication and material characterization tools valued over $100M. Tools include 8” e-beam writer, TEM, focused ion beam, nanoimprinting, atomic layer deposition, etc.
- Every year, SDNI facility supports over 700 researchers from 150 academic groups, >80 companies, government labs for nanotechnology related research, development, and commercialization. It supports >60 PhD theses and >200 academic publications.

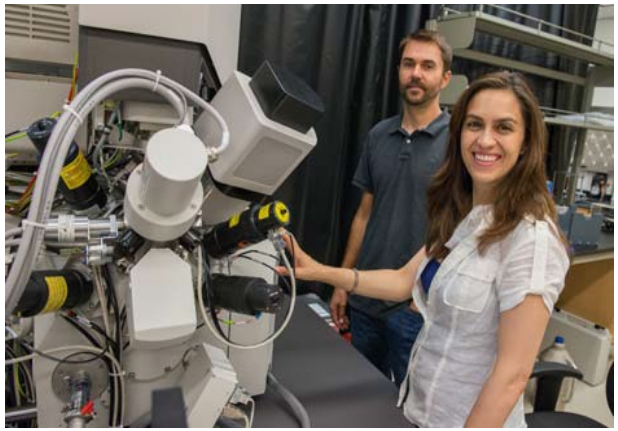
San Diego Nanotechnology Infrastructure (SDNI)



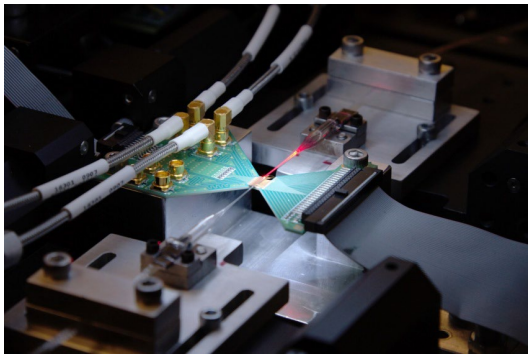
SDNI: A “User Friendly” User Facility

E-Beam Lithography

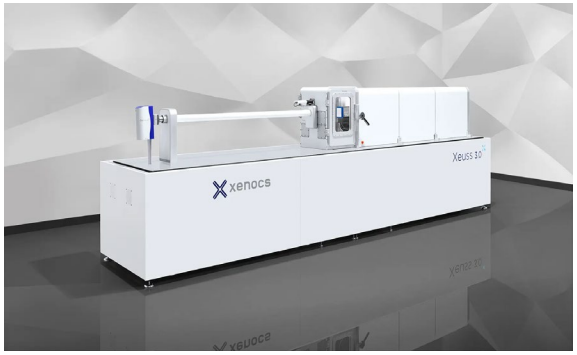
Atomic Layer Deposition



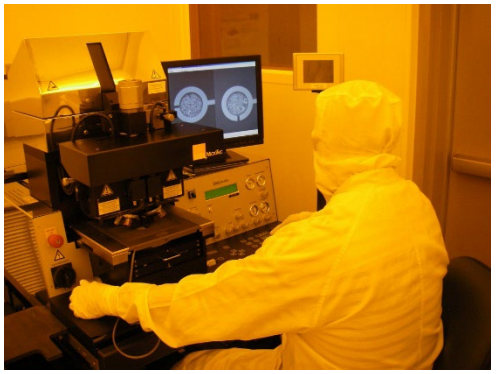
Cryo FIB/SEM System



High speed testing system



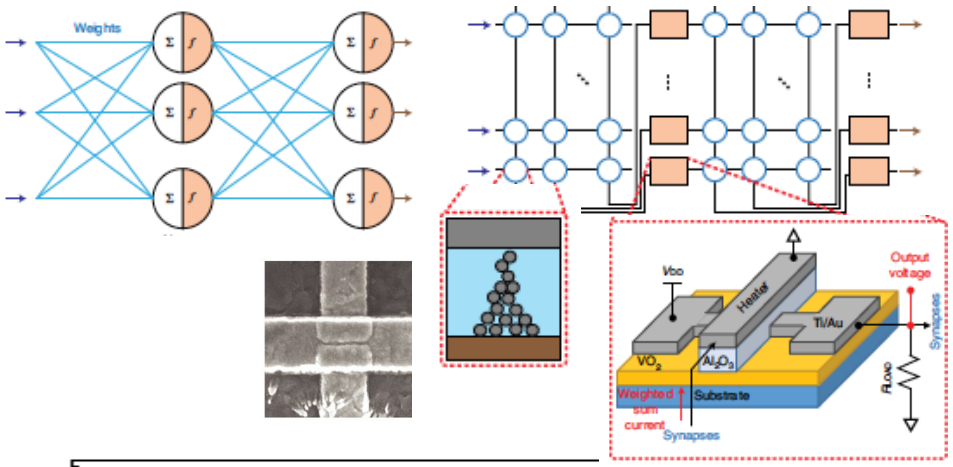
3D SAXS/WAXS Instrument

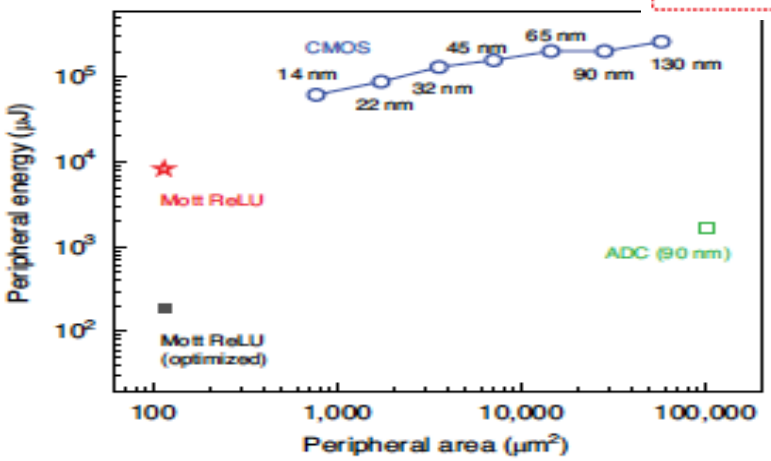


Nanoimprinting System

Research Examples

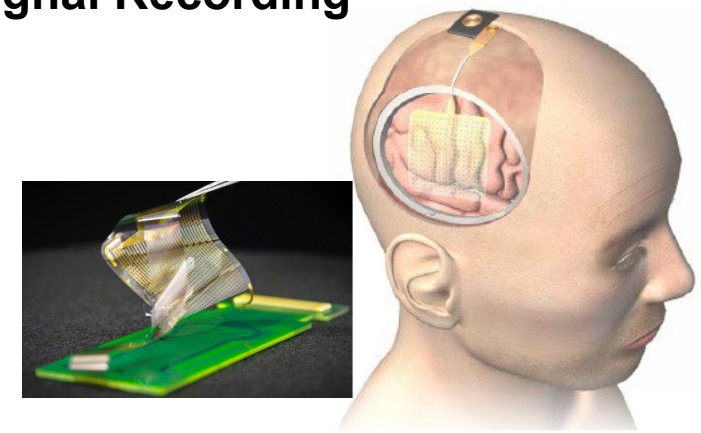
Artificial Neuron Device for Efficient Neural Network Accelerators





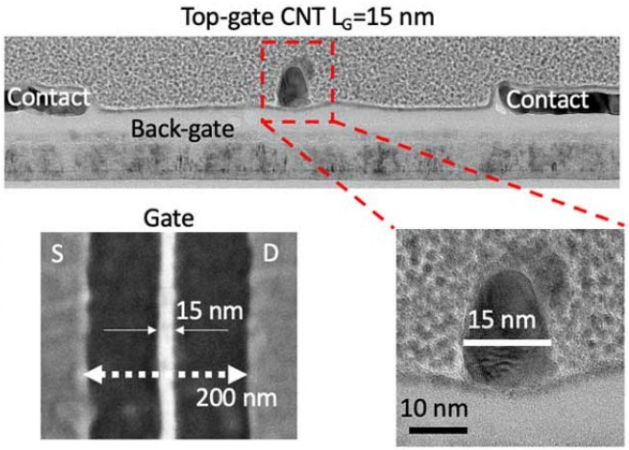
Profs. Duygu Kuzum (ECE) Ivan Schuler (Physics), Takaki Komiyama (HDSI)

3D Heterogeneous Sensors for Ultra-Resolution Human Brain Signal Recording



Shadi A. Dayeh, ECE UCSD

Nanofog Technology for Scaled-Down Carbon Nanotube Transistors



Andy Kummel

UCSD/TSMC/ Stanford

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Education and Workforce Development

ECE/SDNI developed a Nanophotonic Education Kit to support workforce development in photonic ICs

Motivation

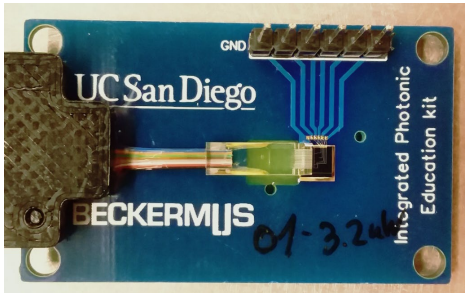
- Silicon photonics is rapidly developed into a key industry crucial to national competitiveness and security.
- Hands-on training is not readily available outside of special Ph.D. programs.

Features that support training

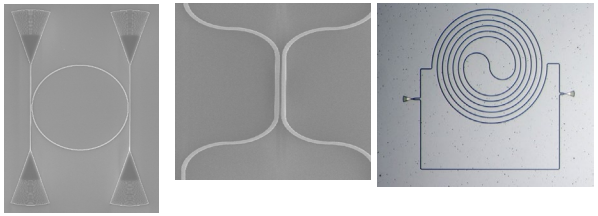
- Foundry fabricated components, heterogeneously integrated with photonic/electronic packaging.
- Provide turn-key operation with extensive instructions and manuals.
- Provide supporting software and UI (a "complete" training/education tool).

Impact

- Provide essential hands-on experiences with Si photonics.
- Bridge the gap between the needs for silicon photonics industry and today's education environment.
- Improve the quality of photonics education at all levels.
- Delivered IPEKs to technical schools (Bridgewater State University, Rose Hulman Institute of Technology), universities, and industry with strong, positive feedback.



Integrated Photonics Educational Kit (IPEK) prototype Board



Test components include ring resonators, evanescent couplers, MZIs, and more!

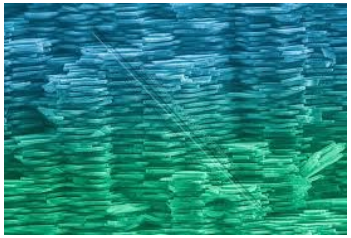
Education and Workforce Development

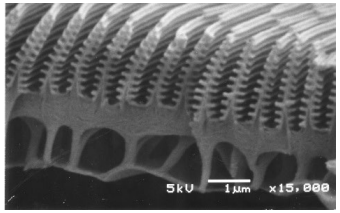
Hands-on Lab:

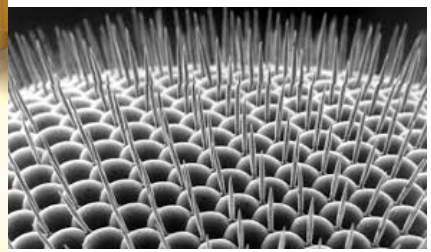
High school students are offered the chance to gain hands-on experience with nanotechnologies. Serving about 60 high school students and teachers per yr.

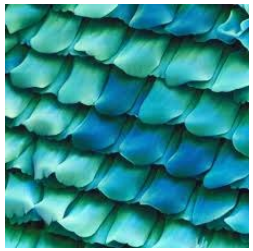
An HOL example:

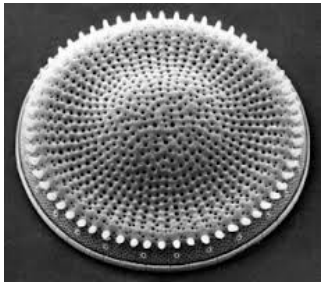
Nanostructures in nature: lab activities to explore camouflage, pigmented vs artificial colors, photonic crystals, suppression of reflections and glare, superhydrophobicity, structures of high strength and light weight, diatoms, etc..



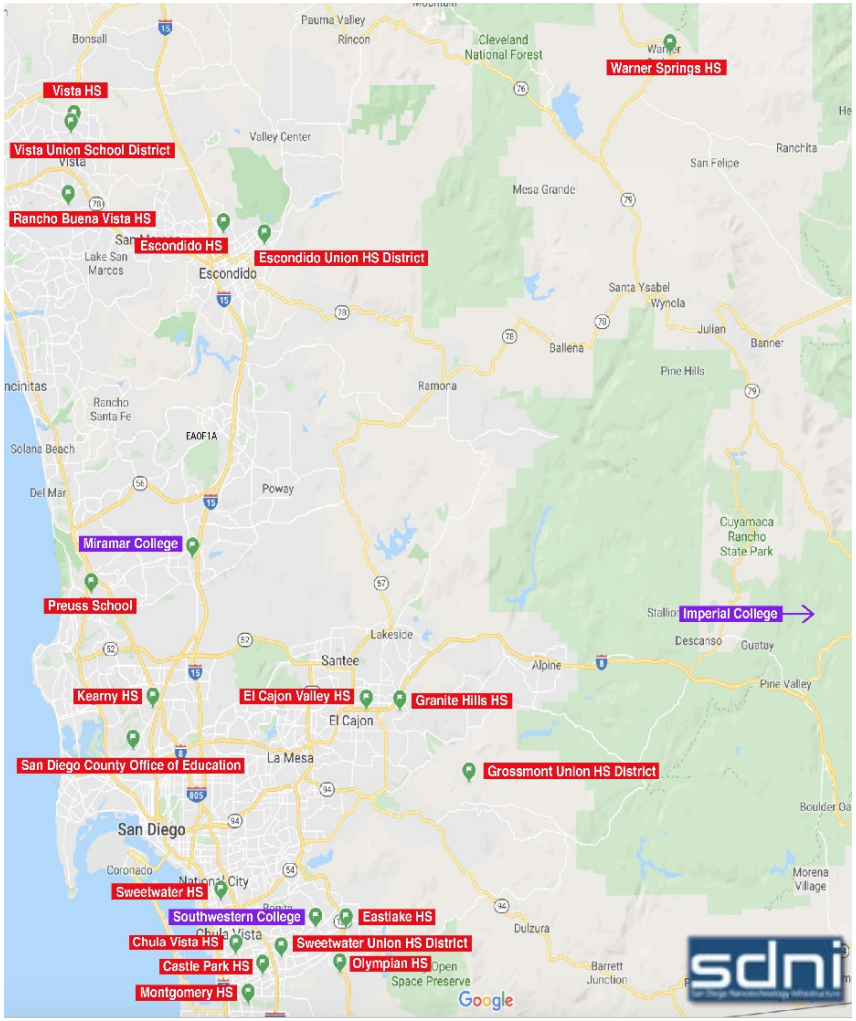








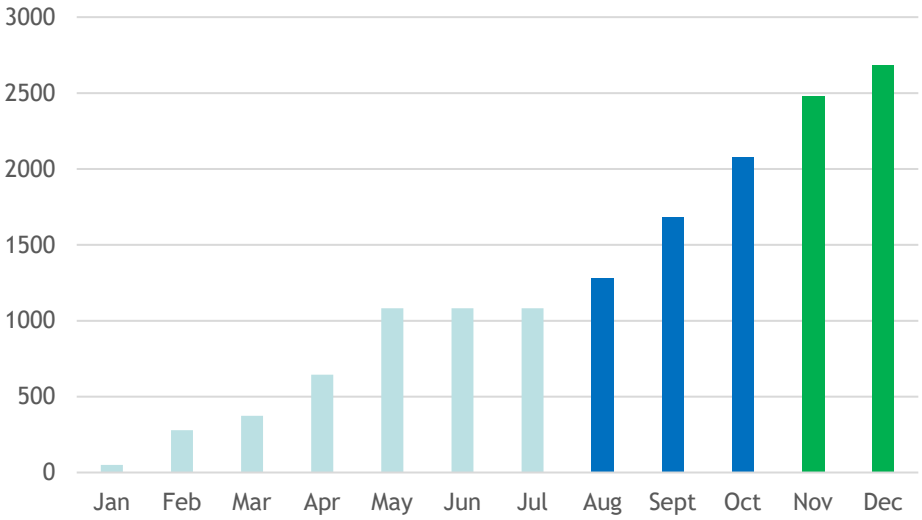
Education and Outreach: Reaching the Classroom of High School and Community Colleges



STRONG IMPACTS:

Institutions mapped on the left: San Diego County Office of Education, Escondido Union High School District, Grossmont Union High School District, Sweetwater Union High School District, Vista School District, Warner Springs School District, Imperial College, Miramar College, Southwester College, Castle Park High School, Chula Vista High School, Eastlake High School, El Cajon Valley High School, Escondido High School, Granite Hills High School, Kearny High School, Montgomery High School, Olympian High School, Preuss School, Rancho Buena Vista High School, Sweetwater High, Vista High School

Remote SEM Sessions Attendance
Long Term Relationship Development
(Number of Students – Cumulative Graph)



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Questions?