Berkeley Sensor & Actuator Center

Kyoto MEMS Symposium

- Basic Center Statistics & Benefits
- Membership & Faculty Roster
- Announcements

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What is BSAC?

- Research Consortium on MEMS, BioMEMS, & NEMS at the ***University of California, Berkeley***.
- BSAC is also **The National Science Foundation** I/UCRC on MicroSensors & MicroActuators

–Industry/University Cooperative Research Center.

–Pre-commercial, “Enabling” Research

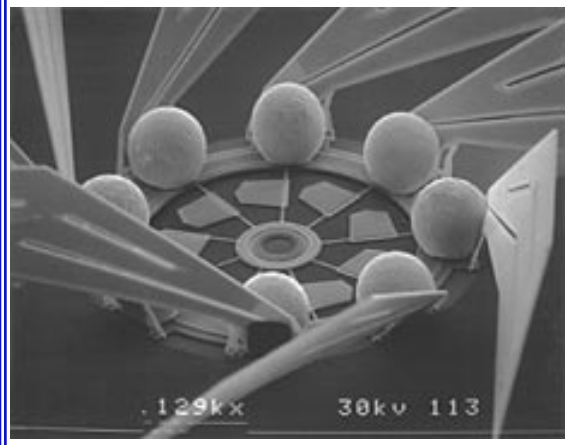
–Rapid Research Adoption by Industrial Members.

–Founded 1986 at UC Berkeley;

– Added *University of California, Davis* 1998.

–Largest of 50 U.S. I/UCRC’s

Some BSAC Achievements
(Large Deep Multidisciplinary Research Center)



MEMS Processing and Materials

-Surface Micromachining of Polysilicon
-Low Temperature Integrated Silicon-Germanium Process
-Anti-Stiction Surface Treatments and Dimpled Structures

Micro Electro Mechanical Devices and Structures

-Integrated Digital Accelerometer
-Integrated Digital Gyroscope
-Comb-Driven Electrostatic MEMS Actuator
-Lamb Acoustic-wave Sensors and Actuators
-Pin-Jointed Micromachined Gears, Cranks, and Springs
-MEMS Micro-Vibromotors
-Hinged, Pop-up Micromachined Out-of-plane Structures

MEMS Systems and Subsystems

-MEMS Microfluidic Mixing/Dispensing System
-MEMS Based Free-Space Optics
-Multi-level PolySi Micromechanics w/on-chip Activation
-Integrated x,y Rastered Real-Time Projected Display
-Piezoelectric Biomimetic Directional Diaphragm Microphone
-MEMS-Scanned Barcode Reader
-Microfluidic Host-Fueled Glucose Microbial Power Cell

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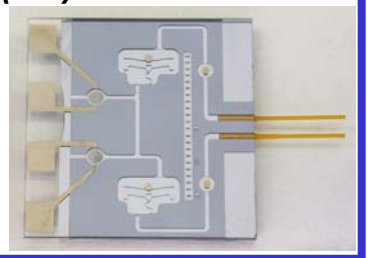
Outstanding IAB Papers (Past Year)

Best Research Papers Fall 03

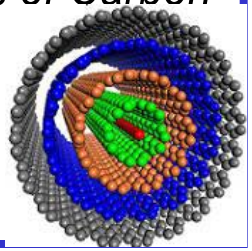
- **Jeremy Frank *(APP)* &**
  Stefan Zimmerman *(DL)*

"MEMS Positive Displacement Liquid Pump"



- **Dane Christensen *(LWL)***

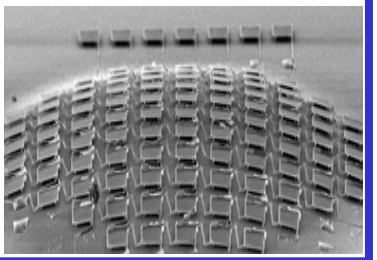
"Room Temperature Synthesis of Carbon Nanotubes"



Best Research Papers Spring 04

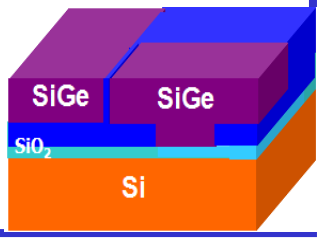
- **Paul Hung (LPL)**

"Biomemetic Imager as Omnidirectional Sensor ("BIOS")"



- **Dr. Emmanuel Quevy (RTH)**

"Damascene Process for Integrated Poly-SiGe RF MEMS"



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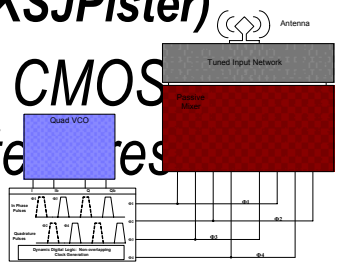
Outstanding IAB Papers (Fall 2004)

Best Research Papers Fall 04

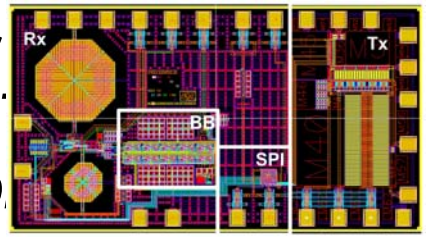
- **Benjamin Cook *(KSJPister)***

"Ultra-Low Power RF CMOS Transceiver Architectures"



- **Brian Otis *(JRabaey/BWRC)***

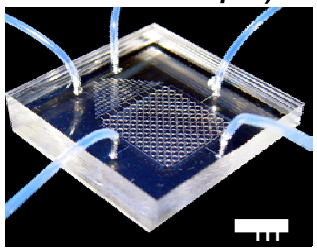
"Low-Power Wireless Sensor"



Best Posters Fall 04

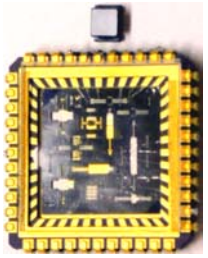
- **Phillip Lee *(LPLee)***

"Integrated BioMEMS Cell Culture Chips)"



- **Baris Cagdaser *(BBoser)***

"MEMS *Single Electrode Resonant Drive* "



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Berkeley Sensor & Actuator Center

Industrial Members (34) circa Winter '04

Alza (Johnson & Johnson)
Analog Devices
*Applied Biosystems
ChevronTexaco
*Corning Corporation
Draper Labs
Discera
Eastman Kodak
*Freescale Semiconductor
Gillette
Honeywell
HRL Laboratories
*IBM
Intel
Livermore Nat'l Labs
*Nortel Networks
Raytheon
Sandia Nat'l Labs
Textron
Timken
Zyvex

Bosch
Siemens
*France Telecom
Suss MicroTec

Omron
*Rohm
Samsung
Sharp
Sony
TDK
*Toshiba
*TRDA
Yamatake

*Entering Member 2004

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Multidisciplinary Faculty of BSAC

- Bernhard E. Boser EECS
- **Roger T. Howe EECS,** (Division Chair EE)
- Richard Muller EECS (Founder)
- Kris Pister EECS
- Richard White EECS (Founder)
- Ming Wu EECS
- **Luke P. Lee BioEngineering**, (Director, BioNanoTech Center)
- Dorian Liepmann BioEngineering (Chair)
- **Albert Pisano Mechanical Engineering** (Chair)
- **Liwei Lin Mechanical Engineering**
- Norman Tien UC Davis ECE (Chair)
- David Horsley UC Davis Mechanical Engineering

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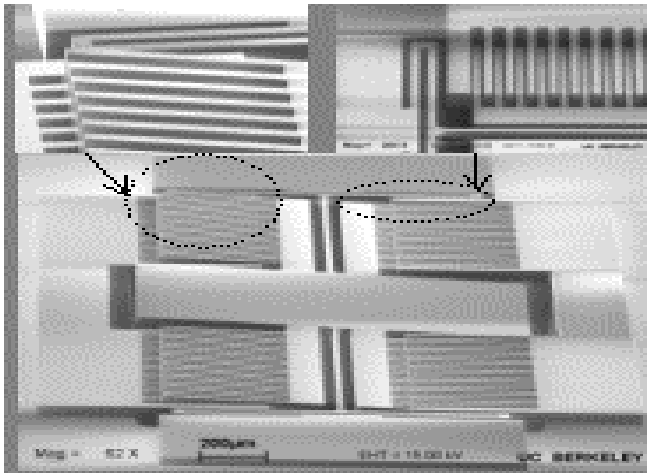
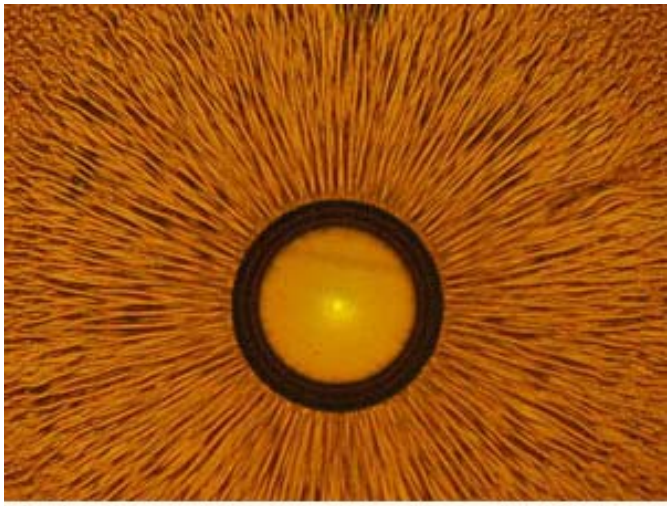
BSAC Personnel & Project Statistics





big photoresist bubble with newtons rings photo: Matt Last

People & Projects

- 117 Graduate Researchers
- 20 Post-Doctoral & Research Leaders
- 25 Faculty Directors & Faculty Affiliates
- 34 Industrial Members
- 108 Reported Projects
- **Research Area:** *(# Projects)*
- *Devices, Processes, Packaging (11)*
- *Wireless & RF Devices (23)*
- *BioMEMS & Microfluidics (29)*
- *Power/Energy Generation (17)*
- *Sensors, Actuators, Robotics (17)*
- *MicroPhotonics (8)*
- *CAD, Other (3)*
- *Nano-Micro Transduction/ Interfaces*

BSAC Membership Details

- Annual Membership Fee $50K U.S.
  - 15%-20% of Research Budget (6:1 “leverage”)
  - Membership benefits can* extend to subsidiaries

    *with Director approval
- Semiannual 3-Day Research Review (+ Regional IAB)
  - Confidential prepublication disclosure of <u>all</u> research
    - Member funded and Grant Funded
  - Every project reviewed each meeting
    - Summary presentation + Poster Session
  - Member-Only 500+ page proceedings each meeting
    - **All Proceedings material available from secure website**

http://www-bsac.eecs.berkeley.edu or **http://bsac.berkeley.edu**

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Other Member Benefits

- Patent license advantages for Members
  - 90 Day First Look at all commonly funded/grant funded BSAC Invention Disclosures. (Exclusive/Nonexclusive Licenses from OTL)
- Member Access to UC Berkeley Programs
  - MicroLab Affiliate Program
  - Visiting Industrial Fellow Program
  - Sponsored BSAC Research Projects
    - » Collaboration with Directors/Researchers
  - Member access to other Berkeley Industrial Liaison Meetings
  - Graduate Recruiting benefits-Web access to student profiles
  - Student Internship opportunities
  - Attendance at on-campus research group meetings

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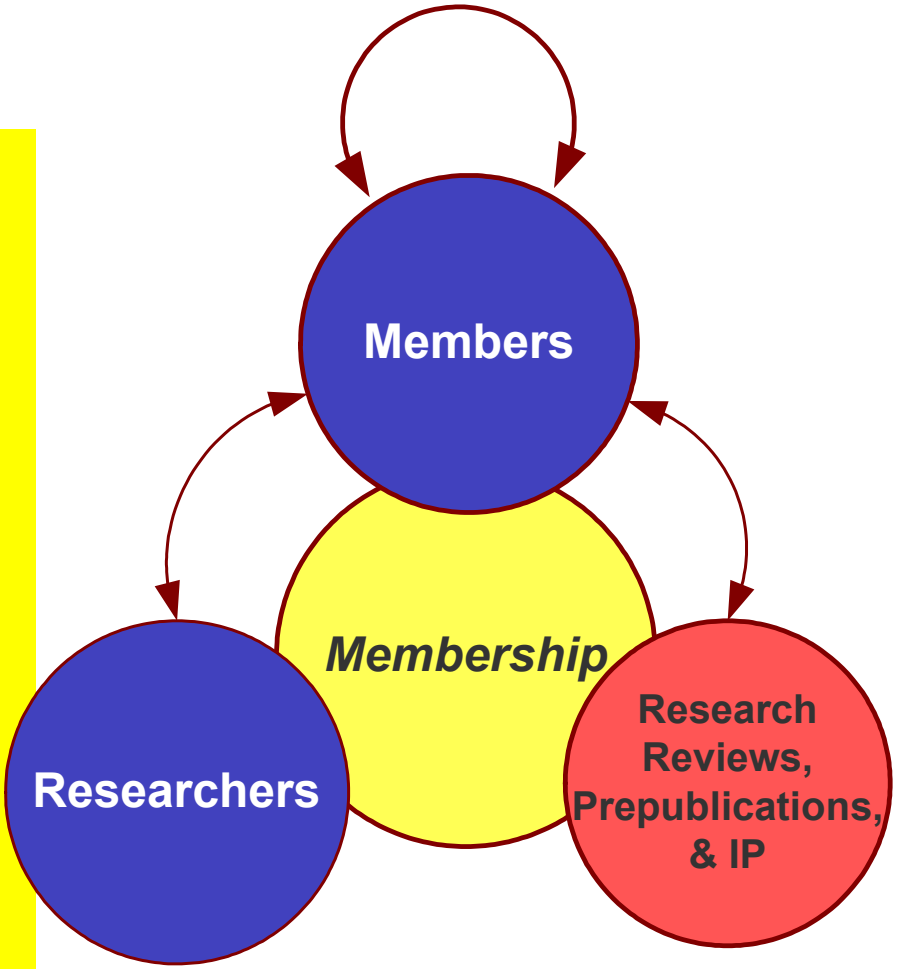
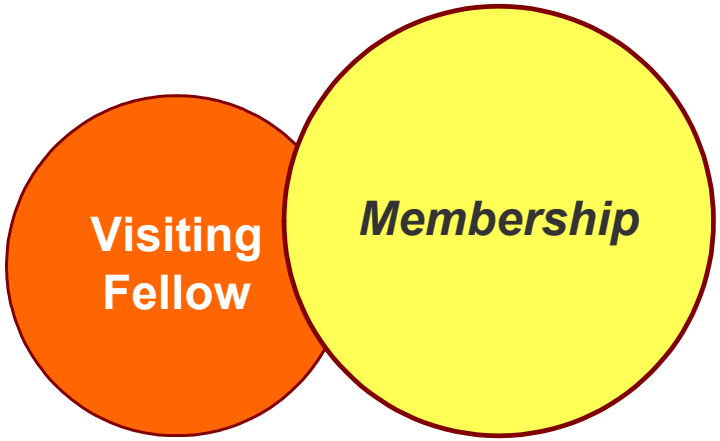
Collaboration-Membership

- Members-Researchers
  - Personal
  - Summer Internships
  - Hiring
- Member-Member
  - Leads to business relationships
- Information Dissemination
- Intellectual Property License



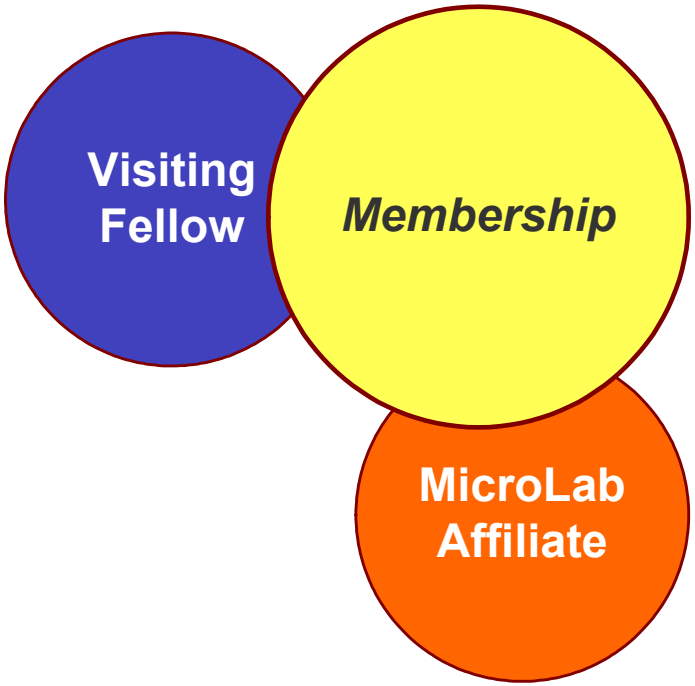
Visiting Industrial Fellow (send a researcher to campus)

- With Consent of Faculty Sponsor
- In Research Group
- On Private Research Project
- Microfabrication Access
- Campus "Contacts"
  - Other centers
  - Seminars
  - Audited Courses



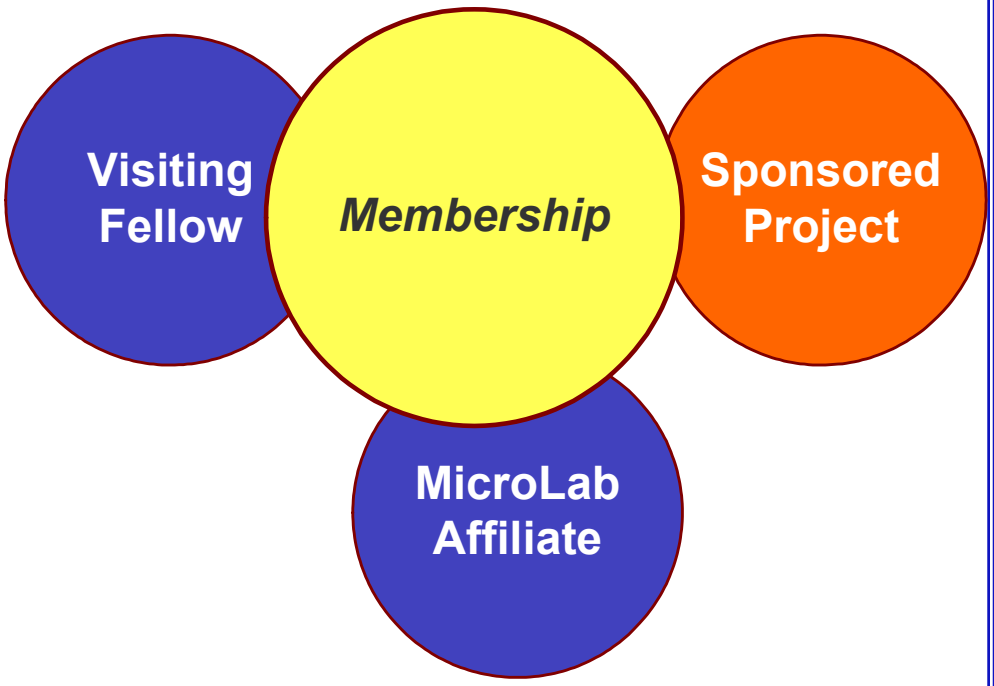
Microlab (microfabrication facility) Affiliate
(Use our Microlab on a recharge basis)

- Equipment Evaluation
  - DRIE Centura/STS/Alcatel
  - Flip Chip Bonder Suss
  - Nanomanipulator Zyvex, etc
- Process Module Development
  - SiGe (MEMS on CMOS)
  - SiC (Harsh Environment)
  - BioCompatible Microprocesses
- Product Development



Sponsored Projects

- Built on pre-existing research
  - Specific PI (Faculty)
  - Specific Student or Post-Doc
- Prenegotiated Goals
- Prenegotiated Deliverables
  - Reports
  - Prototypes
- Prenegotiated IP
  - Options to Patents



Announcements

Upcoming Events

- **Wireless Symposium Berkeley July 2005 (Date TBD)**
  - *In Conjunction with other Berkeley wireless research groups*
  - *No cost to BSAC Members*

- **Spring IAB UC Berkeley March 7-9 2005**

Technical Papers

Kyoto December 2, 2004

Luke P. Lee, Department of BioEngineering UC Berkeley

"BioPOEMS with BASICs for Molecular Medicine"

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