

NMSU State and Federal Partnerships for Research and Development

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**Assistant Vice President for Research
Infrastructure and Partnerships**

**Presentation for the NM Legislative Finance Committee
July 16th, 2024**



BE BOLD. Shape the Future.®

NMSU Office of Research, Creativity and Economic Development

NMSU Research powers:

Student Opportunity

Social Mobility

Return on Investment

Technology Development

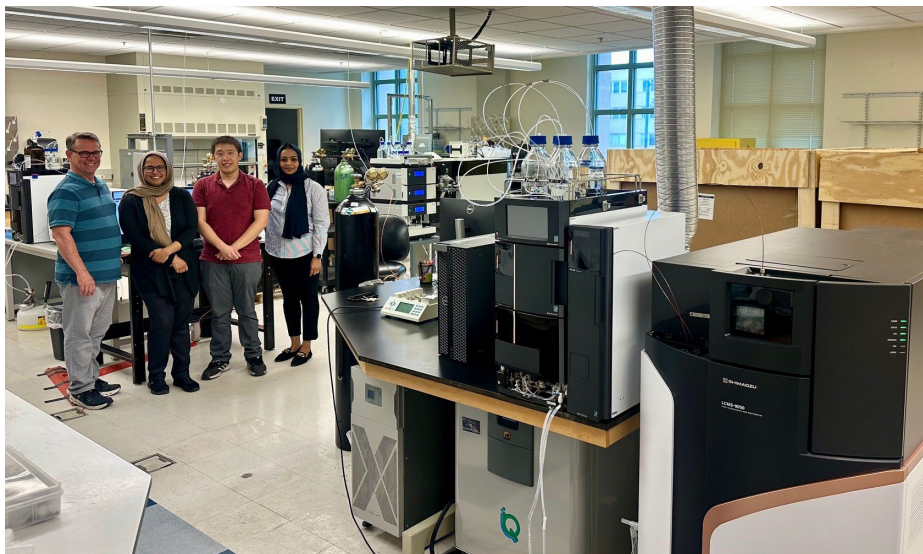
Economic Development

NMSU Highlights

- Water
- Energy
- Cybersecurity and AI
- Advanced Manufacturing
- Agriculture
- Radionuclide Research



NMSU Research Priority: State-of-the-art Analytical Chemistry

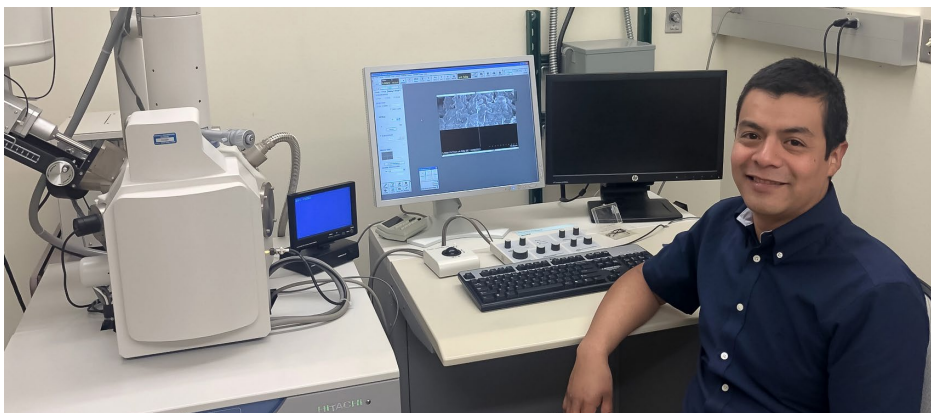


Recent Funding

- Past two years: \$2.3 M in direct Federal funds to this lab (DoE, Bureau of Reclamation, NIH, NSF)
- Past two years: The total value of collaborative efforts exceeds \$11 M in **new** Federal research funding.
- Lab supports **ongoing** research projects for which the total Federal funds awarded to NMSU exceed \$25 M.

Key research partnerships

- National High Magnetic Field Laboratory
- NM INBRE (NIH Biomedical capacity)
- NMSU Agricultural Experiment Station
- NMSU College of Engineering
- Shimadzu Corporation
- NM Tech



Supported by \$1.9 million NM Technology Enhancement Fund (50% match, \$3.9 million in new instrumentation)



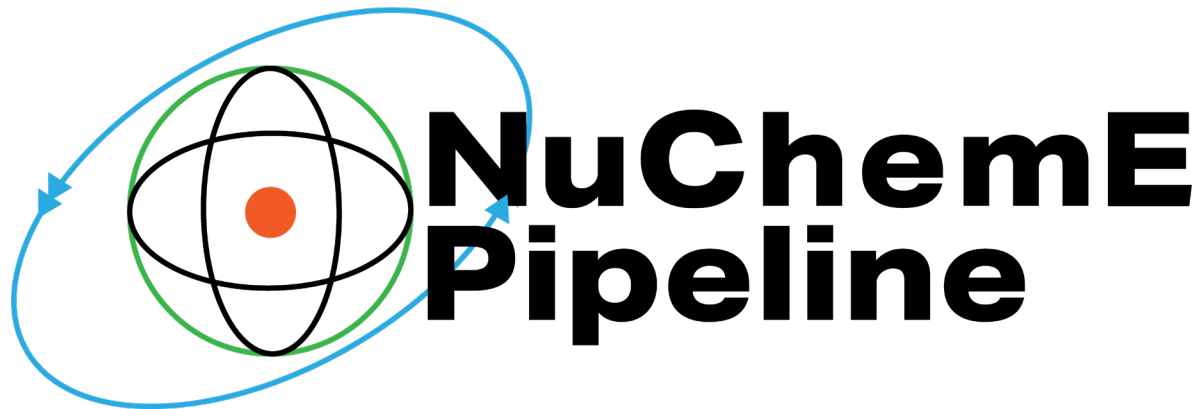
NMSU Research Priority: Intelligent Additive Manufacturing



- June 2024, \$7 million NSF EPSCOR E-RISE award to Dr. Jay Misra
- Making Distributed additive manufacturing a reality in NM.
- Key research partners
 - Navajo Technical University
 - New Mexico Tech.
 - Univ. of New Mexico
- Other Partners
 - NM National Labs
 - Private Sector

NMSU Research Priority: Radioactive Material Research and Workforce Development

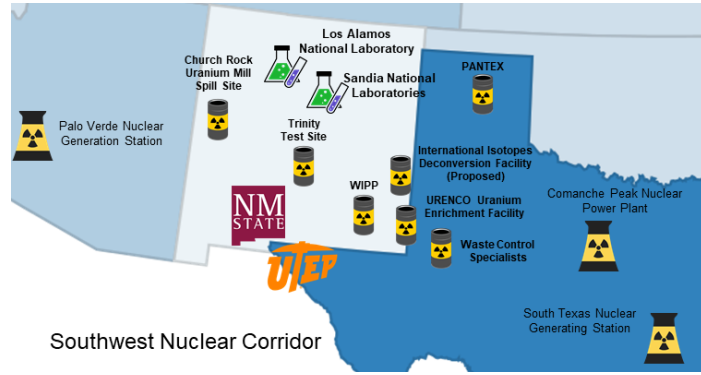
New \$4.8 million DOE award to Dr. Katie Brewer



Other Federal Radioactive Material Funding

- \$2.1 million in **new** Federal funding to NMSU Dept. of Chemistry (past 2 years) for radioactive material research
- \$18 million (in progress) to NM institutions to create employment pipeline to LANL PWDI initiative

The Location Opportunity



NuChemE Pipeline Partners



NuChemE Pipeline Goals

- **Expand Workforce** – Increase workforce and diversity of workforce at DOE Environmental Management locations - need skilled personnel to manage radioactive tank waste
- **Enhance regional research capabilities** in nuclear chemical engineering, chemistry, and supply chain management
- **Develop an NMSU interdisciplinary graduate certificate** in nuclear chemical engineering that can be completed remotely by students and professionals with backgrounds in science, engineering, or business

NMSU Research Priority: Hypersonic Research, Testing, and Workforce Development

Recent Funding

Past two years: **\$2.5** million in new Federal funds at NMSU (DoD, AFOSR, ONR, AFRL, NSF)

NM Technology Enhancement Fund: \$1.36 million (50%) to support a \$2.7 M proposal for a Mach 7 wind tunnel

Key research partnerships

- Lockheed Martin Hypersonic University Engagement (HUE)
- U.S. Naval Research Laboratory (NRL)
- Sandia National Laboratories



NMSU Aerospace Engineering Impacts New Mexico

- NMSU = **only Aerospace Engineering degrees** in the State of NM (BS, MS, ME, and Ph.D.)
- **Economic Development Position**: proximity and relationships to White Sands Missile Range
- NMSU provides available expertise, **workforce** (>300 degree-seeking UG students in the AE program), facilities & instrumentation, state-of-art research, and outreach

Stakeholders

- Boeing, LMCO, Raytheon, RTC, Keitos, Leidos
- SNL, LLNL, LANL, ORNL
- DOD, AFRL, ARL, NRL
- ONR, AFOSR, ARO
- SBIR sized companies
- US universities



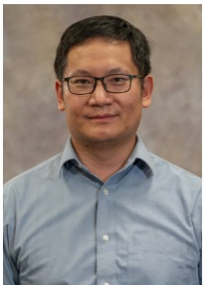
We expect \$2 million in non-State research funding for the Center for Hypersonics Research (HypRC) with the new hypersonics wind tunnel

Meet the Growing Hypersonics Research Team

Faculty



Dr. J.I. Frankel*, Department Head and R. G. Myers Endowed Professor



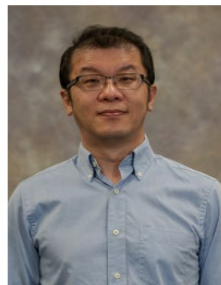
Dr. Fangjun Shu



Dr. Andreas Gross



Dr. Qiong Liu



Dr. Yanxing Wang

Will join us Fall 2024

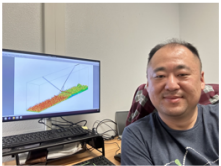


Dr. Francisco Torres-Herrador



Dr. Shabnam Mohammadshahi

Postdoctoral Research Associates



Dr. Sunyang Lee
Computational fluid dynamics
Shock/boundary-layer interaction
Heat flux sensor



Dr. Bryan Barraza Hogue
CFD, Boundary Layer Transition,
Machine Learning, Laminar-to-Turbulent Transition Modeling

Undergraduate Research Assistants



Colin Ross
Image Stabilization,
Schlieren Image processing

Graduate Research Assistants



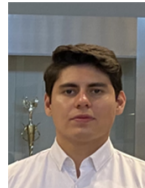
Leonardo Saenz
Experimental fluid dynamics,
shock tunnel characterization,
laser-based high-speed flow
diagnostics, hypersonic
junction flows



Luke Vergeer
Heat flux and temperature
sensors, heat flux data
reduction methods



David Vazquez
computational fluid
dynamics, hypersonics,
heat and mass transfer,
shockwave interaction



Julian Marin Olivas
Heat flux sensors, heat
flux calibration and data
reduction



Arafat Ahmed
Computational Fluid
Dynamics,
thermochemical nonequilibrium



Morelia Enriquez Martinez
Supersonic Nozzle Design,
hypersonic tunnel design



Marco Gomez
CFD, Shock/Boundary
Layer Interaction
hypersonic swept and
unswept fin flow

Corporate Sponsored Research Collaborations

- Depts. Of Molecular Biology & Interdisciplinary Life Sciences
- Department of Chemistry and Biochemistry
- Nut Crop Industry Sponsors
- Venture Capital Firm



Continuous High-Speed Determination of Aflatoxins in Pistachios and Other Crops

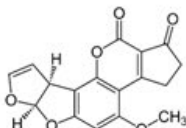


The Problem

Agricultural crops (including nuts, grains, and legumes) are often contaminated with mycotoxins, such as aflatoxin. Aflatoxins are highly toxic to humans and animals when consumed, so their presence in food supplies is highly regulated.

Aflatoxin testing of crops, food items, and animal feed is routinely performed in a destructive fashion, having several drawbacks:

- ▶ The sample that is tested is destroyed
- ▶ Aflatoxin may be missed when a representative sample is tested and may be found on re-testing elsewhere
- ▶ If a sample tests positive, the entire batch is destroyed
- ▶ For many crops, testing and approval occurs at the very end of the production line, after all value is added



Solution & Innovation

Methods and technology to non-destructively detect the presence of aflatoxin in real-time, enabling:

- ▶ Continuous monitoring of pistachios for aflatoxins during processing
- ▶ Alarms to alert when levels of aflatoxins are high
- ▶ Automatic activation of flow diverters to protect the bulk of pistachios

Our rugged device design shall be suitable for use by non-specialists in chemical measurements and provide early awareness of high levels of aflatoxins in crops.



Need & Market Potential

Aflatoxin:

- ▶ 120+ countries have regulations for maximum allowable aflatoxin levels in food
- ▶ 25% of the world food crops are affected by aflatoxin
- ▶ U.S. annual economic loss from mycotoxin contamination: \$932 million
- ▶ U.S. annual loss from regulatory enforcement: \$466 million

Pistachios:

- ▶ Pistachios are a high value crop netting \$2.9 billion in 2021
- ▶ U.S. has 67% of value, with Iran having the next largest share at 17%
- ▶ Failure with a single batch (44,000 lb) costs a grower/producer approximately \$500,000 per event, and the sample that is tested is destroyed



Applications

A real-time, continuous detection and/or monitoring of aflatoxin in pistachios:

- ▶ At the start of processing
- ▶ Before storage in silos
- ▶ After storage

Huge markets beyond pistachios, including:

- ▶ Almonds and other tree nuts
- ▶ Corn, wheat, and peanuts
- ▶ Dairy products and eggs
- ▶ Dried fruits
- ▶ Black pepper and chilis



Thank you!

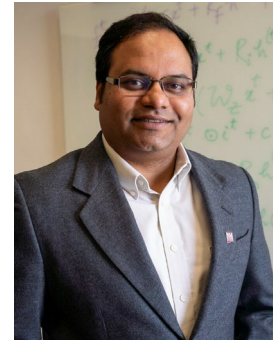
Please Direct Questions To Our Experts

Radioactive Materials



Dr. Catie Brewer
Associate Professor of Chemical
Engineering

Intelligent Additive Manufacturing



Dr. Jay Misra
Associate Dean of Research, College of
Engineering
Professor of Computer Science and
Electrical and Computer Engineering

Hypersonic Vehicles



Dr. Jay Frankel
Department Head and
R. G. Myers Endowed Professor

Advanced Chemical Analysis



Dr. Tanner Schaub
Research Professor
Assistant Vice President for Research
Infrastructure and Partnerships