Why Large Scale Initiatives: An NSF (Federal) Perspective

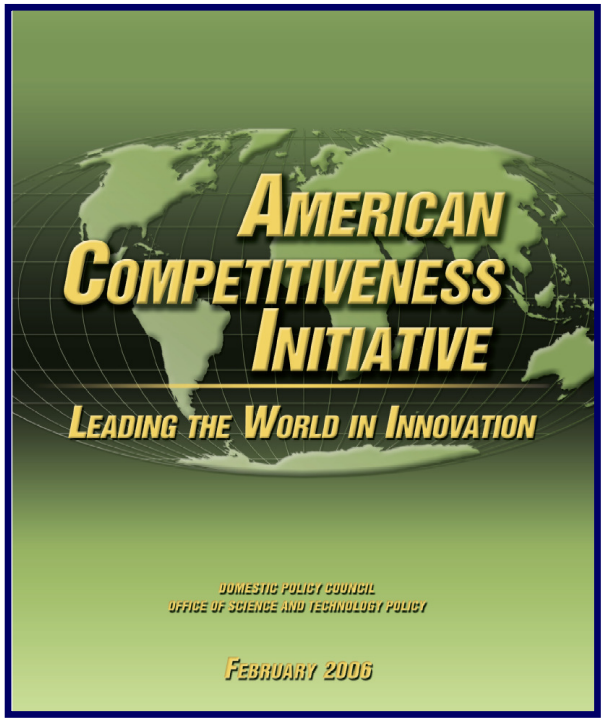
❖ **Centers and Large Scale Initiatives permit accelerated progress in research areas of National priority**

❖ **Particularly where such progress cannot be accomplished through single investigator funding**

❖ **Centers and LSIs can promote institutional change by addressing broader impacts including education and diversity enhancement**

♦ **The American Competitiveness Initiative is currently a major driver at NSF**

Office of the President



Endorsed by Congress

Practical Consequences of the ACI (A Unique Opportunity):
--Doubling of the NSF, DoE, and NIST budgets
--Reactivation of the Advanced Technology Program ($70M this year)

Why the American Competitiveness Initiative?

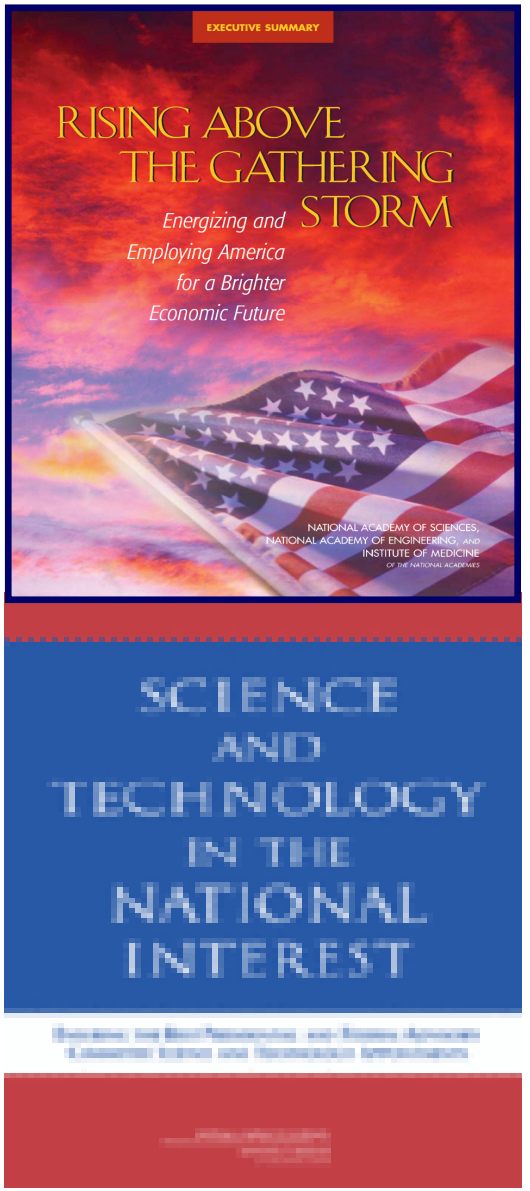
America at Risk! ⇒

⇓

- Well documented crises in energy and high technology areas
- Well documented workforce issues

The American Competitiveness Initiative naturally focuses on broader impacts

National Academy of Sciences Reports



Why Large Scale Initiatives: A University Perspective

♦**Universities pursue Large Scale Initiatives for many of the same reasons as the Federal government**

⇒ Concentrates significant resources for major problems of National importance.
⇒ Assembles interdisciplinary expertise
⇒ Promotes pursuit of new educational experiments
⇒ Facilitates development of diversity programs.

♦**Large scale initiatives can be attractive to industry**

Why Large Scale Initiatives: A Faculty Perspective

♦**Facilitates meaningful and enjoyable collaborations**
♦**Facilitates "broader impact" activities (which can help with single investigator proposal submissions)**
♦**Enhances graduate student recruitment**

The Route to Large Scale Initiatives

Development of Teams of Collaborators and Facilities—Success Begets Success

Federal Grant Awards (2001)

- National Science Foundation Nanotechnology Interdisciplinary Research Team (NIRT) ($2M)
- Department of Defense MURI Center for Smart Materials ($5M)
- Department of Defense DURINT Center for Nanoelectronics & Nanophotonics ($5M)
- BMDO Demo Project on EO Devices ($3M)
- Department of Defense MURI Center for Nano Materials and Processing ($5M)

Pending Awards (2001)

- ***National Science Foundation Science & Technology Center on Materials & Devices for Information Technology Research (STC-MDITR) ($19M/5 years)***
- DARPA (CS-WDM/$10M with Boeing)
- DARPA (Supermolecular Photonics (MORPH)/$25M)

Facility Grants

- DoD DURIP
- NSF Instrumentation Grants

Industrial Partnerships

- Lumera
- Boeing
- Lockheed Martin
- Eastman Chemicals
- Solvay
- Intel
- Luxtera
- AES
- Lumoflex
- NP Photonics
- Ford
- CIBA

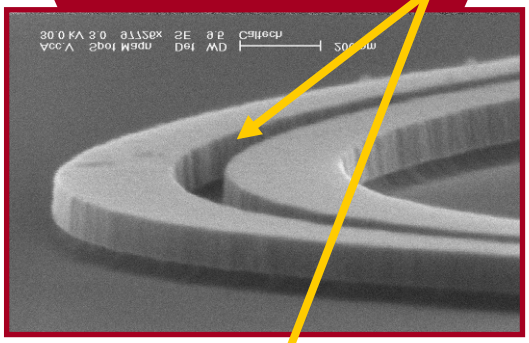
UW Center on Materials and Devices for Information Technology Research

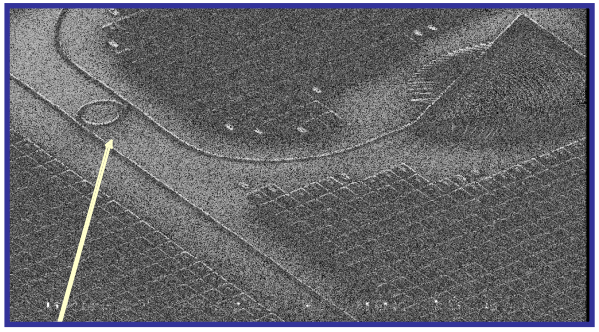
An NSF Science and Technology Center, DMR-0120967

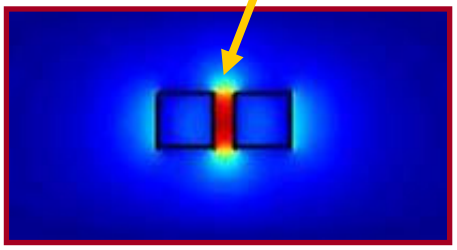
Organic Electro-Optic and All-Optical Materials and Devices

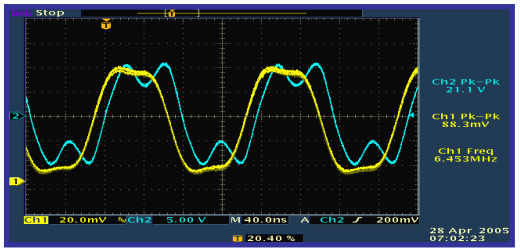
ACHIEVEMENT: Electro-optic (EO) polymers have been incorporated into novel silicon (Si) waveguide devices where the optical wave is concentrated in the slot (see figure). Voltage-tuned Si modulators with tuning sensitivity of over 15 GHz/V have been demonstrated in devices smaller than the diameter of a human hair.

Si SOI wave-guide with 100nm slot Organic EO material goes here:









Distribution of optical field in the slot: Optical field intensity is 100x higher in the slot.

IMPACT

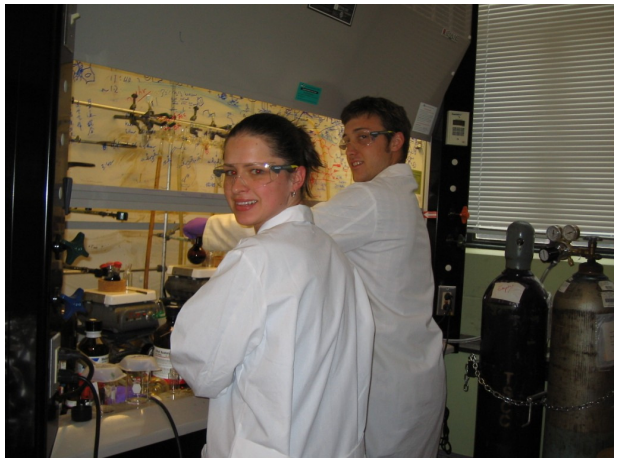
The incorporation of organic electro-optic materials into slotted silicon photonic ring micro-resonators has permitted both high bandwidth electro-optic modulation and optical rectification to be demonstrated.

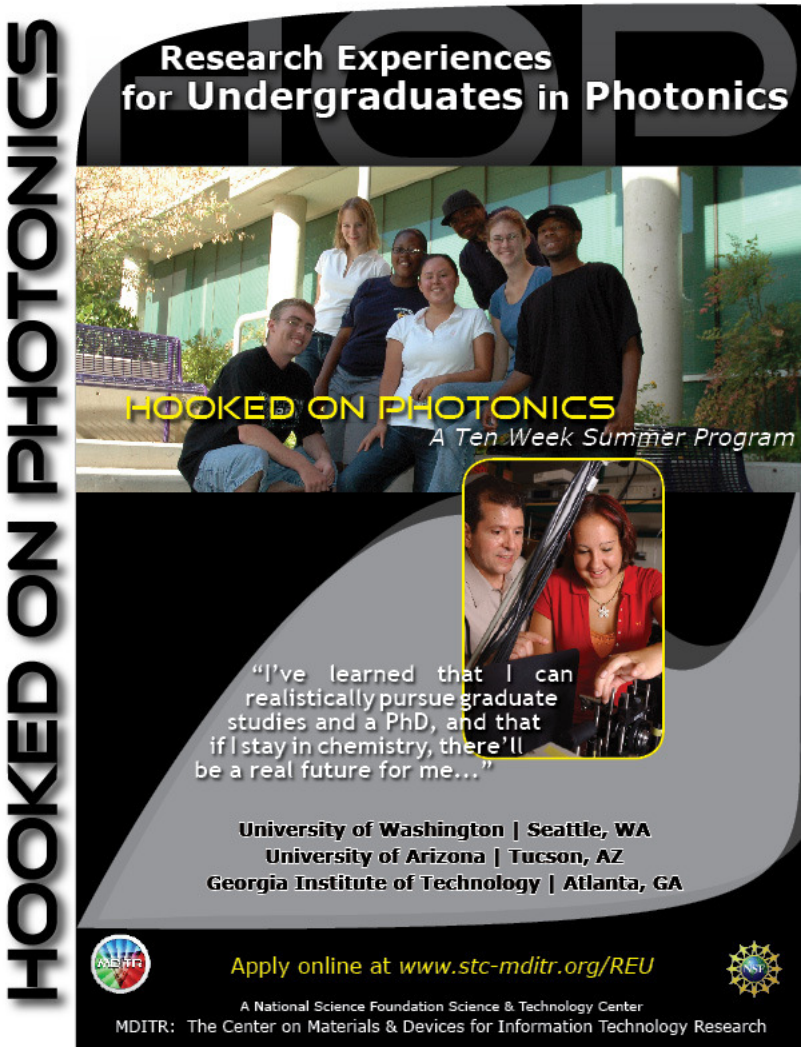
The size of the ring micro-resonators are smaller than the diameter of a human hair permitting high density integration of such devices on a single chip. All-optical modulation in silicon photonic Mach Zehnder modulators incorporating organic nonlinear optical materials has been demonstrated up to 5 THz with milliwatt control beams.

STC REU Program: Hooked on Photonics

Gateway Experience:

- Partnerships with community colleges and minority-serving 4-year institutions
- Attract and retain
- 50% of the participants in 2006 were gateway

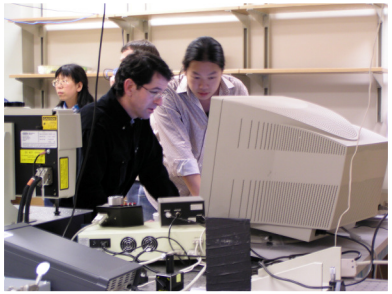


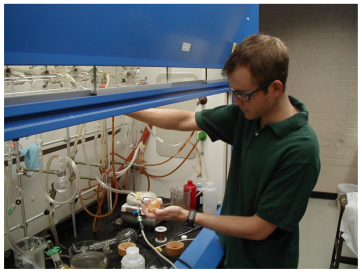


Graduate Student Industry Internship Program

Benefits for graduate students

- Gain valuable industry research experience.
- Better understand industry career tracks.
- Stimulate University-Industry collaboration.
- Build a network of industry contacts.





Benefits for faculty advisors

- Cross-pollination of ideas, techniques, and cultures.
- Students will have increased scientific and professional training.
- Stimulate University-Industry collaboration.
- Build a network of industry contacts.

Education and Partnership Program

ACHIEVEMENT: Norfolk State University's Ph.D. Program in Materials Science and Engineering is Approved by the State of Virginia.

CMDITR has been collaborating with NSU faculty in the development and implementation of a new Ph.D. program in Advanced Materials Science and Engineering (www.nsu.edu/cmr)

NSU's Ph.D. recruitment workshop was attended by 45 students on November 17, 2006.

This is NSU's first Ph.D. program in Science or Engineering and only the second MSE Ph.D. program in an historically black college or university.

NSU held its first student recruitment workshop on November 17, 2006 with 45 participants.

The program will begin in fall 2007 and had received 20 applications by the end of January 2007.

Diversity and Outreach Program

CMDITR LEADS GEM-STC PARTNERSHIP INTO NEW PHASE

The GEM-STC Partnership pairs the recruitment needs of seven STCs with the recruitment success of the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM). The partnership entered into a new phase of refined recruitment initiatives for the Fall 2007 season.

The GEM-STC Partnership offers graduate fellowships to underrepresented students. In 2006, four inaugural fellowships were awarded. The CMDITR recipient enrolled in UW's Chemistry Ph.D. program in Fall 2006 and has successfully completed her first term.

SECOND ANNUAL FUTURE TECH WORKSHOP

CMDITR partnered with three other Centers to introduce minority students to research opportunities within NSF funded STCs. A total of eight hands-on workshops were offered during the conference. 150 minority students participated – Native American, Hispanic and African American – from over 30 institutions.

THE NATIONAL GEM CONSORTIUM

Knowledge Transfer

- Results communicated to academic, industry, and public audiences worldwide.
- Existing industry partnership was expanded from $3 million to $5 million.
- New partnership was forged with a leading semiconductor manufacturing firm.
- Researchers and inventors worked together seamlessly across institutional boundaries.
- Industry Internship and Graduate Mentoring Programs were launched.