Photonics: A High-Tech Opportunity for NM

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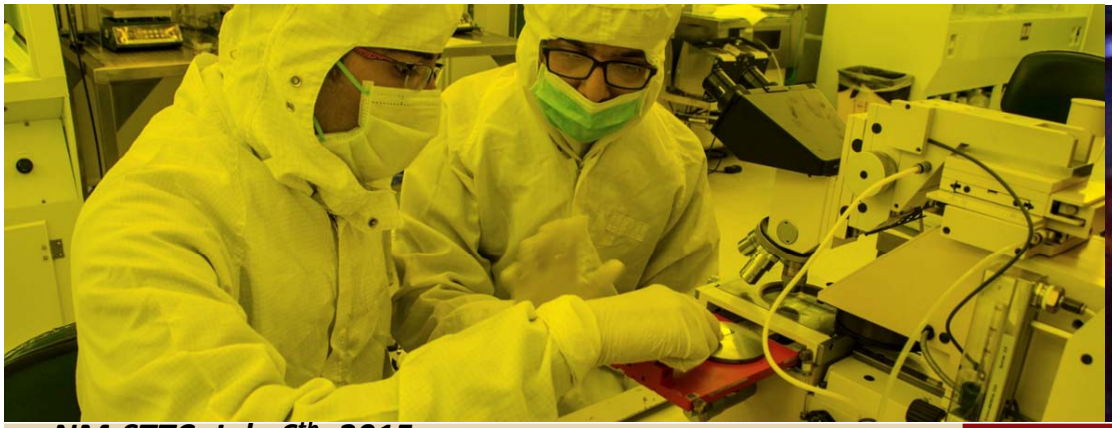
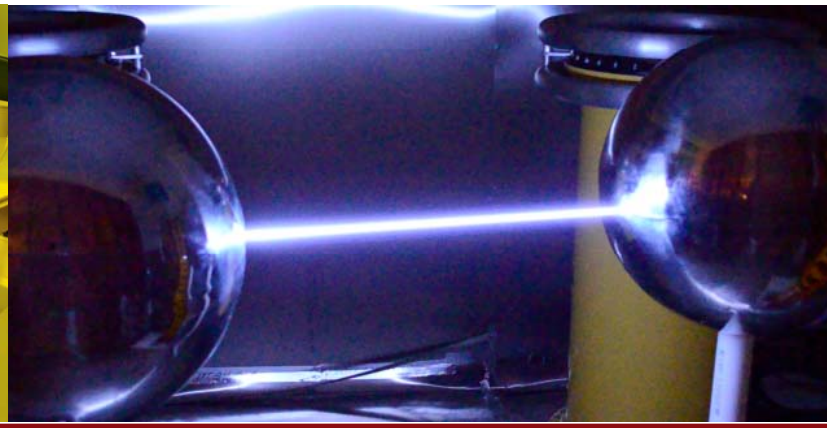
University of New Mexico,

Briefing to NM Science, Technology and Telecommunications Committee
July 6th, 2015





Outline

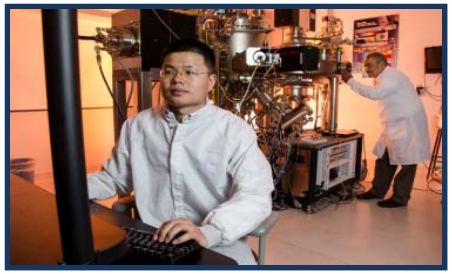
- Overview of CHTM, Center for High Technology Materials at UNM
- Photonics Manufacturing Opportunity
  - Nationwide Perspective
  - NM Initiative: IMMPACT Effort
- Legislative Request

Center for High Technology Materials at UNM

CHTM Was Established in 1983 With a Seed Investment of $10M Over Five Years by the State of New Mexico

Mission Statement: Fostering a *Culture of Excellence* by

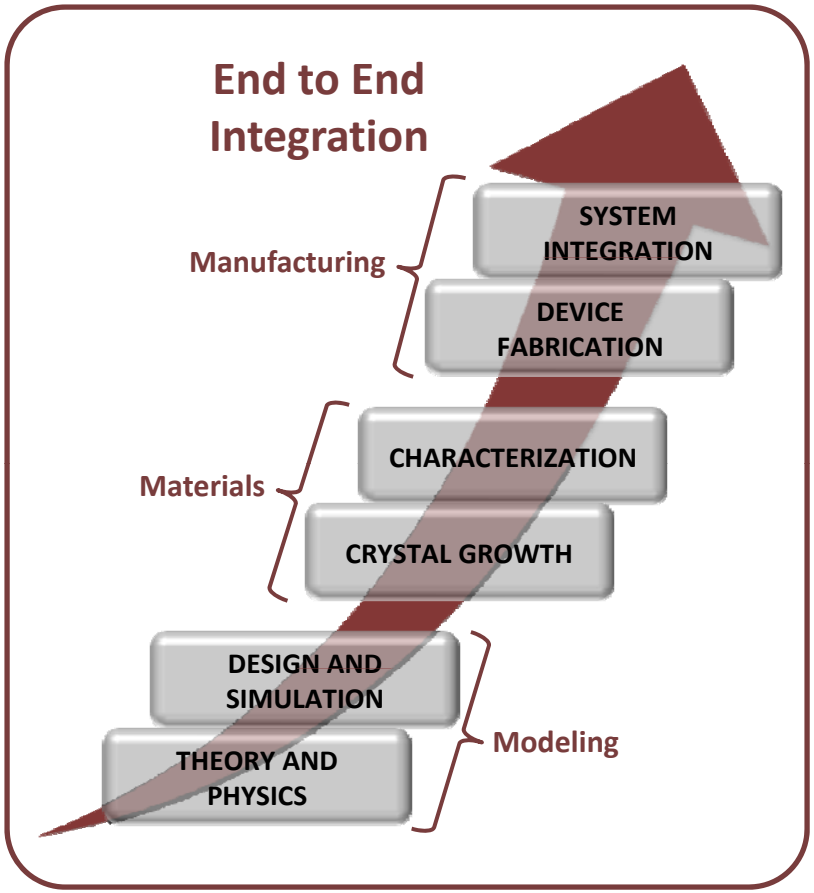
1. Promoting Research and Education In Photonics, Microelectronics and Nanoscale Materials, Devices and Their Applications
2. Fostering Interactions Between UNM, Federal Laboratories and Industry
3. Promoting an Entrepreneurial Spirit for Economic Development in NM



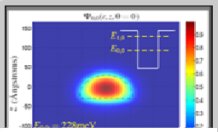
Who We Are and What We Do

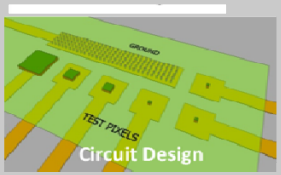
People

- 14 Faculty – Tenure & Tenure - Track
- 14 Research Faculty and 4 Post-docs
- 20 Staff - Technical and Administrative
- 50 Graduate Students
- 15 Undergraduate Students
- 8-10 High School Students and Teachers

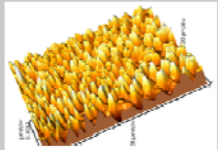


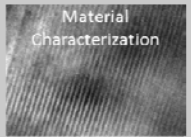
Model


Wavefunction Modeling



Make


AFM of InAs Quantum Dots

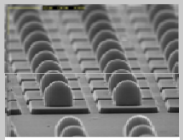


XTEM of Strained Layer Superlattice

Measure

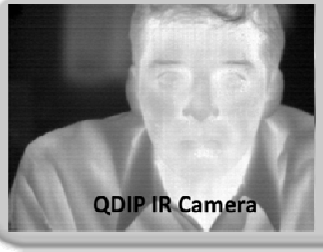
Device Fabrication

FPA Pixels


Indium Bump Bonds

SYSTEM INTEGRATION: Flip Chip Bonder

Manufacture


QDIP IR Camera

SLS IR Camera

Economic Impact Analysis of CHTM

Conducted by: UNM Bureau *of* Business & Economic Research

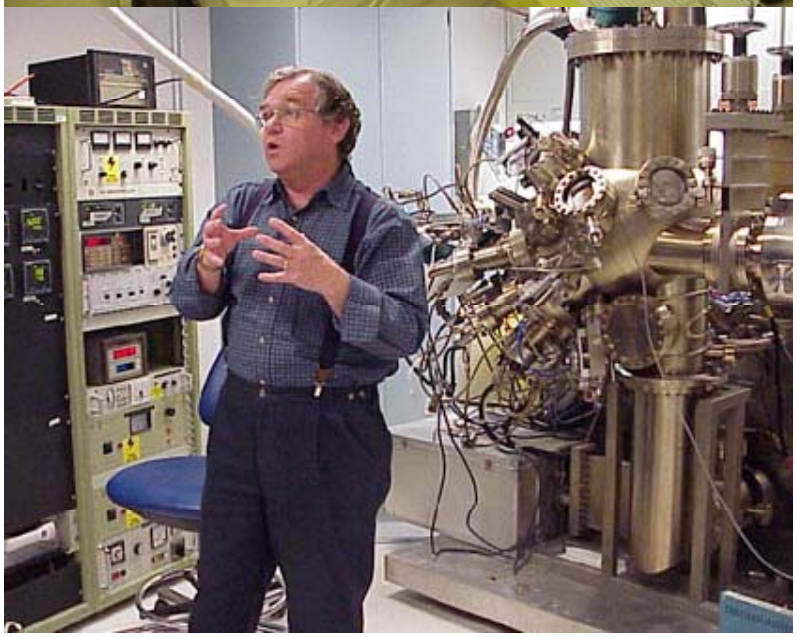
BBER Provides Objective and Credible Economic Information, Analysis and Projections to the State of New Mexico and Local Government Agencies, Businesses and the General Public.

BBER Report Quotes:

- Sizable Impact On The New Mexico Economy
- CHTM Supports
  - 131 Jobs In New Mexico on an Ongoing Basis
  - $6.5 Million in Labor Income
  - $11.7 Million Economic Output Annually
- Since 1983, the Cumulative Total Impact In 2014 Dollars Was

MORE THAN $372M in ECONOMIC OUTPUT

Metrics of Success



Since CHTM's Inception:

- 244 MS (thesis) and 220 PhD Students Have Carried Out Their Research at CHTM (Many Remain in NM).
- Annual Research Funds of $7-8M from Government and Industry
- Internationally Renowned Faculty (Average H-Index: 26, Highest: 57)
- 158 U. S. Patents Awarded: ~35% of UNM Portfolio (38% licensed).
- $10M in Royalty Revenue from Licensing
- 15 Companies Have Been Spun-off (Started by CHTM Faculty and Students) and Many More Small Companies Have Been Assisted.
- $190M in Grants and Contracts and $372M in Direct Economic Output to NM

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Photonics: Study of Light

Photonics Includes the Generation, Emission, Transmission, Modulation, Signal Processing, Switching, Amplification, and Detection/Sensing of Light.

It Covers All Technical Applications of Light Over the Whole Spectrum from Ultraviolet Through the Visible to the Near-, Mid- and Far-Infrared.

The Nobel Prize in Physics 2014

Isamu Akasaki, Hiroshi Amano, Shuji Nakamura

Examples of Photonics in everyday life include:

Photonics function	Device
Generation & Emission	LEDs, laser in computer mouse & DVD players, plasma & LCD displays
Transmission	Fiber optics, infrared remote controls, TV images, cell phones
Modulation	Optical communication, laser marking, LCD
Signal processing	Encryption, optical communication, cameras, image processing, DVD players
Switching	Optical communication
Amplification	Repeaters, laser cutting, LASIK, laser welding
Detection	Chemical analysis, night vision, cameras, barcode scanners, solar panels
Sensing	Pulse oximeters, motion detectors, guidance systems, collision avoidance

Photonics in New Mexico

New Mexico Employs Thousands in the Photonics Industry:

- 6,234 Entrepreneurs, Manufacturers, Technicians, Finance, Marketing and Sales People Across the State Work in Photonics
- 96 Companies with $28B in Revenue
- 33% (532 of 1596) Patents Granted to Entities in the State Since 2009 are Photonics Related

Source: Photonics In New Mexico, Prepared by nmOptics, Spring 2015

Incredible Alignment of New Opportunities

Integrated Photonics - Innovative Manufacturing Institute (IP-IMI)

- Our Team Selected for Final Competition - $110M 5-year , Federal Funding
- 1:1 Match Required From Industry, Academia and Local Governments
- Advancing Manufacturing, Workforce Development and Growth of Industry Clusters

Lead

USC, ASU, UCB, UCLA, UCSD, OSU, UNM

Hub Hub Hub Hub Hub

IMMPACT*

Integrated
Manufacturing for
Mid-infrared
Photonic
Appli**C**ation
Technology

United Nations Declares 2015 the International Year of Light and NPI launched

INTERNATIONAL YEAR OF LIGHT 2015

NATIONAL PHOTONICS INITIATIVE

New Mexico
State Economic Development Dept.
Highlights Optics/Photonics
1 of 4 Focus Areas

What is IMMPACT?

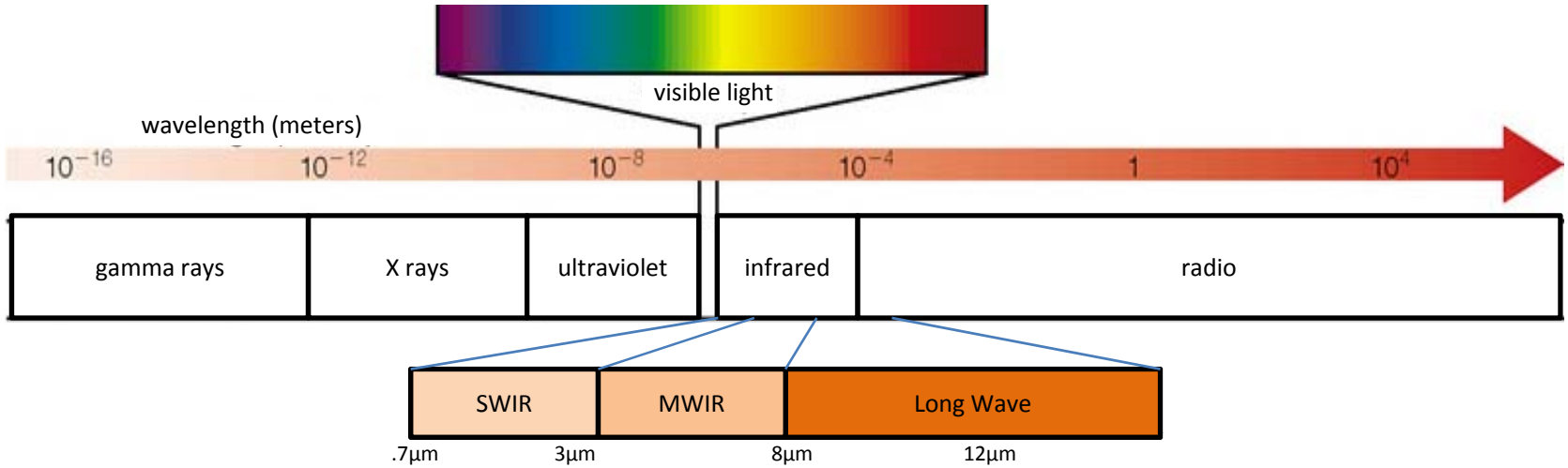
Integrated **M**anufacturing of **M**id-infrared **P**hotonic **A**ppli**C**ation **T**echnology (IMMPACT)

CHTM Will Establish a Regional HUB Called IMMPACT With Three Objectives:

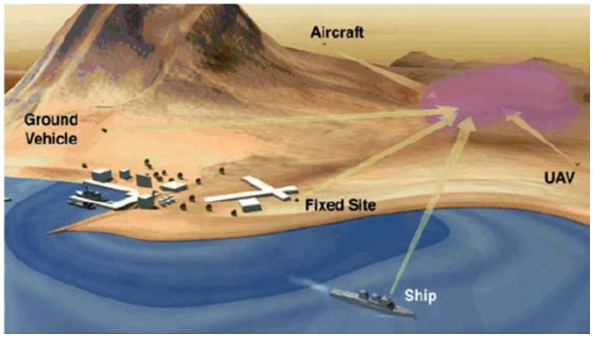
1. **Hub Management:** Build Membership from Local and National Industry and Develop an Efficient Administrative Structure for Public-Private Partnerships
2. **Industry Driven Projects:** Work Toward Industry Relevant Projects Addressing Manufacturing Challenges
3. **Workforce Development:** Partner with Universities, Community Colleges and High Schools to Train the Next-generation of Technicians, Scientists and Entrepreneurs

CHTM Has a Proven Track Record in Accomplishing These Objectives

DoD Photonics Manufacturing Proposal



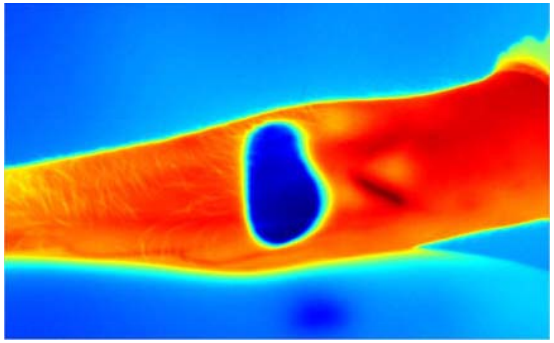
Stand-off Chemical Sensing



NATO Report :Task Group SET-098/RTG-55

Seeing Through Objects

Thermal Imaging

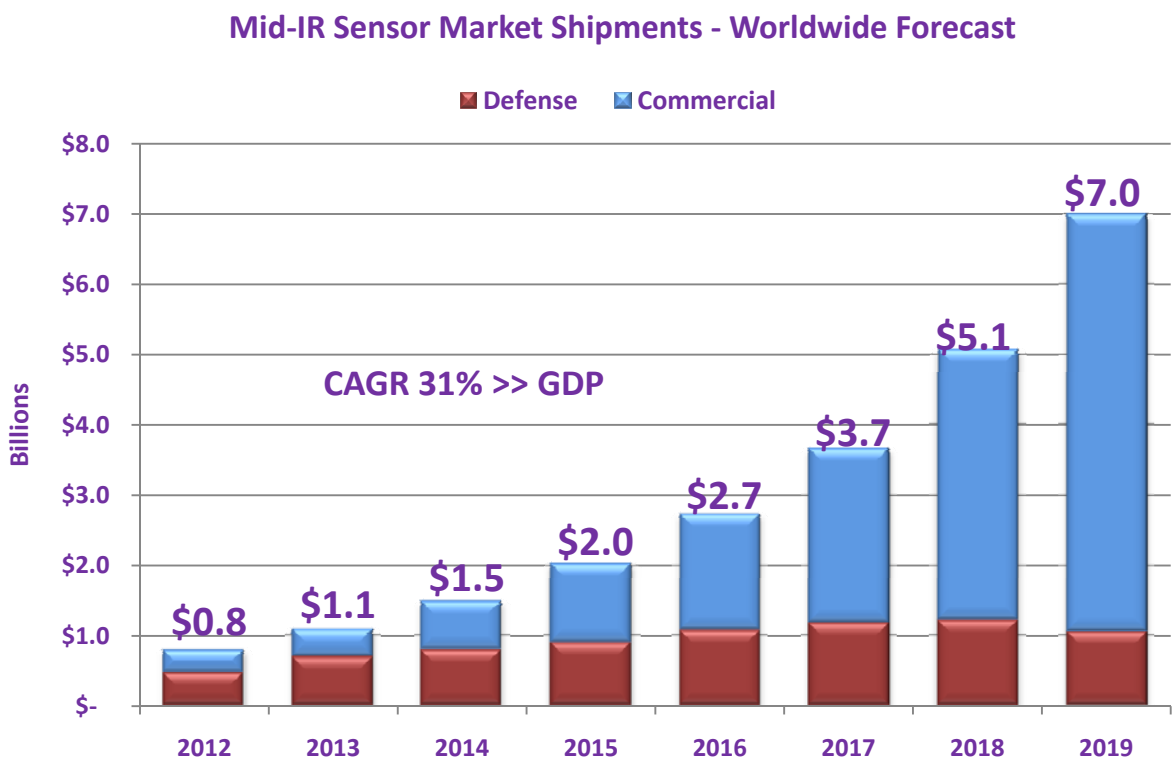


The NM Hub Will Focus on this Dual-Use Technology Area

Integrated Manufacturing of Mid-infrared Photonic AppliCation Technology (IMMPACT)

Why Mid-Infrared Photonics?

- Large Growth Potential for Pre-Competitive Technology
- Broadly Applicable – Excellence Remains in U.S. (at Present)
- Leverages Historical DOD Investments



Source: WinterGreen Research Inc.

High Cost & Low Volume

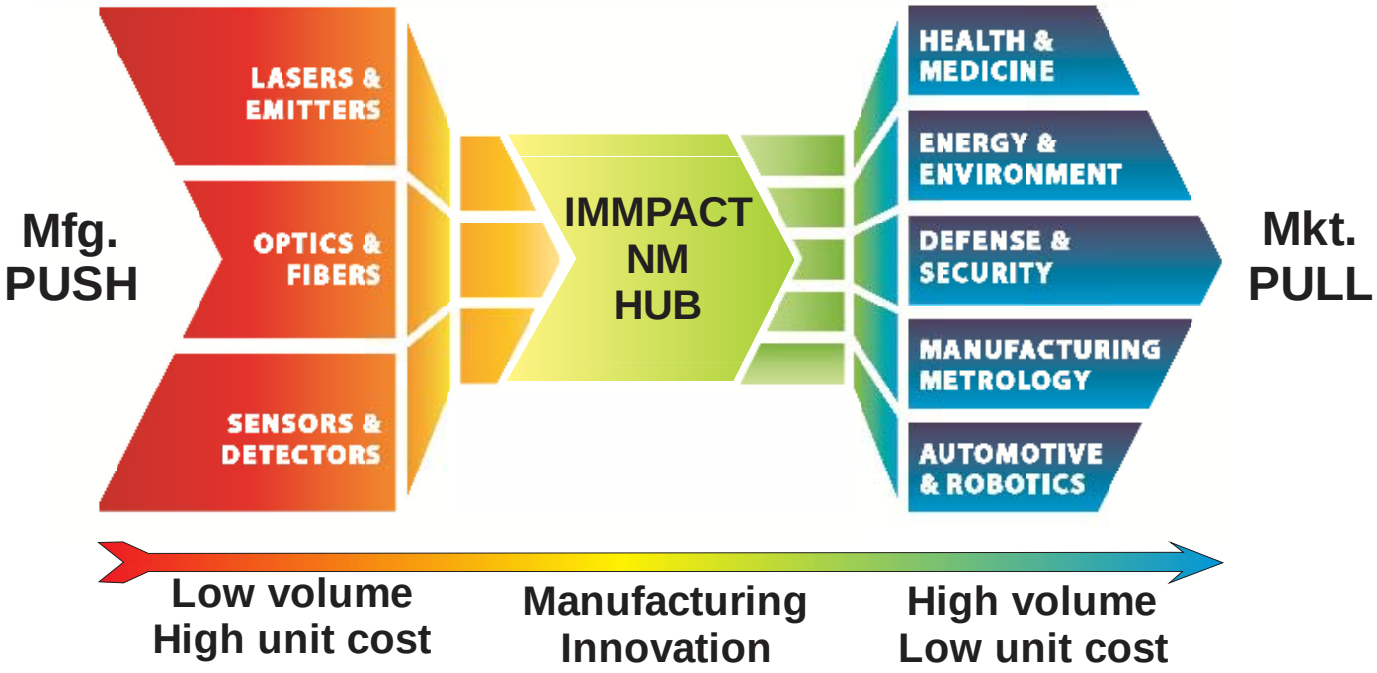
Are the Biggest

Manufacturing and

Economic Challenges

IMMPACT's Push-Pull Strategy

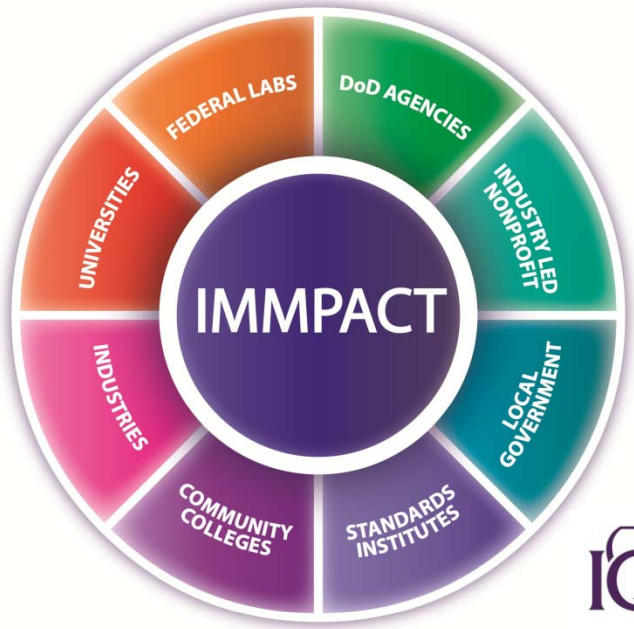
- IMMPACT Aims To Break the Cycle by
  - Manufacturing Push (Drive the Cost Down) and
  - Market Pull (Increase the Demand).



Will Lead to a Sustainable Market
Resulting in Economic Development
And High Technology Jobs

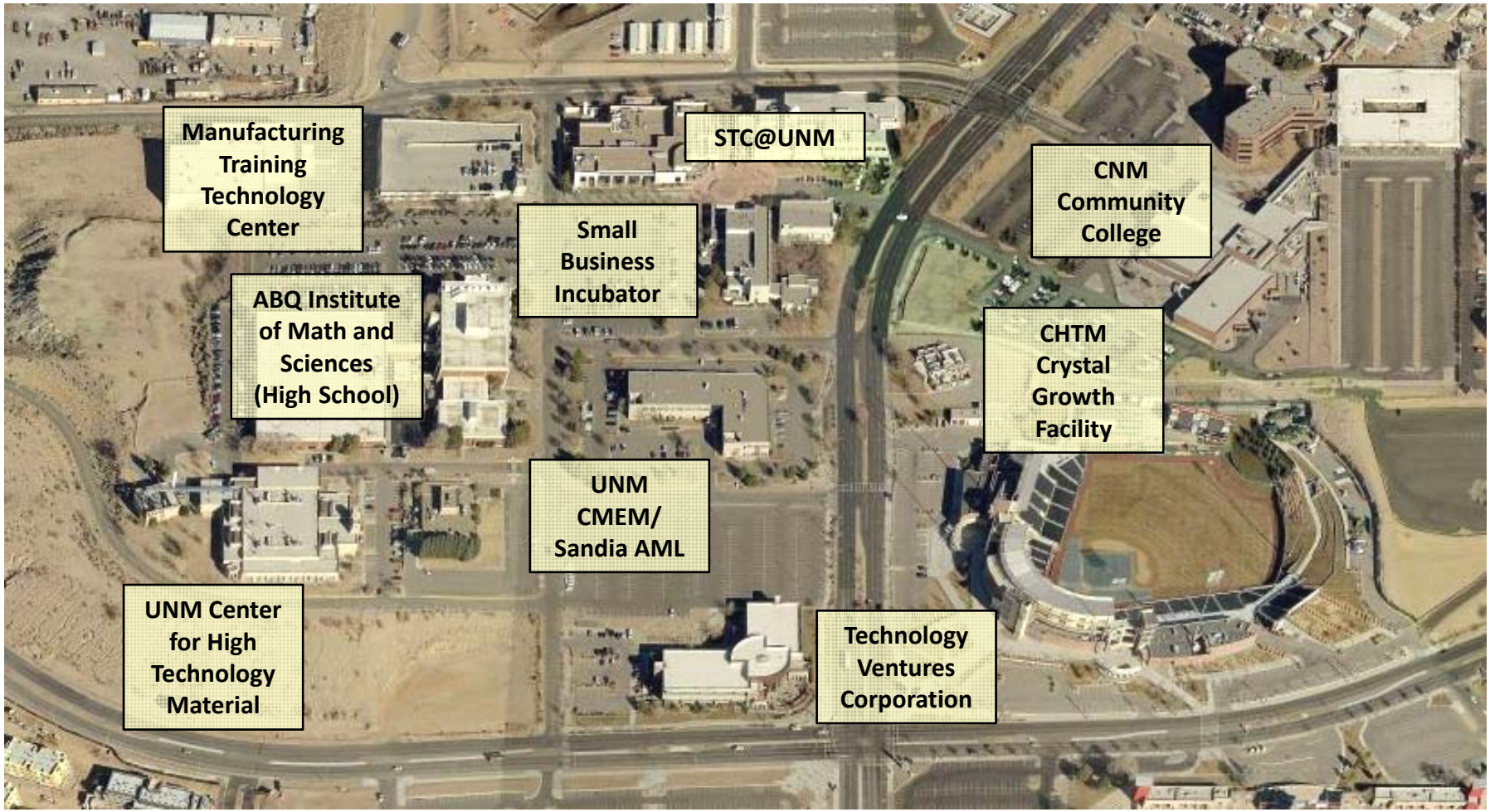
Outcomes of IMMPACT: Public-Private Partnership

- Actively Engage with Industry/Local Govt. to Build Enhanced Photonics Infrastructure
- Provide Advanced Capabilities and Infrastructure in World-class Photonics Manufacturing,
- Train Next-generation Workforce to Fill the Needs of this High-growth Industry
- Quantify Job Creation Report/Economic Development Impact
- Enable Industry Clustering for High Pay-off Job Creation of Technicians, Engineers and Scientists



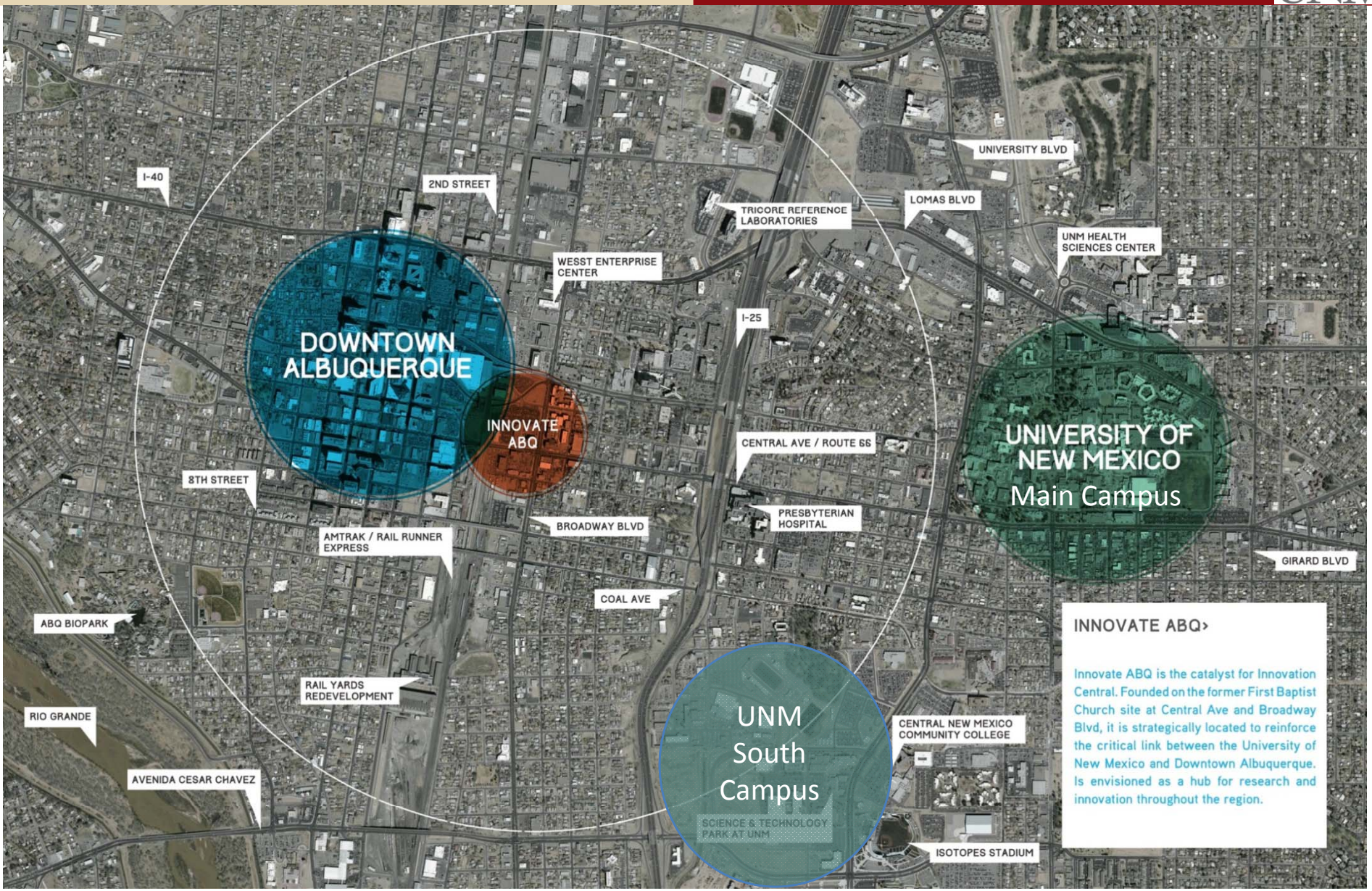
Location and Potential

CHTM is Strategically Located in UNM's South Campus: UNM Science and Technology Park



Collaboration is a Contact Sport

Albuquerque Innovation District



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Request from Legislature

- Request for $10M Funding Over Five Years to:
  - Re-invest in Infrastructure and Capability in Photonics ➔ Industry Relevant Projects ➔ High-paying Technology Jobs
  - Attract National Industry While Growing Local Technology Start-ups with Strong Technical and Entrepreneurial Work-force to Create a Self-sustaining Eco-system

Leveraging Investments in People, Infrastructure and Facilities in NM

Support from Offices of Governor and Mayor

Upon successful award of the IP-IMI, I commit to working with the University of New Mexico and our state legislature to generate $10 million over the next 5 years in matching funds to support this project. In addition, several existing programs and funds at the New Mexico Economic Development Department (EDD) such as Local Economic Development Act (LEDA), JTIP (Job Training Incentive Program) and Technology Research Collaborative (TRC) programs can provide financial support for certain elements of this project.

Sincerely,

Susana Martinez
Governor

State of New Mexico

The City of Albuquerque is pleased to participate in this partnership and commits to providing $1.0 million cash in a matching contribution to support this project. Additionally, the City is investing more than $2.5 million in in-kind programs that will have a direct positive impact on the success of this project in our region, including: advanced skill set matching programs between employers, education institutions, and employees; entrepreneur accelerator programs; technology commercialization programs; and a five-fold increase in the funding for our existing industry support programs.

Best regards,

Richard J. Berry
Mayor

CITY OF ALBUQUERQUE

Funding IMMPACT

- If the DoD Photonics Manufacturing Effort Is Not Funded, IMMPACT Can Be a Free-standing Institute Through
  - Support from City and State Government
  - Investments by the Industry (>$6.5M committed)
  - Leverage Federal Opportunities in Photonic Manufacturing

Industry	Cash	In-Kind
Daylight Solutions	250,000	
EOS Photonics	250,000	250,000
Lasermax	1,000,000	
Intelliepi	250,000	500,000
Skorpios Technologies*	75,000	2,000,000
SolAero Technologies*	75,000	2,000,000
Total ($)	**1,900,000**	**4,750,000**

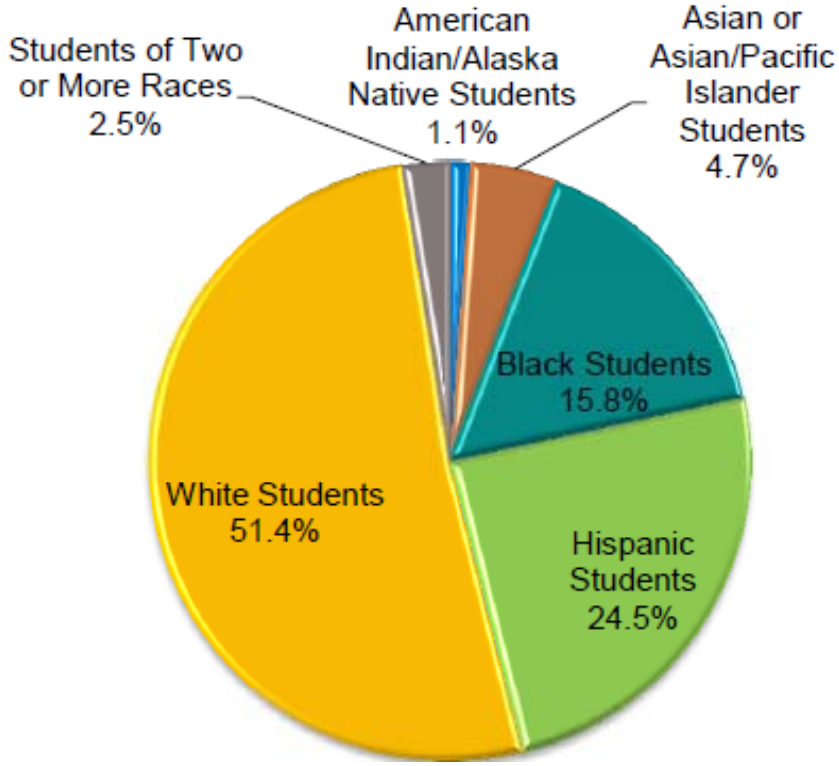
*NM Companies

CHTM Outreach: Coordinator Stefi Weisburd

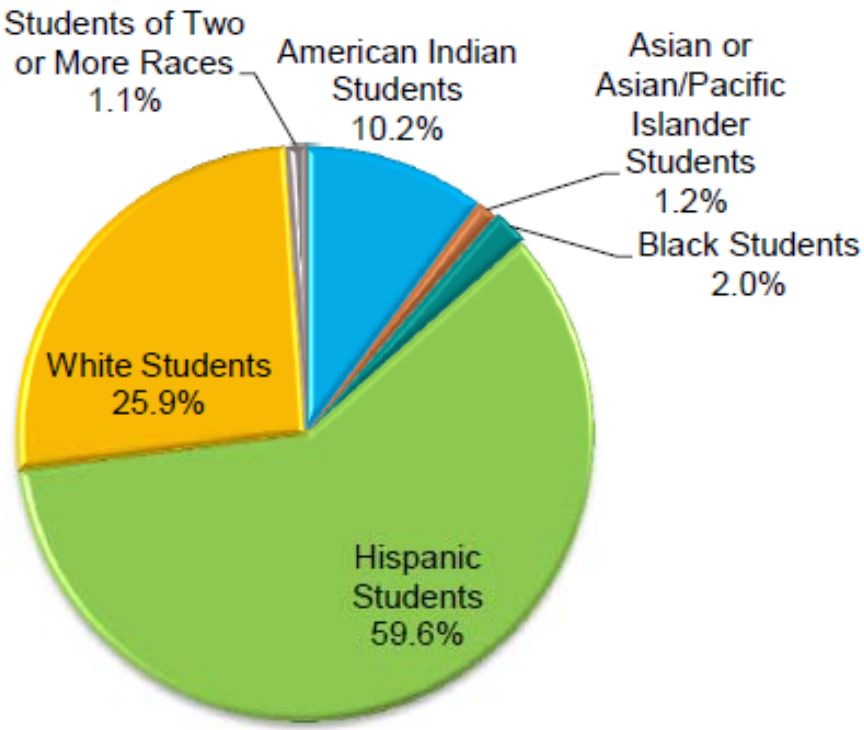
Thank you for your attention

Back up slide

Diversity and Under-represented Minorities



United States Student Demographics



New Mexico Student Demographics

NM is the first majority-minority state [60.3% underrepresented minority (URM) population]

NM: Social test-bed of the future?

Math and Science Annual Report
November 30, 2014