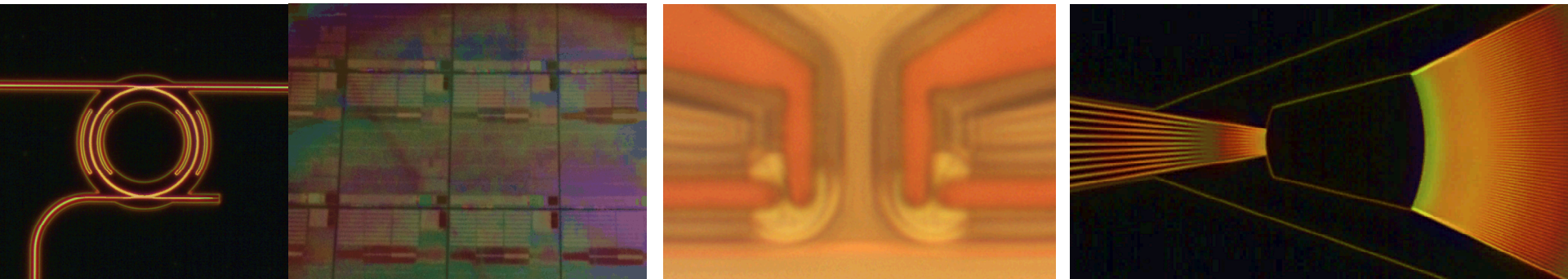


Exceptional service in the national interest



Sandia Photonics

Grant S. Heffelfinger, Director 1100

Photonics Introduction

■ What is Photonics:

“science and technology of generating, controlling, and detecting light waves and photons (particles of light)”



Laser/
Light sources



Display/
Projectors



Filter / lens /
glasses



Copier /
Scanner



Photo Detector
/ Camera

■ What does Photonics enable:



Communication /
Networking



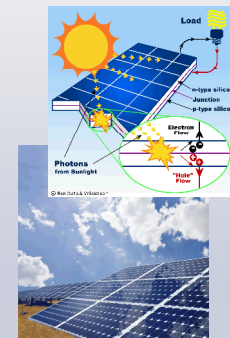
Imaging



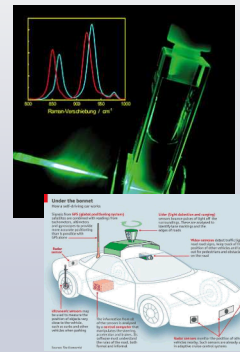
Manufacturing



Entertainment



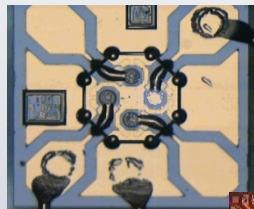
Energy



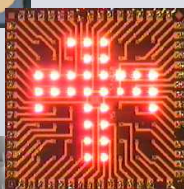
Sensing /
Analysis

Photonics Technologies at Sandia

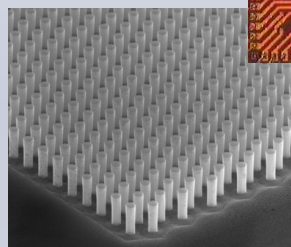
Generation



Single-Frequency
Tunable VCSELs

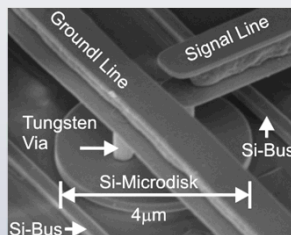


High
Efficiency
VCSELs



GaN Nanowire
Laser

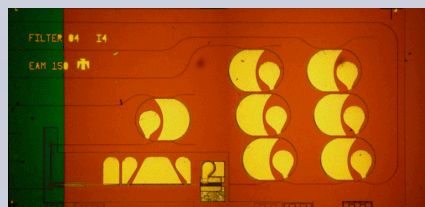
Control



Resonant Optical
Modulator/Filter



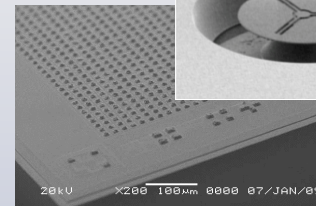
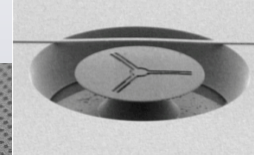
Si Array Waveguide Grating
Channelizing Filter



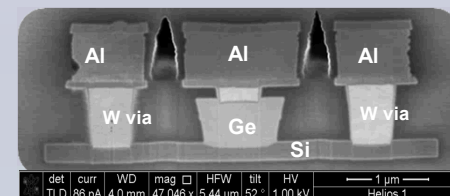
RF-Optical Channelizing Filter

Detect

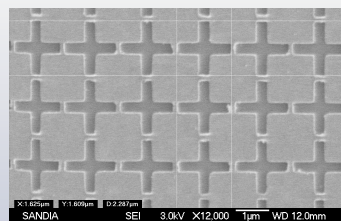
Suspended SiN
resonator / bolometer



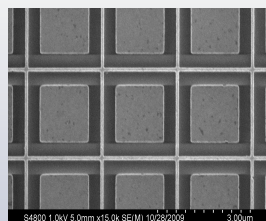
Infrared Focal Plane Array



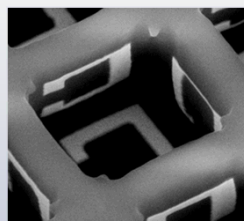
High-speed Germanium
Detector on Silicon



Infrared Plasmonic Filter

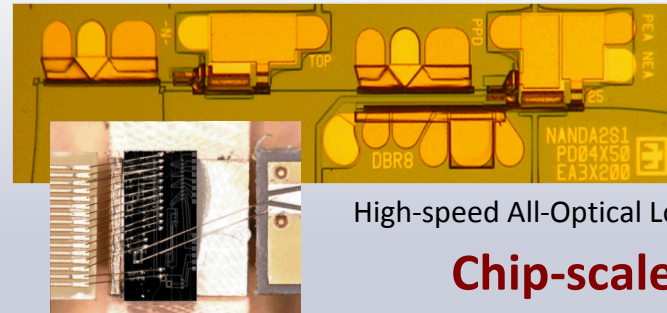


Perfect Absorber / Emitter



3D Metamaterial

Novel Subwavelength Devices



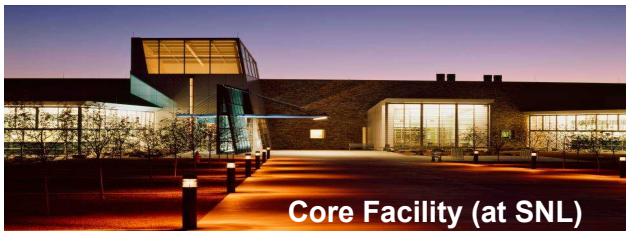
Silicon QKD Transceiver

High-speed All-Optical Logic

Chip-scale Systems

Center for Integrated Nanotechnologies

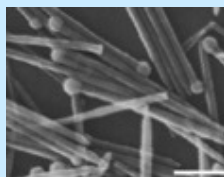
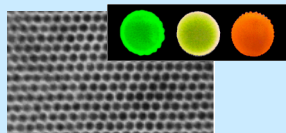
Two facilities one vision



“...world-class research capabilities and technologies which are available broadly to science community worldwide from universities, industry, private laboratories, and other Federal laboratories for work that will be published in the open literature.”

Averaging 500 users and
200 publications per year!

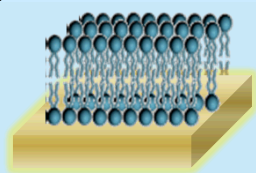
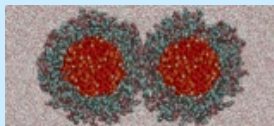
Nanophotonics & Optical Nanomaterials



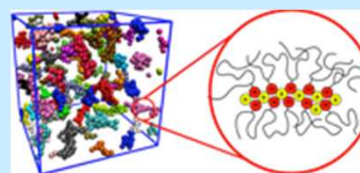
Nanoscale Electronics & Mechanics



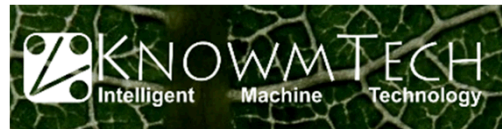
Soft, Biological, & Composite Nanomaterials



Theory & Simulation



CINT's New Mexico Industrial Users



Think Strategically!
Technology Development ▶ Strategic Planning ▶ Export Control

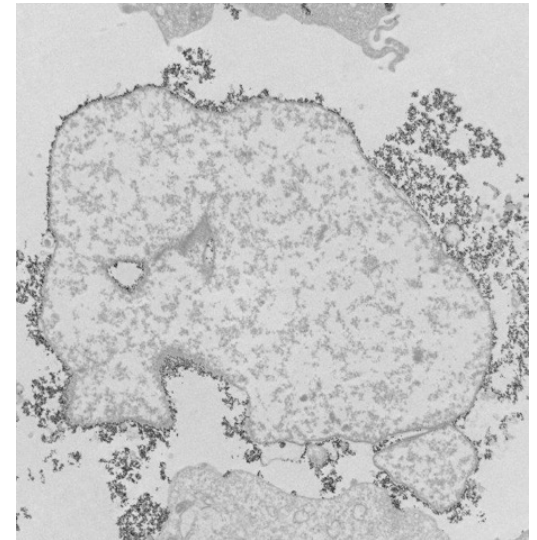
Senior Scientific – CINT User



After his wife survived breast cancer, Ed Flynn, a nuclear physicist of 50 years, refocused his research on using **magnetic nanoparticles** as a more sensitive detection method for cancer.

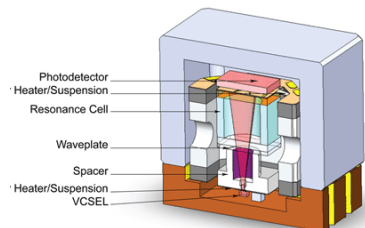
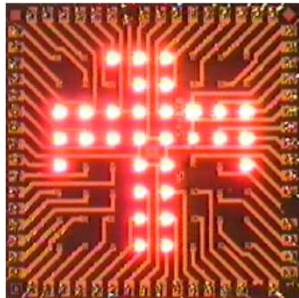
CINT makes nanoparticles, which can then be functionalized with cancer-specific antibodies and injected into the patient's body.

The antibodies, with the hitchhiking nanoparticles, bind to receptors on the cancer cells and can then be detected with specialized magnetic sensors.



Intellectual Property and Tech Transfer

- **Moving R&D breakthroughs to U.S. industry**
 - Technical IP: Sandia has 1200+ patents, with over 100 in photonics
 - Avenues: licensing, tech transfer, entrepreneurial leave
- **Success Story: Vertical-Cavity Surface-Emitting Lasers (VCSELs)**
 - Technology first developed at Sandia, 20+ years of R&D
 - IP licensed to every commercial manufacturer
 - New Mexico spin-out companies have employed over 500 people



VCSEL technology used in fiber communications, optical sensors, printers/mice, autonomous vehicles



PHILIPS



TRILUMINA

Vixar

FINISAR

SONY

Sandia VCSEL inventions licensed and transferred to U.S. businesses

Industrial Partnerships Programs

- **Sandia Science & Tech Park (SS&TP):**
 - Affiliated with and funded by Sandia, provides access to world-class facilities, technologies, and engineers at Sandia.
 - Ex: Applied Technology Assoc. – a photonics company who provides precision measurement, sensing and controls to government and commercial customers.
- **CRADA (Cooperative Research and Development Agreement):**
 - Mechanism to transfer of Sandia technologies, processes, research and development capabilities, and technical know-how to the private sector.
- **SPP (Strategic Partnership projects):**
 - Provide integrated services for Strategic Partnership proposals and agreements, CRADA, Lockheed Martin Intra-Work Transfer Agreements (IWTAs), and guidance for responding to opportunities and solicitations.
- **Entrepreneurial Separation to Transfer Technology (ESTT):**
 - 152 Sandians have participated in the program since 1995
- **IP License:**
 - Enable the results of Sandia's publicly funded research and, Development to be deployed for the US public good. Over 100 issued and pending patents in photonics
- **Academic Alliance:**
 - Enhance Sandia's capability base and mission impact by partnering more closely with leading universities to advance science and engineering in support of national security



- **NM Small Business Assistance (NMSBA):** Technical assistance provide to small businesses in New Mexico (more on next slide)

New Mexico Small Business Assistance (NMSBA) Program



- Governed by the Laboratory Partnership with Small Business Tax Credit Act
- Public/Private Partnership with Sandia National Laboratories, Los Alamos National Laboratory, State of New Mexico, and New Mexico Small Businesses
- Allows up to \$2.4M per lab per year in assistances and tax credits
- In 2015, Sandia provided \$2.4 million of assistance to 203 New Mexico small businesses
- Since the inception of the program, 4863 jobs have been created or retained, and 2495 businesses have been assisted in all 33 counties in the state
- Ex: Optimization of laser array submount assembly for TriLumina Corporation