

SUMMARY:

- UNM Presentation - Innovative Manufacturing for Mid-infrared Photonic Application Technologies (IMMPACT)
 - o Cost of Mid-IR components has been biggest deterrent to wide0scale acceptance of this technology
 - o IMMPACT aims to break cycle through a manufacturing push (drive cost down) and applications pull (increase demand
 - o Market research report stated Mid IR sensor markets at \$789M in 2012 are anticipated to reach \$7B by 2019.
 - o Vision is that technology will move from DoD specific and spur new commercial applications, there have been dramatic improvements in the past decade
 - o UNM strengths: Exploit Nanoscale Physics to realize next generation infrared detector focal plane arrays using two material systems and investigate the use of infrared imaging in Medicine.

Innovative **M**anufacturing for **M**id-infrared **P**hotonic Application **T**echnologies **IMPA**CT

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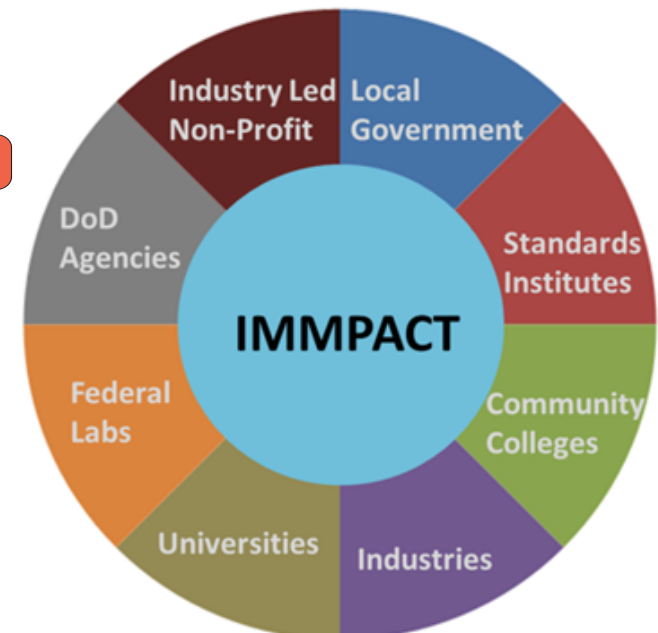
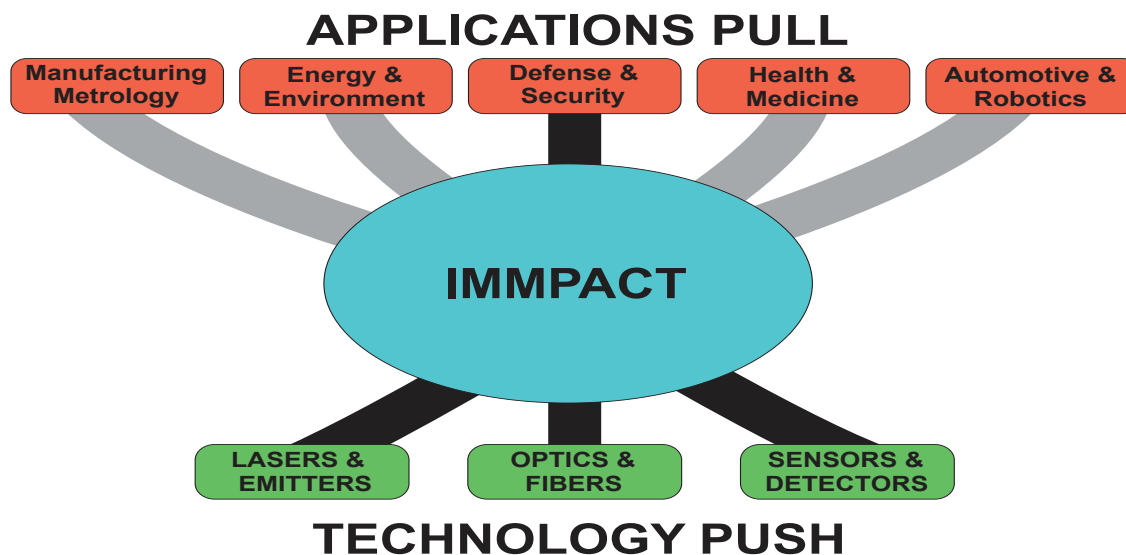
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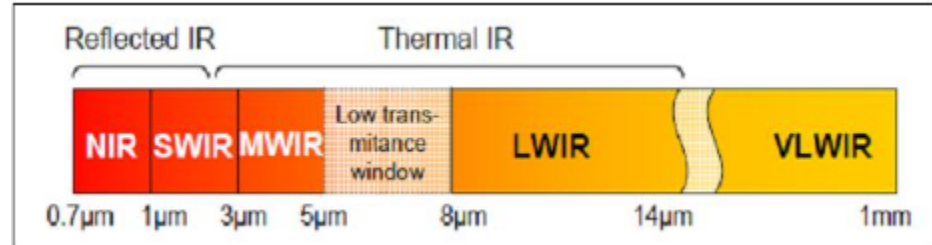
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Innovative Manufacturing for Mid-infrared Photonics Application Technologies

- Cost of Mid-IR components has been the biggest deterrent to the wide-scale acceptance of this technology
- Cycle of High cost → Insufficient market demand → High cost.....
- IMMPACT aims to break that cycle through a manufacturing push (drive the cost down) and applications pull (increase the demand)
- Will lead to a sustainable market with economic development and high technology jobs



- Mid-Infrared Photonic System consists of
 - Lasers or emitters
 - Sensors, detectors and cameras
 - Optics: fibers, lens and mirrors
- Applications
 - Defense and Security
 - Medical Diagnostics
 - Surveillance
 - Astronomy
 - Home inspections
 - Fire fighting
 - Automobiles



Key arguments for IMPACT

1. Pre-competitive technology with large growth potential
2. Technology has not left the shores of the US
3. Platform technology with applications in energy/environment, medicine/health, automation/robotics and industry/manufacturing
4. Leverages large Department of Defense Investment (will follow the path of technologies like GPS and Radar)

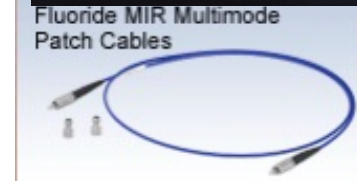
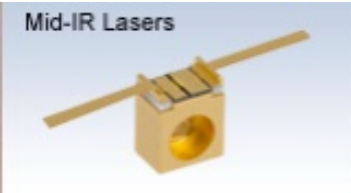
RESEARCHANDMARKETS
 Brochure
 More information from <http://www.researchandmarkets.com/reports/2666706/>

Mid IR Sensors: Market Shares, Strategies, and Forecasts, Worldwide, 2013 to 2019

Mid IR sensor markets at **\$789 million in 2012** are anticipated to reach **\$7 billion by 2019** as price performance increases and unit costs decrease from \$3,000 per unit to \$300 and even to \$8 or less per unit on average drive further interest from commercial buyers. The decrease in size of units from bench size devices to portable units makes them more useful across the board in every industry.

Dramatic improvements in the past decade

- Mid-IR emitters/lasers (Quantum Cascade Lasers, Interband Cascade Lasers)
- Detectors/sensors (Type II Superlattice Detectors, Microbolometers)
- Optics/fibers (Fluoride/Chalcogenide fibers)



Technology will move from DoD specific and spur new commercial applications

Defense & Security	Manufacturing Metrology	Environment & Energy	Health & Medicine	Automotive & Robotics
Surveillance	Building systems	Gas/Oil exploration	Cancer diagnosis	Driver-assisted systems
Search and Tracking	Metrology	Fire-fighting/hazards	Diabetes monitoring	UAVs/UGVs
Missile Launch Warning	Manufacturing systems	Energy efficiency	Wound healing	Traffic monitoring
Night Vision and IRCM	Research and Development	Security & Pipeline/ Refinery monitoring	Image-guided surgery	Maritime systems

Industries



THORLABS



3M



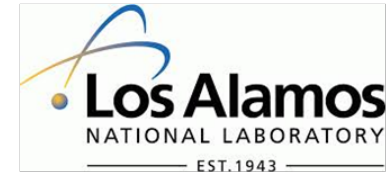
Small and Medium Enterprises



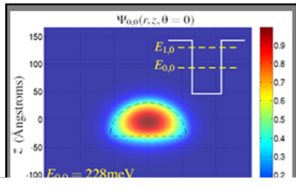
Academic Institutions and Non-Profits



National Labs



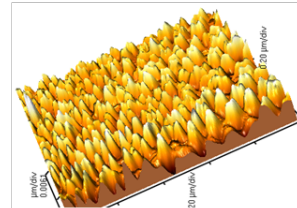
1. Exploit Nanoscale Physics to realize next generation infrared detector focal plane arrays using these two material systems
 - (a) InAs/GaSb Type II Superlattices
 - (b) InAs/InGaAs quantum dots in a well (DWELL) Heterostructures
2. Investigate the use of Infrared Imaging in Medicine



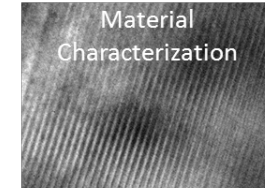
Wavefunction Modeling



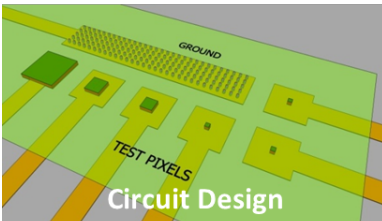
MBE CRYSTAL GROWTH



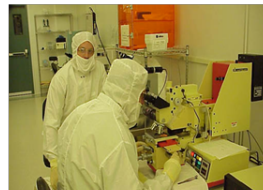
AFM of InAs Quantum Dots



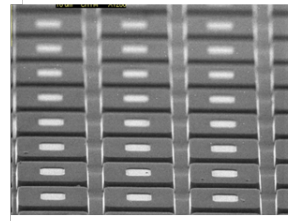
XTEM of Strained Layer Superlattice



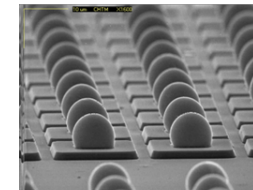
Circuit Design



Device Fabrication



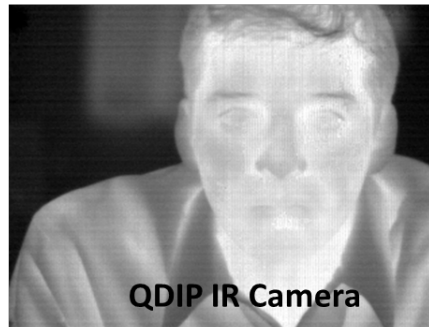
FPA Pixels



Indium Bump Bonds



**SYSTEM INTEGRATION:
Flip Chip Bonder**



QDIP IR Camera



SLS IR Camera