

# **Center for High Technology Materials**

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**Director**

2019 Annual Review Of Category 3 Research Centers/Institutes | Submitted to OVPR on 02/25/2020

# 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.

# CY 2019 Goals And Status

- Continue to remain a pillar for transformative interdisciplinary research and education in photonics, microelectronics, and nanoscale materials and devices at UNM.
- Integrate the two new faculty hires into CHTM research and education mission.
- Hire a new Program Operations Director at CHTM to fill a vacant position.
- Install a state-of-the-art Magnetic Property Measurement System (MPMS) funded by NSF.
- Acquire new critical equipment for Nano-Fab user facility; Integrate new gas sensing and flood sensing system to replace the outdated systems to improve CHTM safety.
- Expanding relationships with AFRL, Sandia Labs, and LANL.
- Reorganize and optimize CHTM staff operations.
- Maintain a balanced budget aligned with CHTM mission.
- Consolidate and reorganize laboratory space, convert unused storage space to functioning laboratory space.
- Start the process of obtaining and installing a new chilled water plant at CHTM.

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

# Membership of Advisory Committee

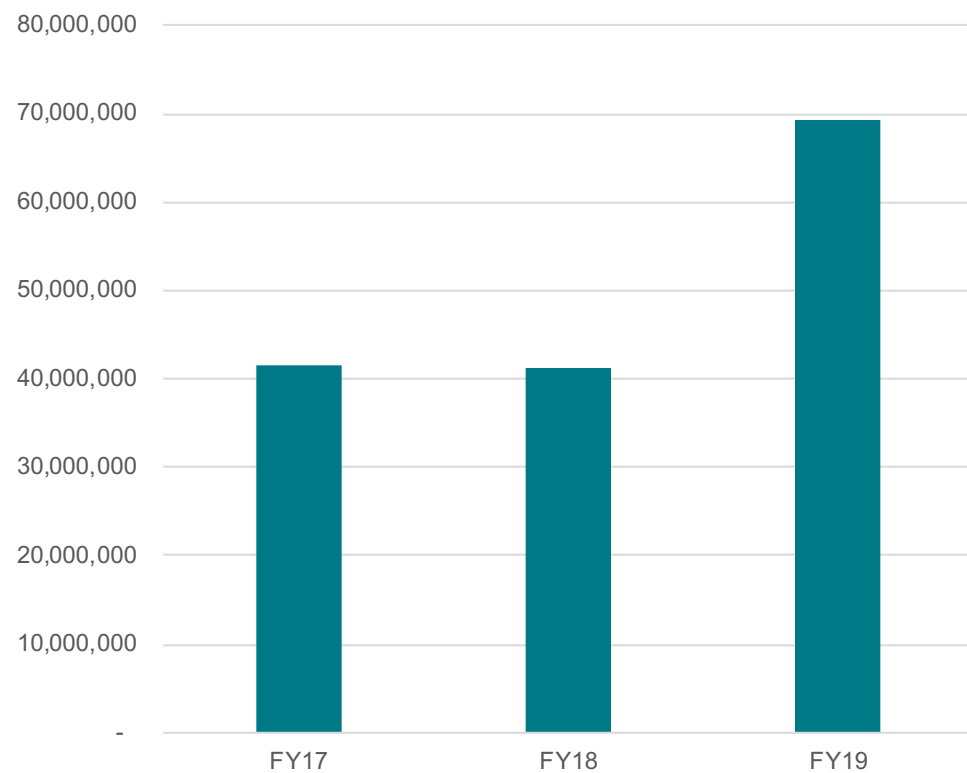
- Associate Deans for Research
  - College of Arts & Sciences (Turner)
  - School of Engineering (Schamiloglu)
- Department Chairs
  - Electrical and Computer Engineering (Devetsikiotis)
  - Physics and Astronomy (Rand)
  - Chemistry and Chemical Biology (Edwards)
  - Mechanical Engineering (Shen)
- CEO of STC.UNM (Kuuttila)
- Director of Center for MicroEngineered Materials (Garzon)
- No annual review was held in CY2019 because the new Director was hired in 2018. An annual review will be held before the end of the 2<sup>nd</sup> quarter of CY2020.

# CY 2019 Highlights

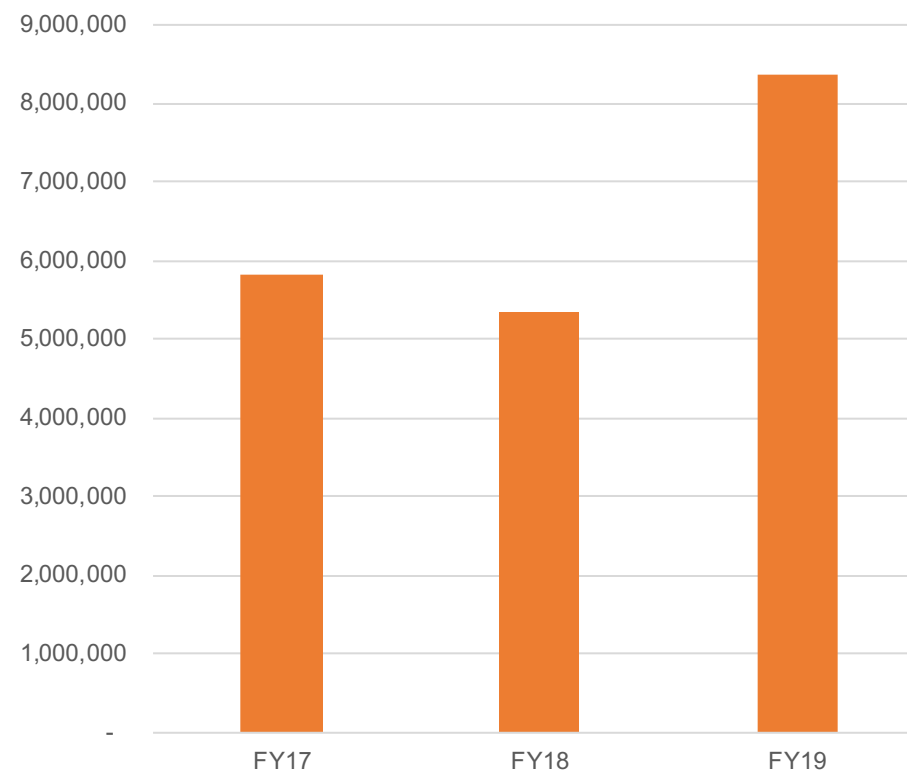
- Successful faculty search and hiring; two positions (Profs. Drake and Busani). All eight CHTM faculty lines are now filled.
- CHTM signed international collaborative research agreement with CIMAV, Mexico; sister organization to CHTM, as part of the Mayor's delegation.
- CHTM Federal Research Award Highlights:
  - NSF MRI award for Magnetic Property Measurement System (MPMS), \$276K
  - AFOSR award on Slow-wave Waveguides (PI Cavallo), \$856K
  - ARO award on Laser Filamentation (PI Diels, Arissian), \$588K
  - ARO award on Supersymmetric Optics (PI Mafi, Allahverdi), \$580K
  - AFRL Co-op. Agreement on Semiconductors; Space Applications (PI Balakrishnan), \$828K
- Faculty Accolades:
  - Osinski became a UNM Distinguished Professor; Acosta won the Cottrell Scholars Award; Mafi became an SPIE Fellow; Feezell received the UNM Regent's Lecturer Award; Zarkesh-ha won the UNM/ECE Outstanding Teacher Award
- 10 patents awarded to CHTM core faculty in 2019; total of 225 since inception
- Hired a new Program Operations Director

# Proposals & Awards

## Proposals

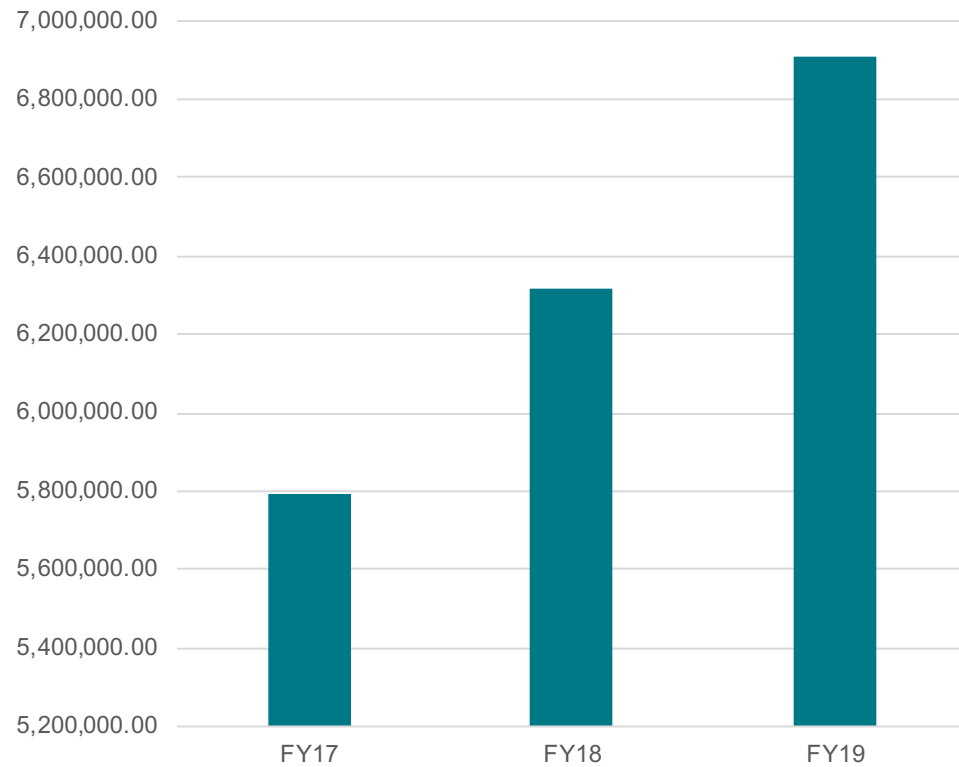


## Awards

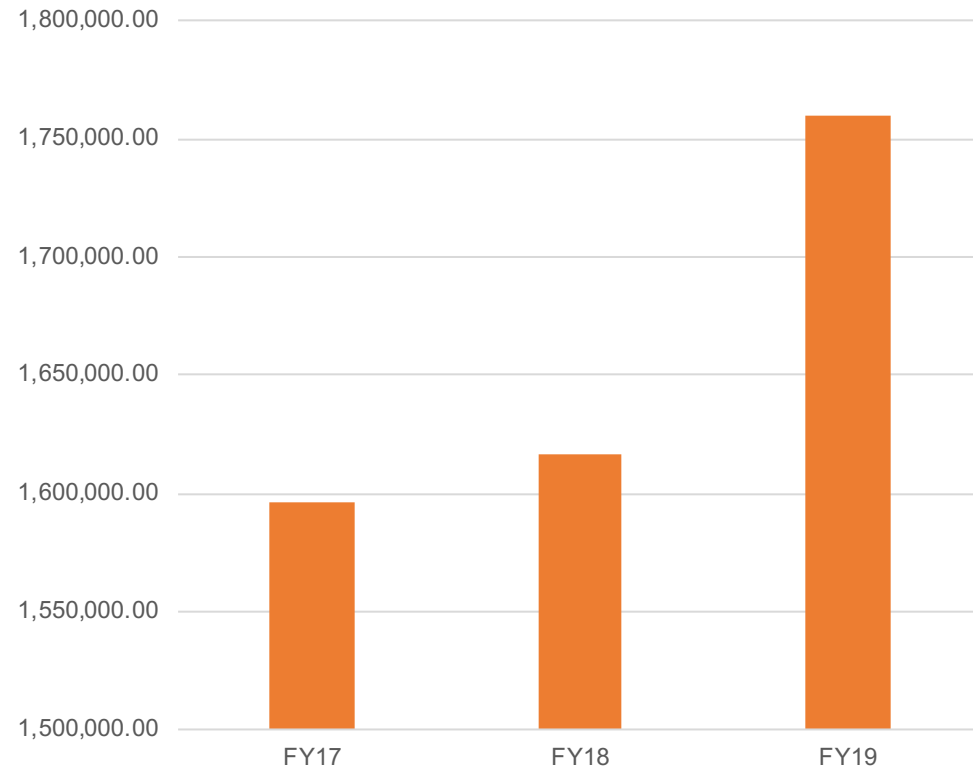


# Research Expenditures and F&A

### Research Expenditures

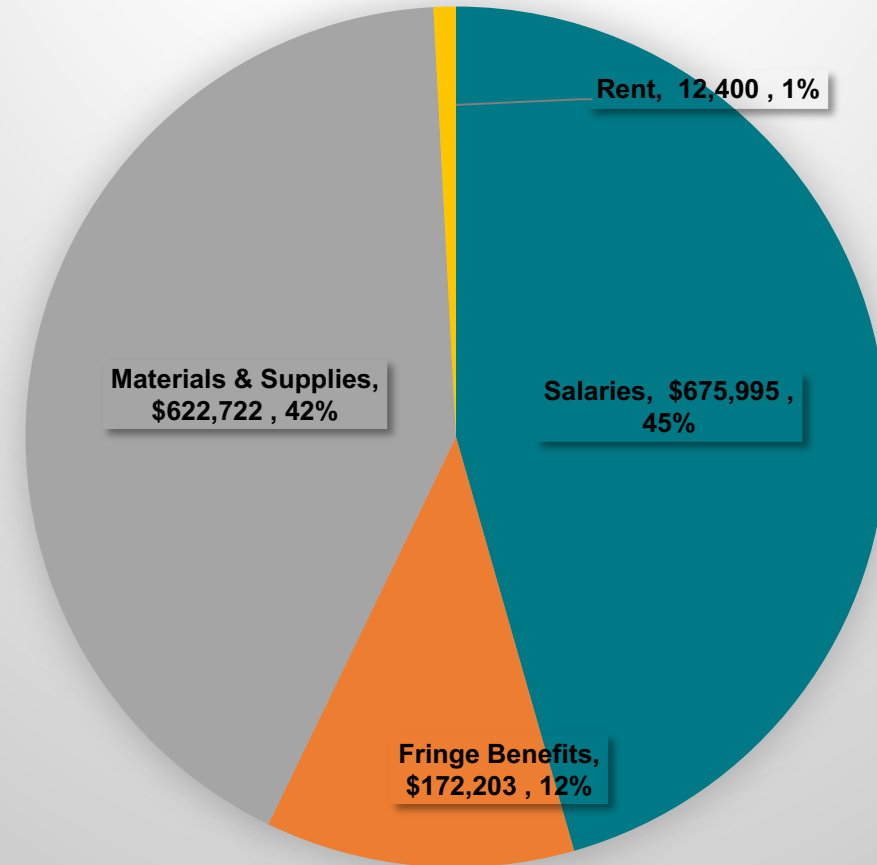


### F&A



FY19 Sources of Revenue	
F&A Return	\$ 1,052,018
VPR Pullback	\$ (52,403)
PI F&A Return	\$ (61,014)
Cost Share	\$ (161,866)
Gifts	\$ 167,446
Service Centers	\$ 471,551
Other	\$ 67,263
Support from OVPR	\$ 532,901
FY19 Reserves	\$ 876,802
<b>Total Revenue</b>	<b>\$ 2,892,698</b>

## CHTM EXPENDITURE DETAILS





# Research Center Impacts

- CHTM core faculty (17 total, 3 retired) published 82 journal articles (131 including conferences), many more from affiliated faculty
- Partner in two active NSF ERCs; Part of MURI on high power lasers; remains a leader in semiconductor device fabrication; hosted an HEL-JTO conference at CHTM
- Nano-Fab/cleanroom: 24/7 access & support to UNM, local companies, National Labs (DoE & DoD)
  - Nano-Fab hosts ECE474/574 Microelectronics Processing
  - Provides Summer high school cleanroom hands-on training
- Extensive Outreach: The students, staff and faculty of the CHTM ERCs interacted with over 6000 pre-college teachers, students and their families during 2019 in 40 events. Many CHTM labs also take high school students and REU students – Prof. Osinski has 4 REAP students; Prof. Jackson mentored Cleveland HS students who were participating in the NM Governor's STEM Challenge for inventors (won LANL sponsorship). Prof. Drake served as a judge of students at APS Four Corners meeting. Prof. Busani organized scout science trip at CHTM.
- CHTM provides resources for campus (especially South Campus)
  - CHTM supports CMEM, AML/Sandia Labs, and MTTC facilities and research infrastructure
  - CHTM hosts equipment demos by companies open to entire campus, national labs, local companies
  - CHTM facilities host start-up Armonica Tech: DNA Nanopore Sequencing Technology

# Return On Investment

- CHTM research resulted in 12 Ph.D. and 8 M.S. degrees in 2018
  - CHTM currently hosts 43 graduate students on Research Assistantships. Several other graduate students work at CHTM through other forms of support
  - CHTM currently supports 9 undergraduate students
- CHTM core faculty (17 total, 3 retired) published 82 journal articles (131 including conferences), many more from affiliated faculty
- CHTM faculty received 46 awards for a total of \$8,372,175 in FY19 which is up from \$5,361,408 in FY18
- 10 patents awarded to CHTM core faculty in 2019; total of 225 since inception, making it 35% of UNM patent portfolio (38% licensed)
- Industry engagement
  - 2 STTR subcontracts; 1 SBIR subcontract, 3 small business industry contracts
  - Industry using the nanofab facilities for fee and collaborate with faculty
  - 16 companies have been spun-off (CHTM faculty and student started) and many more small companies have been assisted since the inception of CHTM.

- Diverse interdisciplinary research
- Eight dedicated faculty lines
- State-of-the-art user facility (including Nanofab /cleanroom), available 24/7
- 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/AML
- 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
- Lack of direct state support, difficulty in obtaining cost share
- Diversity of students

**WEAKNESSES**

- Future faculty recruitment at CHTM
- Growing optoelectronics and photonics market and opportunities; emerging national quantum initiatives
- Potential to lead in directed energy and quantum materials
- 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 22-year-old facility infrastructure; e.g., heating, cryogenic plumbing (liquid nitrogen), and roofing systems
- 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 2020

- Starting the process of hiring a new faculty in **directed energy lasers**
- Expanding high-impact **collaborative research**; encouraging & enabling faculty to submit large collaborative proposals; increasing the number of such proposals
  - Apply for all CHTM-relevant grant opportunities related to the **National Quantum Initiative**
  - Assemble appropriate **MURI** teams to respond to the upcoming calls
- Expanding relationship with AFRL, Sandia Labs, and LANL
  - Proposed **Directed Energy Center** of Excellence; **Quantum Materials** Laboratory
- 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; enable Staff career growth opportunities
- Develop an **infrastructure funding master plan** with UNM Facilities Management
- Establish an **external industrial advisory board** for CHTM

# 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.