

UCSB Nanofab: Overview and Capabilities



Jonathan Klamkin*, Umesh Mishra, Brian Thibeault and Demis D. John

*Electrical and Computer Engineering Department
University of California Santa Barbara
klamkin@ucsb.edu

What?

The UCSB Nanofab is an advanced **nanofabrication user facility**.

- Open access: Users are internal (UCSB) and external (other universities, government, and industry)
- Facility houses **~\$60M of equipment**

When?

In operation for **more than 25 years**

Why?

To support innovation

- User base is **>500 annual users** and **>50% of these users are from industry**
- To our knowledge, this is the largest industrial base supported by any university nanofabrication facility in the United States.

How?

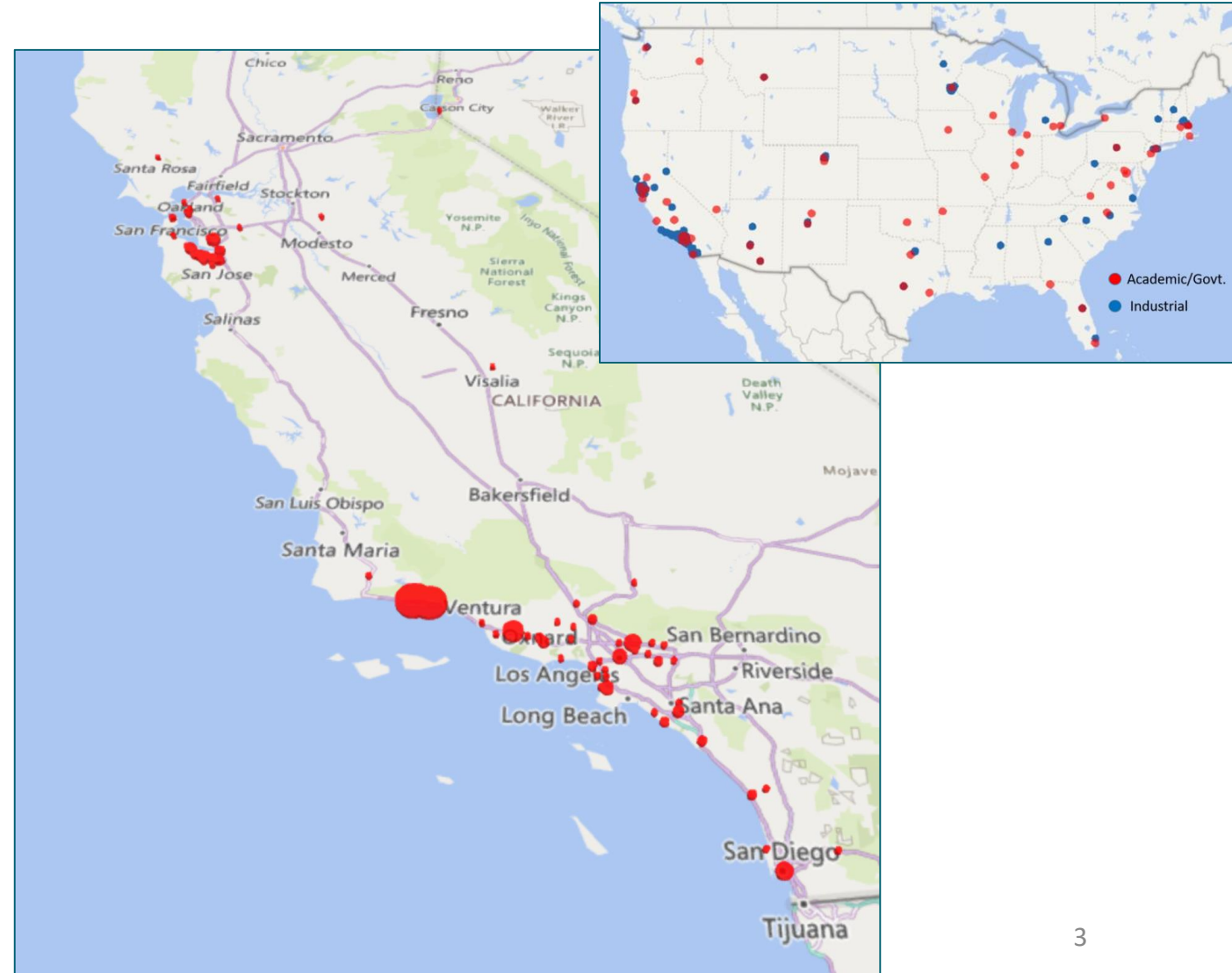
The UCSB Nanofab charges user fees to support its operating budget.



Maps of UCSB Nanofab users

UCSB Nanofab by the Numbers

- **State Impact:** UCSB Nanofab has been accessed by more than **200 California companies** since 2006
- **National Impact:** **260 companies nationwide** have accessed the facility, and of these, **195 are small companies**
- **68 companies are local** (Goleta and Santa Barbara)
 - 29 of these companies were started and led by UCSB faculty and/or graduates
- **92 academic institutions** served nationally since 2006



Summary of Capabilities: $\geq 100\text{mm}$ (up to 150mm)



- Full suite of advanced fabrication and characterization available for nanofabrication including: precision lithography, etching, deposition, integration and packaging
- Our facility is $\geq 100\text{mm}$: All tools support 100mm, many support 150mm
- Full equipment list: https://wiki.nanotech.ucsb.edu/wiki/Tool_List

Main Website



The UCSB NanoFabrication facility combines world-class cleanrooms with expert staff to help our users do the impossible - no matter how small

Researchers

- Staff support on your research and fabrication needs
- Access a wealth of process development information on our Process Wiki
- Collaborative environment for early stage R&D

Faculty

- Strong publications record, see the publications list
- Wide support for non-standard materials and processes
- Staff support on R&D fabrication, design and DOE

Industry

- Ease of use - get in and start processing right away
- High lead up-time and staff responsiveness
- Proven record with industrial prototyping and transition to various levels of production

New access protocols on the Nanofab Wiki: [COVID-19 User Policies](#)

Nanofab Wiki



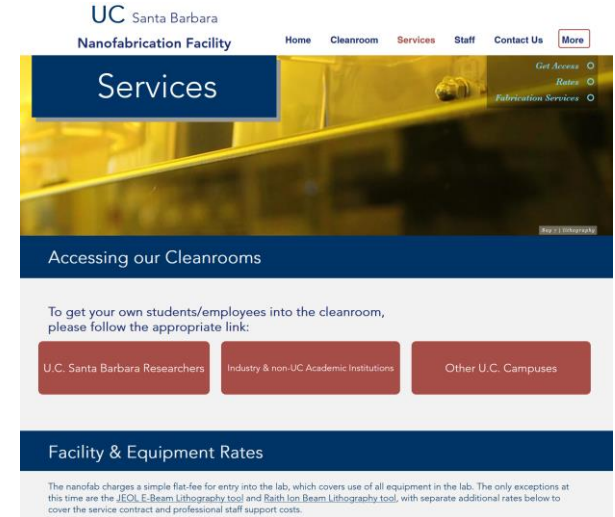
Access made simple for UC and external users

- A. Users directly access facility
- B. Remote access possible with Staff support
- C. Local companies provide fabrication services

Rates

- **New User Fee (one-time charge, in-person lab access only)**
 - U.C. Academic: \$100
 - Non-U.C. Academic: \$137
 - Industrial: \$155
- **Use of Main Facility & Equipment (Including Trainings)**
 - UC-Academic: \$37.50/hr
 - Non-UC-Academic: \$51.00/hr
 - Industrial: \$139/hr
- **Use of Dicing/Polishing Lab (Including Trainings)**
 - UC-Academic: \$26.00/hr
 - Non-UC-Academic: \$36.00/hr
 - Industrial: \$78.00/hr
- **E-Beam Lithography Equipment Use**
 - UC-Academic: \$126/hr
 - Non-UC-Academic: \$173/hr
 - Industrial: \$412/hr
- **Ion Beam Lithography Equipment Use**
 - UC-Academic: \$45/hr
 - Non-UC-Academic: \$62/hr
 - Industrial: \$211/hr
- **Dedicated Staff Support**
 - UC-Academic: \$85/hr
 - Non-UC-Academic: \$116/hr
 - Industrial: \$162/hr

Gaining Access



Working with our Staff

Fabrication Services by Cleanroom Staff

Use our expert cleanroom staff to perform your experimental and prototyping jobs!

Request Fabrication Services

We are trained on all the equipment, have experience with a vast array of different fabrication needs, and develop processes for many industrial and academic customers.

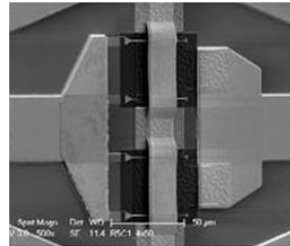
We bill at the above rates for "Use of Facility" plus "Dedicated Staff Support", per hour - equivalent to your own staff performing the work in the lab.

Facility and capabilities support efforts across science and engineering including:

- Electronics
 - Photonics
 - MEMs
 - Microfluidics
 - Materials
 - Physics
 - Chemistry
 - Biology
 - Quantum
- Mixed materials and use
- Strong emphases on:
- Compound semiconductors including GaAs, InP, GaN, GaSb, and related compounds
 - Heterogeneous integration of compound semiconductors on other platforms including silicon

*Note: Heterogeneous integration includes flip-chip integration, wafer bonding, micro-transfer printing, and direct heteroepitaxy

GaN HEMTs



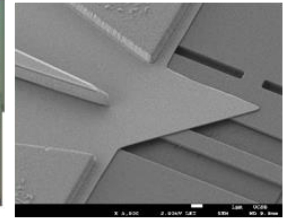
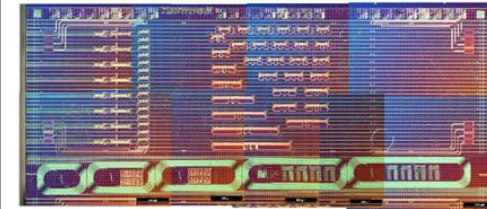
III-V MOS



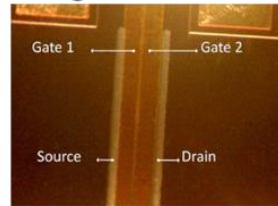
LEDs for Lighting



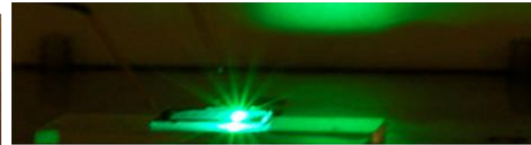
Silicon photonics



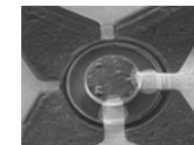
Organic FETs



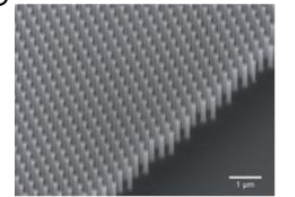
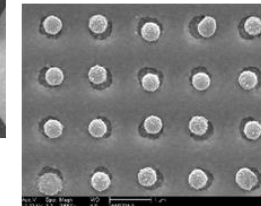
Nitride-based lasers



DNA Sequencing



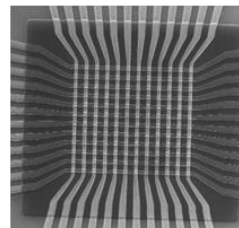
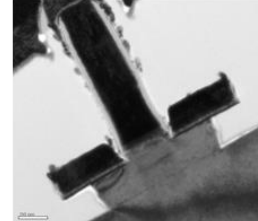
VCSELs



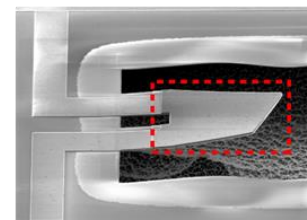
Chem. Sensing

Photonic ICs

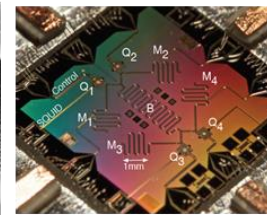
THz transistors



Phase-change memory

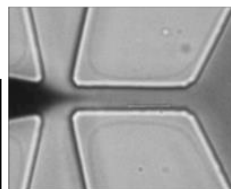
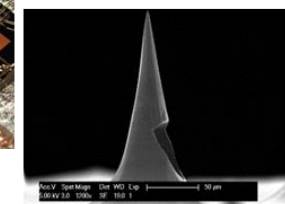


Quantum MEMs



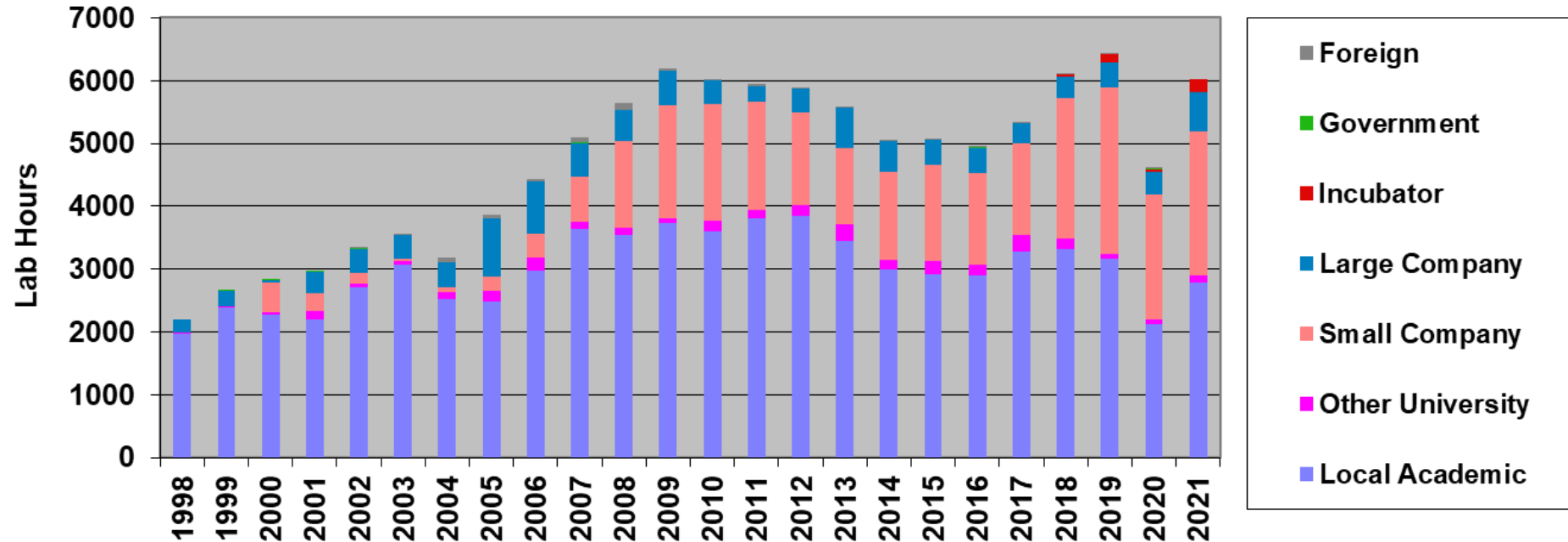
Q-bits

Microneedles



Micro-Nanofluidics

Average Monthly Lab Hours by Affiliation



- Facility capabilities and use grew organically with growth in research at UCSB
- In early 2000s, more and more industrial users requested access, and over time this has enabled continuous growth in the Staff and equipment capabilities.

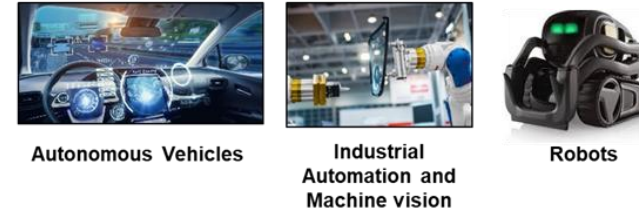
Example Industrial User and Commercialization Successes



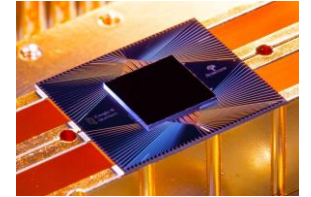
- Imagers and range finders for defense and aerospace
- Processes developed at UCSB then transferred to production
- Founders are UCSB graduates
- ~50 employees



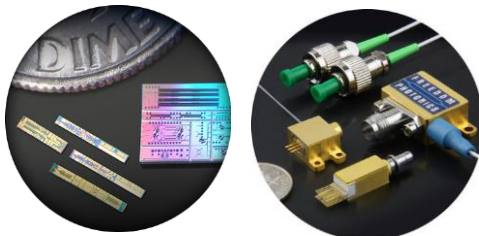
- Soraa and then SLD Laser develop LED and laser products for lighting, displays
- Founded by Nobel Laureate Shuji Nakamura, Steven DenBaars, James Raring (UCSB graduates and faculty)
- Acquired by Kyocera and >200 employees



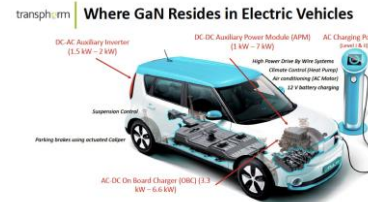
- Scalable, cost-effective sensors for automotive and industrial LiDAR
- Founders are UCSB graduates and faculty
- Company went public in 2021



- Quantum computing technology spun out of UCSB to Google
- Fabrication development at UCSB Nanofab



- Lasers and photonic integrated circuits for communications and sensing
- Processes developed at UCSB and transferred to foundry
- Founders are UCSB graduates
- Company acquired by Luminar



- GaN power electronics and RF devices
- Automotive market focus
- Founded by UCSB graduates and faculty
- Processes developed at UCSB and transferred to production
- Company went public in 2020



- Ultra-low noise crystalline mirrors for spectroscopy and sensing applications
- Processes developed at UCSB Nanofab
- Founded by UCSB graduate
- Acquired by Thorlabs

UCSB

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