

# **Center for High Technology Materials**

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**Director**

2017 Annual Review Of Category 3 Research Centers/Institutes | Submitted to OVPR on 03/09/2018

# CHTM Mission Statement

The mission of CHTM is to create and sustain a culture of excellence to promote research and education in photonics, microelectronics and nanoscale materials and devices and their applications; foster interaction between UNM, federal laboratories, industry; and promote an entrepreneurial spirit for economic development with a regional focus but of global importance.

CHTM is committed to training the next generation of scientists, engineers, discoverers and entrepreneurs who can combine their technical training and critical thinking with excellent interpersonal and communication skills to become leaders of the 21st century.

## **Our core strengths are:**

- Research, creativity and innovation,
- Interdisciplinary education, training and outreach,
- Entrepreneurship and economic development.

We will continue to invent and discover disruptive technologies that can be scaled to develop innovative advanced manufacturing initiatives to create self-sustaining wealth based economies to leave the earth a better place than we found it.

## 2017 Goals And Status

- Continue to remain a pillar for transformative interdisciplinary research and education in photonics, microelectronics and nanoscale materials and devices at UNM.
- Hire a Director.
- Acquire new critical equipment for Nano-Fab user facility.
  - ICP Etcher purchase, install, and make available for Nano-Fab.
  - Obtain a state-of-the-art XRD: critical for MOCVD and MBE operations.
- Reorganize CHTM staff operation.
- Balance the budget and align expenditure with CHTM mission.
  - Consolidate and reorganize laboratory space, convert unused storage space to functioning laboratory space.
- Upgrade network to comply with main campus IT requirements.

**All the above goals have been met.**

# Membership of Advisory Committee

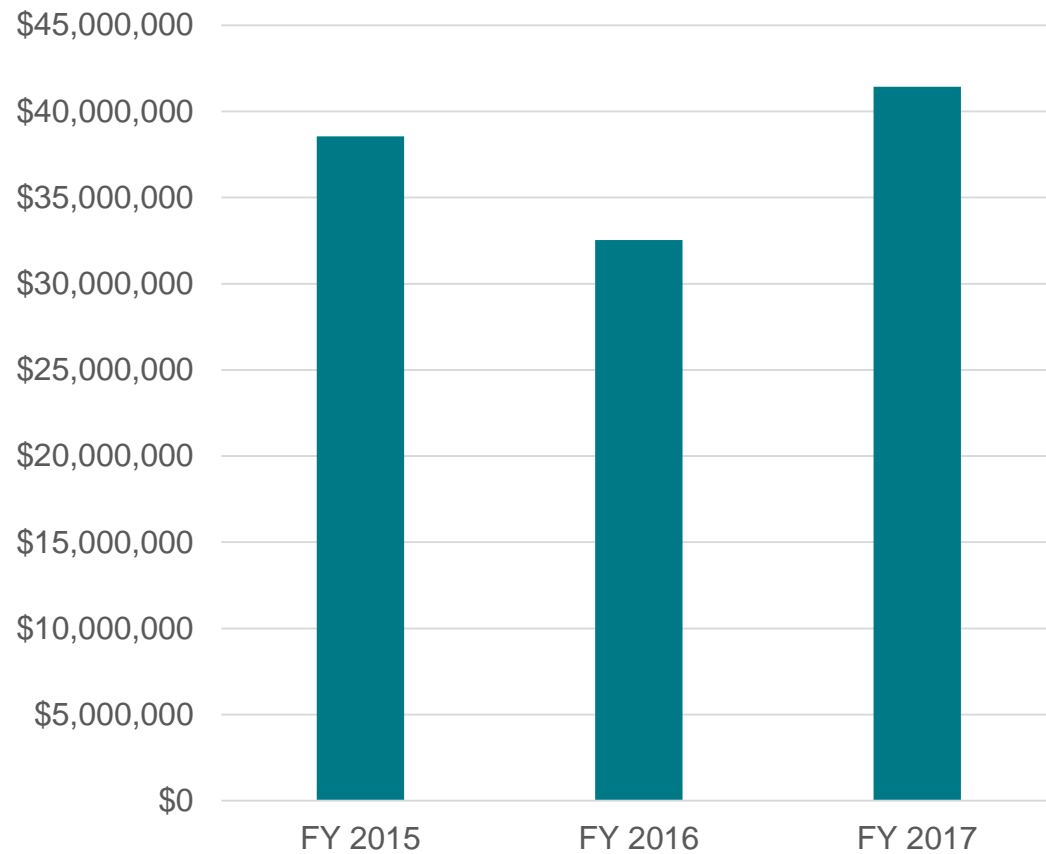
- Associate Deans for Research
  - College of Arts & Sciences (Crossey/Turner)
  - School of Engineering (Schamiloglu)
- Department Chairs
  - Electrical and Computer Engineering (Devetsikiotis)
  - Physics and Astronomy (Rudolph)
  - Chemistry and Chemical Biology (Cabaniss)
- CEO of STC.UNM (Kuuttila)
- Director of Center for MicroEngineered Materials (Atanassov)

# 2017 Highlights

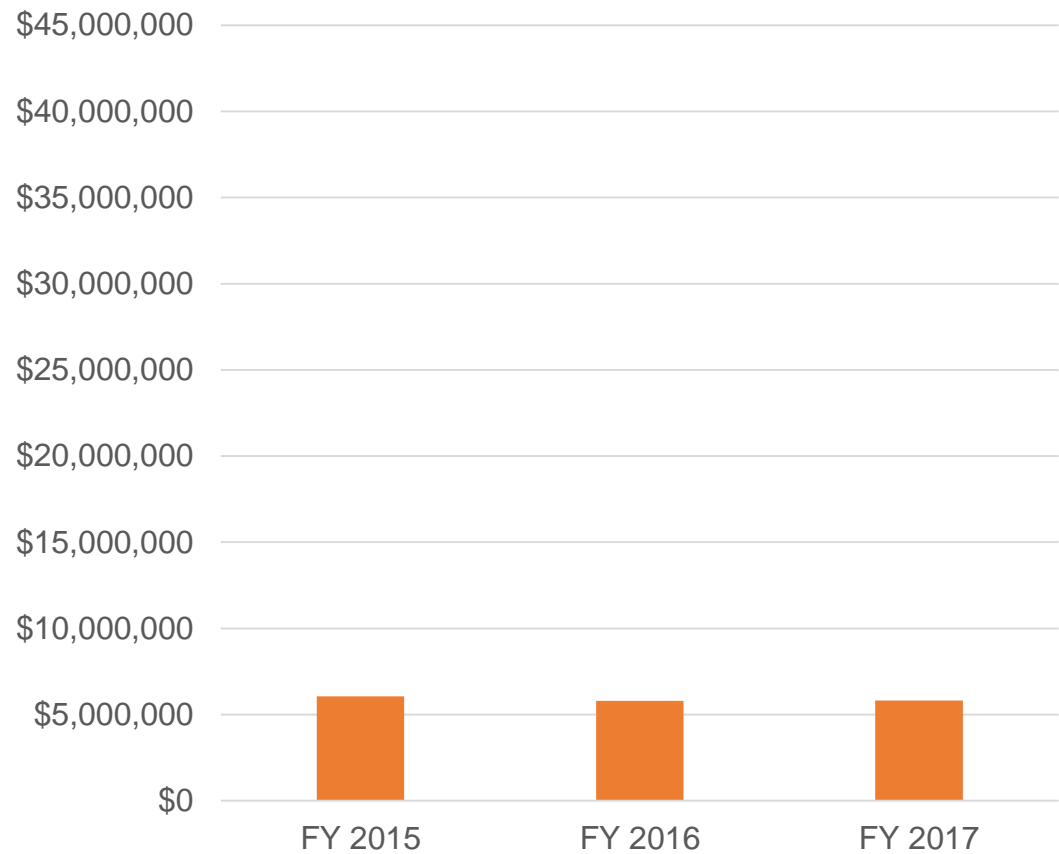
- Nationwide Director search: Mafi was appointed as the Director on 2/18
- CHTM Federal Research Award Highlights:
  - DoD MURI award on Radiation Balanced Lasers (PI Sheik-Bahae), \$7.5M
  - NSF award on Solar Cell Research (PI Sang E. Han), \$950K
  - DOE EPSCoR (PI Feezell) on Superluminescent Diodes for Smart Lighting Systems, \$200K
- Faculty Accolades:
  - Habteyes receives NSF CAREER Award
  - Acosta receives Beckman Young Investigator Award
  - Mafi is named Optical Society Fellow
  - Article by Brueck among top 100 cited articles in Optics Letters
- AFRL+CHTM Nano-Conference, Held at CHTM on 3/31/2017
  - 60 participants from UNM and AFRL, fostered new collaborations between UNM/CHTM and AFRL
- CHTM celebrates its 200<sup>th</sup> issued patent at STC/Lobo Rainforest, 9/15/2017
- CHTM participates in UNM-AFRL project developing next-generation satellite electronics
- Major reorganization of technical and administrative staff functions

# Proposals & Awards

## Proposals



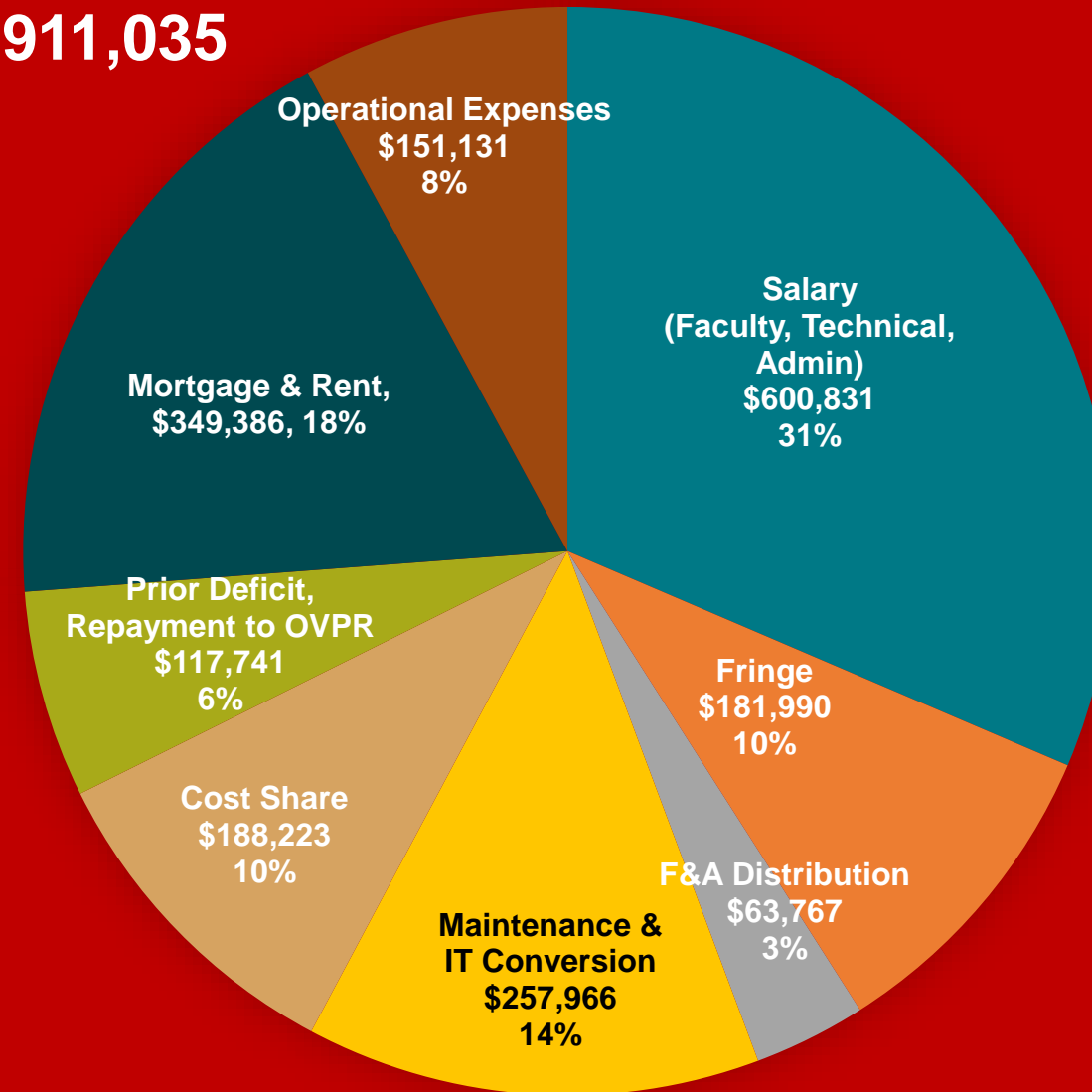
## Awards



## FY 2017 Expenditure:

- Mortgage: \$289,284
- Rent in 2017: \$60,102
- IT Conversion: \$37,179 (one-time expense)
- Prior deficit: \$35,000 for CHTM & OVPR each
- F&A pull-back by OVPR: \$47,741
- F&A distribution is to PIs
- CHTM pays all technical & administrative staff salaries and fringe
- CHTM provides almost all required cost share

**Total: \$1,911,035**



# Research Center Impacts

- Nano-Fab/cleanroom: 24/7 access & support to UNM, local companies/startups, National Labs (DoE & DoD)
  - Nano-Fab hosts ECE474/574 Microelectronics Processing
  - Provides Summer high school cleanroom hands-on training
- CHTM provides resources for campus (especially South Campus)
  - CHTM hosts OSE seminars throughout 2017
  - CHTM provides teaching space for UNM AIMS Charter School
  - CHTM supports CMEM, AML/Sandia Labs, and MTTC facilities and research infrastructure
  - CHTM hosts several equipment demos by companies open to entire campus, national labs, and local companies
  - CHTM facilities host start-up Armonica Technologies for joint research on DNA Nanopore Sequencing Technology
- Outreach: Several throughout the year, some are administered by our NSF ERCs, multiple tours given to students: e.g. to 70 8th grade students, showcasing experiments, CHTM Director made ice cream with liquid nitrogen for all students. CHTM also hosted 8 high school volunteers, 6 high school interns, and several high school teachers
- CHTM continues to remain a leader in interdisciplinary and transformative research at UNM: Examples include 3 NSF ERCs; part of the MURI on high power lasers; collaborates with UNM Hospital on a “Smart Lighting” testbed in an inpatient room; and remains a leader in semiconductor device fabrication
- Pipeline of M.S./Ph.D. graduates to local business/national labs. >500 graduate degrees awarded since its inception
- The 2014 Economic Impact Analysis of CHTM conducted by Bureau of Business & Economic Research concluded that CHTM has a sizable impact on the New Mexico economy, its research supports 131 jobs in the State on an ongoing basis, generates \$6.5M in labor income annually, and has resulted in \$11.7M economic output in 2014



# Return On Investment

- CHTM research resulted in 27 Ph.D. and 23 M.S. degrees in 2017
  - CHTM currently hosts 50 graduate students on Research Assistantships. Several other graduate students work at CHTM through other forms of support.
  - CHTM currently supports 19 undergraduate students.
- CHTM core faculty (17 total, 3 retired) published 60 peer reviewed journal articles (138 including conferences), many more from affiliated faculty
  - Published in well-established high-impact journals
  - 5 in Nature Journals, 2 in PNAS, 4 in ACS/Photonics/Nano/Letters
- CHTM faculty received 44 awards for a total of \$5,809,616
- 30 patents were awarded to CHTM core faculty in 2017
- Industry engagement
  - 4 STTR subcontracts; 6 small business industry contracts; 3 new startups

- Diverse interdisciplinary research
- Dedicated faculty lines
- State-of-the-art user facility (including Nanofab /cleanroom)
- Strong sharing culture, providing opportunities to others at UNM and New Mexico
- Well-trained and professional technical and administrative staff: providing services to CHTM, CMEM and SNL
- CHTM provides a gateway to collaboration with National Labs, especially AFRL, UNM leader in safety!

## STRENGTHS

- Fluctuations in operational funding from year to year
- No annual designated capital funding for renewal and replacement of major facility components
- No I&G lines for staff
- STEM department rankings at UNM have been declining, affecting the quality of our graduate students; CHTM is the largest beneficiary of the OSE program and desires expanded OSE support from UNM
- Lack of direct state support, difficulty in obtaining cost share

## WEAKNESSES

- Future faculty hiring at CHTM
- Growing optoelectronics and photonics market and opportunities
- Expanded collaboration with National labs
- CHTM can lead and champion initiatives at UNM South Campus, e.g. in energy saving, Safety, IT services, and facilities and maintenance

## OPPORTUNITIES

- Imminent failure of facility operation: 20+ year-old chiller, HVAC equipment, nearly expired roofing
- Faculty retention has been an ongoing issue. The main reason is that UNM faculty salaries are not competitive nationally. If faculty leave CHTM, they are difficult to replace due to shortage of startup funds

## THREATS

# Looking Ahead To 2018

- New faculty hires
- Expanded high-impact and visible research
- Significant grant/contract opportunities, Center-wide awards
  - Potential opportunities include NSF MRI, EFRC, MURI
- Expanded relationship with AFRL, Sandia Labs, and LANL
- Expanding research space at CHTM by creative management of storage space
- Encouraging CHTM Staff to expand duties and responsibilities to improve research and education support at CHTM and enable Staff career growth opportunities

# Summary

CHTM will continue to create and sustain a culture of excellence to promote interdisciplinary research and education; foster interaction between UNM, federal laboratories, industry; and promote an entrepreneurial spirit for economic development in New Mexico.

CHTM will remain committed to providing a diverse interdisciplinary research access point to UNM and New Mexico.