Nano.gov
U.S. National Nanotechnology Initiative

Nanotechnology Signature Initiative*
Nanoelectronics for 2020 and Beyond

Overview

The semiconductor industry is a key driver for U.S. and global economic growth and has contributed significantly to the productivity gains experienced over the past several decades. These gains are due, in part, to the continuous miniaturization enabled by advances in materials science, microelectronics design and fabrication, and manufacturing, resulting in ever smaller, faster, and more affordable devices. As length scales of electronic devices approach atomic dimensions, current architectures are reaching physical limits, and new methods for storing and manipulating information must be developed for miniaturization to continue. Further reductions in device dimensions are important to increase processing speed, reduce device switching energy, increase system functionality, and reduce manufacturing cost per bit.

Goals

To accelerate the discovery and use of novel nanoscale fabrication processes and innovative concepts to produce revolutionary materials, devices, systems, and architectures to advance the field of nanoelectronics.

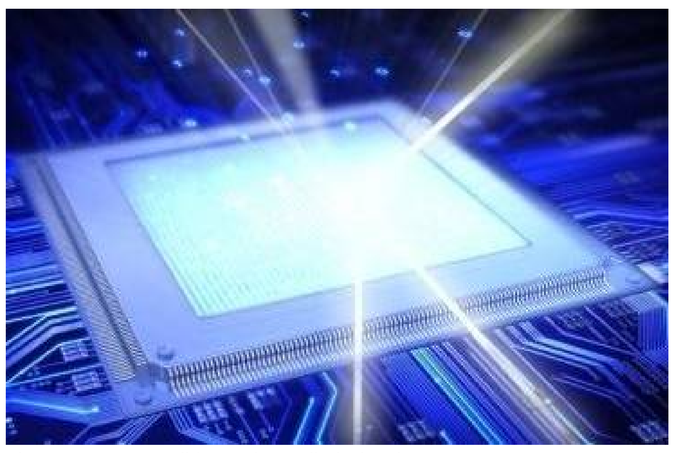
Thrust Areas

- Exploring new or alternative “state variables” for computing
- Merging nanophotonics with nanoelectronics
- Exploring carbon-based nanoelectronics
- Exploiting nanoscale processes and phenomena for quantum information science
- Expanding the national nanoelectronics research and manufacturing infrastructure network

Agencies Involved

Department of Commerce (National Institute of Standards and Technology), Department of Defense, Department of Energy, Intelligence Community, National Aeronautics and Space Administration, and National Science Foundation.

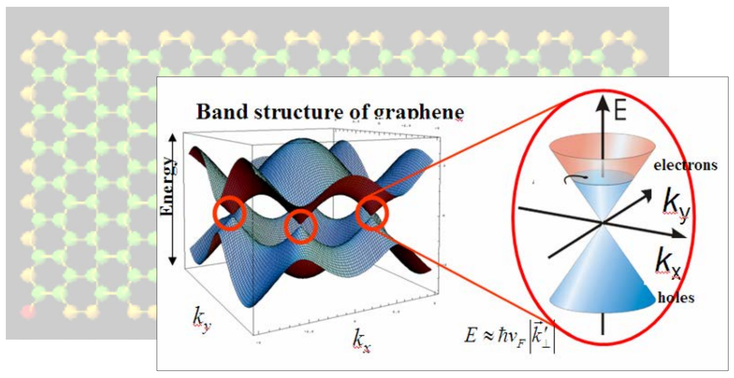
Examples of Activities that Support the Goals of the Nanoelectronics NSI



First CMOS compatible, Ge laser diode (MIT)

Examples of Activities that Support the Goals of the Nanoelectronics NSI

Carbon-based Nanoelectronics

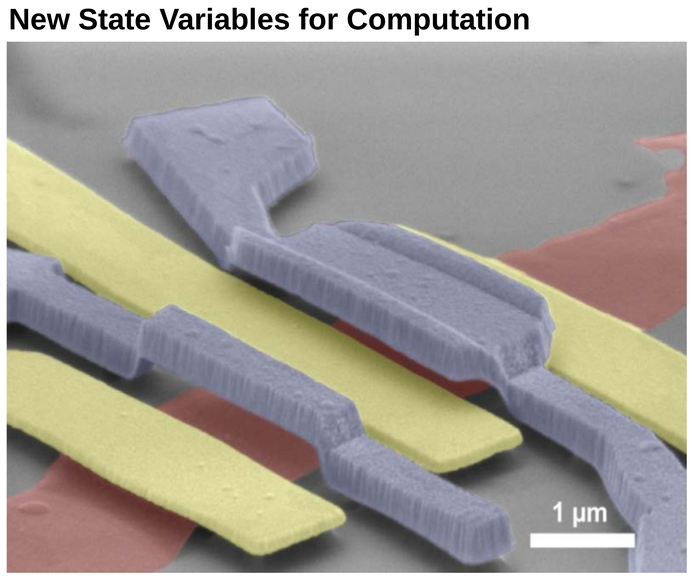


Nanoelectronics Research Initiative

Industry, Academia, and Government Partnership

NRI research is conducted through university-based centers, with the involvement of NRI participants from the semiconductor industry.

New State Variables for Computation



Credit: Courtesy SRC-NRI: A. Yacoby , South West Academy of Nanoengineering (SWAN).

Scribe Line Test Structures for Intel CPUs

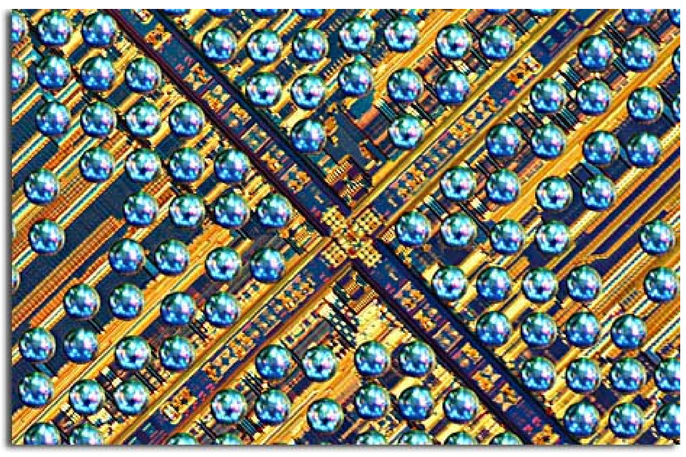
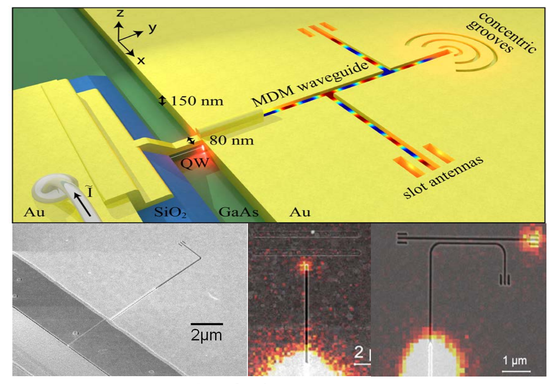


Image courtesy of the Optical Microscopy team at the National High Magnetic Field Laboratory at FSU.

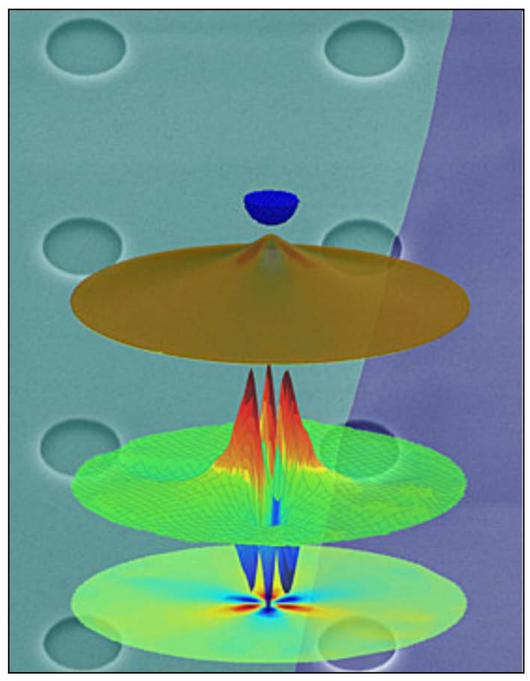
Merging nanophotonics with nanoelectronics



Brongersma group, Stanford

National Nanotechnology Infrastructure Network
Serving Nanoscale Science, Engineering & Technology

NIST Graphene Team – Electromechanical Properties of Graphene Drumheads



NIST researchers showed that straining a graphene membrane creates pseudomagnetic fields that confine the graphene’s electrons and create quantitized quantum dot-like energy levels. Credit: N. Klimov and T. Li, NIST/UMD

* Nanotechnology Signature Initiatives (NSIs) are topical areas identified by the National Nanotechnology Initiative and its agencies as benefiting greatly from close and targeted interagency interactions. The NSIs spotlight key areas of national priority and provide a mechanism for enhanced collaboration to leverage research and development programs across multiple agencies.

For more information, contact the National Nanotechnology Coordination Office (NNCO) at info@nnco.nano.gov
4201 Wilson Blvd, Stafford II, Room 405, Arlington, VA 22230 | 703-292-8626