Optical Materials/Photonic Devices Research

Mark Johnson

NC State University
Raleigh, NC

October 27, 2006
Centennial Campus Facilities

ECE & CSC Dept

MSE & Chem. E Dept

Chemistry & Physics: Nanoscience

NC STATE UNIVERSITY
Larry Monteith Research Center

Graduate Research Central Facility
Fabrication of Devices
Photonics Lab

II-VI Growth
PECVD / RIE

BCl\textsubscript{3}, RIE
e-Beam Evaporator

NC STATE UNIVERSITY
Prototype Device Processing and Characterization

PACKAGING

LITHOGRAPHY

AFM SYSTEM

RAPID THERMAL PROCESSING

NC STATE UNIVERSITY
Characterization Facilities and Equipment in Photonics Lab

SEM / CL

Optical Test Lab

Hall and Kerr Effect (4K to RT)

CV / IV / D' / R0A TESTING

Other Facilities through University Labs
Photonics Research

• A Traditional Strength at NCSU

Blue Laser
Atomic Layer Epitaxy
Pendeo Epitaxy
Magneto-Optic Storage
Quantum Well Lasers
Infrared Focal Plane Array
Ultraviolet Imagers
Laser Ablation Deposition
Molecular Beam Epitaxy

Blue & Green LED
In-Situ Laser Ellipsometry
Dilute Magnetic Semiconductor
BICE Tunable Lasers
Solar Cells
Optical Fiber Weaving
Wide Bandgap: SiC and GaN
Metallorganic CVD
Device Fabrication & Processing

• Faculty and Scientists: >25 full time

• IP Licenses, Entrepreneurs and Partnerships through Centennial Campus
Complementary Research Capabilities

• **Materials**
  – Analytic Instrumentation Facility
  – Materials Research Center
  – Precision Engineering Center

• **Devices and Systems**
  – Advanced Electronic Materials Processing
  – Power Semiconductor Research Center
  – Solid State Physics Laboratory
  – Center for Advanced Computing and Communications
The Applications Spectrum

- Ultraviolet
  - Imaging
  - Military
  - Scientific
  - Biosensing

- Visible
  - Displays
  - Data Storage
  - Illumination
  - Indicator
  - Backlight

- Infrared
  - Telecom
  - Fiberoptic
  - Medical
  - Environment
  - Instrumentation
  - Signal Processing
Sample Projects: Escuti, Muth, Grant, Barlage, Johnson
Japanese Future Vision

Prospects of OE World Market (billion USD)

Source: http://www.oitda.or.jp/main/syourai04-4.html

[1 USD = 110 JPY]

AAGR: average annual growth rate

Medical Care / Welfare
Environment / Sensing
Optical (Solar) Energy
Processing
Input & Output
Display / Lighting
Optical Memory
Info-Communications

Optoelectronics heading to $1T business!
Students in Photonics Lab

Student Research Team

SITE Program Students

Education - Research - Engagement

NC STATE UNIVERSITY