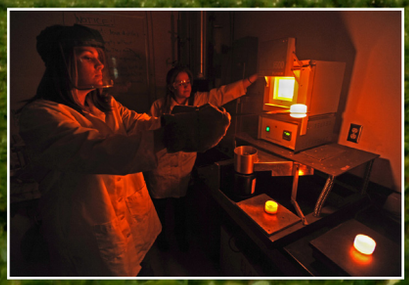
NM STATE UNIVERSITY

NMSU

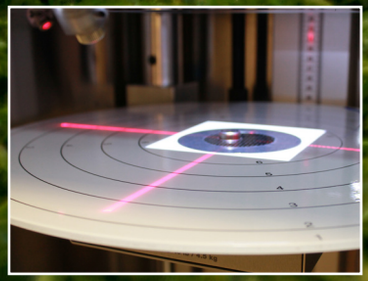
RESEARCH AND RESOURCES 2015

DISCOVERIES AND PARTNERSHIPS BENEFITING NEW MEXICO AND BEYOND









Message from the President, and Vice President for Research

As a university dedicated to conducting meaningful research to benefit the lives of residents of New Mexico and beyond, New Mexico State University is making important discoveries across a dramatic spectrum, from a collaborative examination of climate change right here in the desert Southwest to extensive study of unique characteristics of the two largest bodies in the solar system: the interior of the planet Jupiter and the helioseismology of the Sun.

The pages of this edition of the university's annual research magazine detail accomplishments across the institution. We are pleased to note the acquisition of four patents by NMSU faculty members during the year, as well as continued funding for powerful programs that help transform young lives. These programs include the Mathematically Connected Communities and Scientifically Connected Communities projects, which bolster math and science education for K-12 students, as well as the Alliance for Minority Participation, which – since 1993 – has increased the enrollment and quality of education in STEM fields for historically underrepresented minority students here at the university.

Our longtime contributions to national security through the Physical Science Laboratory, dating back to 1946, as well as state-of-the art research activity in smart grids to make power systems more efficient are examples of the role NMSU plays on a national stage. Advances in water research are ongoing, as well as forward strides in biomedical research. At every step of the way are dedicated faculty members like Martha Desmond in Wildlife Sciences, Gary Eiceman in Chemistry, and Mary O'Connell in Plant and Environmental Sciences, whose work is supported by the US Department of Agriculture's National Institute of Food and Agriculture, the National Science Foundation, and the National Institutes of Health, respectively.

Please enjoy exploring the pages of the magazine. It's a chance to learn about NMSU's dedicated researchers seeking discoveries to transform lives.

Hamid Mansouri Rad

Garrey Carruthers
President

Vimal Chaitanya
Vice President for Research

NMSU RESEARCH AND RESOURCES MAGAZINE

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The magazine can be found on the Web at researchmag.nmsu.edu.

NMSU Foster Hall

CONTENTS 2015

WILDLIFE SCIENCES

Wildlife Sciences Faculty Creates Hub of Research and Education for Students in New Mexico and Puerto Rico

Martha Desmond, professor of Fish, Wildlife and Conservation Ecology was recently awarded Professional of the Year award by the New Mexico chapter of the Wildlife Society for her leadership and development of the Natural Resource Career Track Program. Funded by a $3,315,000 USDA NIFA award, the project prepares underrepresented students for career paths with the USDA Forest Service. The program enables collaboration between 14 Hispanic-Serving Institutions and hosts more than 100 student participants from New Mexico and Puerto Rico. It provides students with opportunities to engage in internships, research mentorships, graduate training, field courses, workshops as well as exchanges between New Mexico and Puerto Rico. Over the three years, students have participated in 180 summer internships and 97 semester lab mentorships. In addition, more than 75 students have attended professional meetings nationally. An ornithologist and a conservation ecologist, Martha Desmond also leads a project funded by the New Mexico Department of Game and Fish studying the distribution and habitat requirements of Bendire's Thrasher, a secretive, cryptic species of birds found in the deserts of New Mexico which are undergoing strong population declines. She is also funded by the New Mexico State Land Office to study the impact of solar energy development on the breeding grassland birds and insects of southcentral New Mexico.

Professor Martha Desmond holding an owlet.

Professor Martha Desmond and students from the Natural Resources Career Track on their retreat at the Valles Caldera Natural Preserve (NMSU photo provided by Martha Desmond)

SMART GRIDS

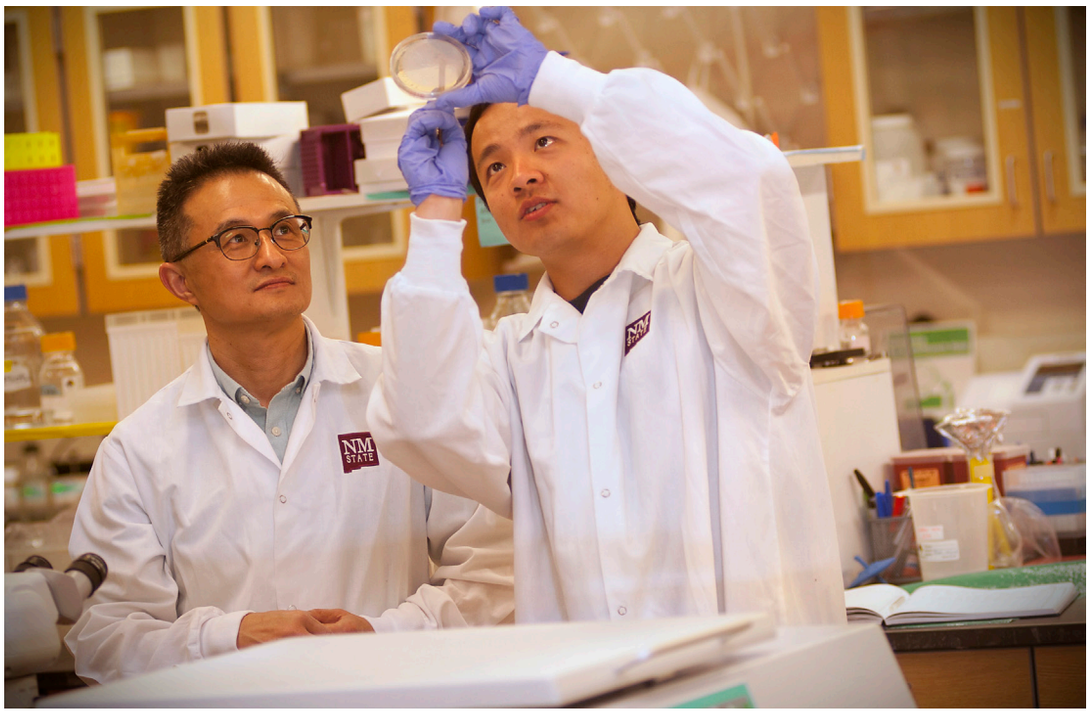
Left to right: Jay Misra (Computer Science), Huiping Cao (Computer Science), Rebecca Galves (Computer Science), Enrico Pontelli (Associate Dean, College of Arts and Sciences), Sukumar Brahma (Klipsch School of Computer and Electrical Engineering), Son Tran (Chair, Computer Science), Satish Ranade (Chair, Klipsch School of Computer and Electrical Engineering), and William Yeoh (Computer Science). Not pictured: Susan Brown, STEM Outreach Office (Photo by Hamid Mansouri Rad)

Innovative Smart Grid Research at NMSU Makes Electric Power Systems More Efficient

NMSU has expanded its research, education, and outreach activities on smart grids thanks to an award by the National Science Foundation's Center for Research Excellence in Science and Technology (CREST) program. iCREDITS (interdisciplinary Center of Research Excellence in Design of Intelligent Technologies for Smart Grids) allows NMSU's electrical engineering and computer science faculty to conduct research to enhance the efficiency of power distribution systems by optimizing four core components: 1) Energy production and delivery by developing a new paradigm that views energy as a commodity, which can be produced, stored, and exchanged, by not only power plants, but also other users who generate power through alternative energy sources such as solar panels; 2) Communication by developing an architecture consisting on three levels of hierarchy with bidirectional information flow between adjacent layers: a) physical layer consisting of agents of communicating devices such as smart meters, b) aggregation layer, which develops aggregation nodes for decoupling data from devices, and c) decision layer, a cloud of computing servers monitoring and optimizing the grid; 3) Coordination by developing an agent for each entity in the network (home, office building, factory, power plant) for controlling its power load, consumption, and transmission and coordinating how much power should be generated, consumed, and transmitted between agents; and 4) Monitoring by classifying in real-time different disturbances occurring in transmission and distribution networks in power systems, so that system operators can respond in order to maintain system integrity. Ultimately, achieving the goal of this project requires addressing the shortage of smart grids workforce. This project addresses this issue by developing a comprehensive interdisciplinary education and training pipeline for students (K-12/Undergraduate/Graduate). At the same time the outreach component of this effort aims to increase the participation of the Hispanic population, and women and other underrepresented groups in smart grids.

The ICREDIT project is led by co-directors Enrico Pontelli (Associate Dean, College of Arts and Sciences) and Satish Ranade (Chair, Klipsch School of Computer and Electrical Engineering). The sub-project leaders include Sukumar Brahma and Huiping Cao (Monitoring), Jay Misra and Hong Huang (Communication), William Yeoh and Son Tran (Coordination), and Susan Brown (Education and Outreach).

LIFE SCIENCES



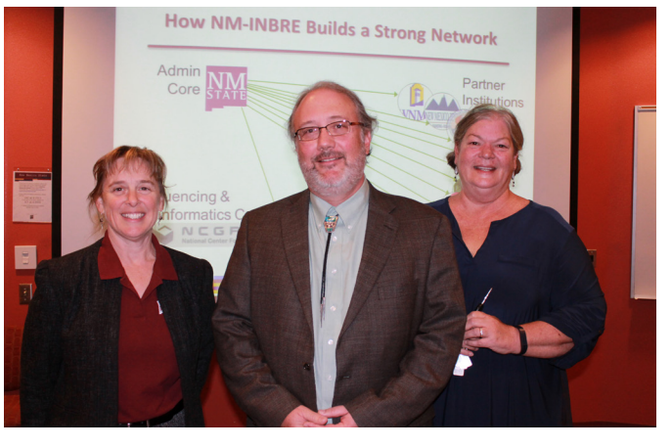
New Mexico IDeA Networks of Biomedical Research Excellence

With recent extension of funding, the New Mexico IDeA Networks of Biomedical Research Excellence (NM-INBRE) will continue to champion biomedical and community-based research excellence and discovery in the state and beyond. The NM-INBRE program was awarded more than $18 million from the National Institutes of Health to extend its operations for another 5 years.

The program has created and funded a network of researchers among 10 New Mexico institutions: NMSU (lead), the National Center for Genome Resources, Eastern New Mexico University, New Mexico Highlands University, New Mexico Tech, Northern New Mexico College, the Pueblo of Zuni, San Juan College, University of New Mexico, and Western New Mexico University.

NM-INBRE supports its member institutions by providing research funding and mentoring to their faculty, connecting students to research training and internships, training researchers in grant-writing and management skills, funding their participation in scientific meetings and conferences, facilitating access to instrumentation, and facilitating collaboration opportunities across the U.S. NM-INBRE provides support for basic, clinical, and translational biomedical research. The program's foci include the structure and function of biomolecules, cells and organisms, pathogens, bioinformatics and genomics, and community-based participatory research (CBPR).

Institutions funded by the NM-INBRE also enjoy the support of genetic sequencing and bioinformatics collaborators with the National Center for Genome Resources based in Santa Fe, NM. During its 14-year history, NM-INBRE has supported 47 faculty in their research and professional development, resulting in 33 successful tenure applications. In addition, INBRE has trained 769 students, including PhD and postdocs. Moreover, NM-INBRE has garnered more than $89 million in NIH funding for participating institutions, from direct program funding and additional NIH grants. NM-INBRE has been developing research resources across New Mexico since 2001.



NM-INBRE administration: Laura L. Haas (left), Program Operations and Evaluation Director; NMSU Regents Professor of Chemistry and Biochemistry Jeff Arterburn, Director and Principal Investigator; Carolyn Bizzell, Program Manager (Photo by Hamid Mansouri Rad). Not pictured: Shelley Lusetti, Program Coordinator.

NMSU-Fred Hutchinson Cancer Research Center Partnership

The collaboration between NMSU and Fred Hutchinson Cancer Research Center (FHCRC) started in 2002 and was initiated by Mary O'Connell, NMSU's Regents Professor of Plant and Environmental Sciences. The goals of this program include enhancing NMSU's expertise in cancer research by providing the faculty with research opportunities in basic science, as well as training NMSU's underrepresented Hispanic students in cancer research. As a result of this program, NMSU students have the opportunity to participate in cutting-edge research activities taking place at FHCRC and to pursue careers in cancer research after graduation.

Mary O'Connell, Regents Professor of Plant and Environmental Sciences and principal investigator of the NMSU-FHCR partnership (Photo by Hamid Mansouri Rad)

NMSU/FHCRC partnership involves 9 researchers from FHCRC and 6 faculty researchers from NMSU's colleges of Agricultural, Environmental and Consumer Sciences; Arts and Sciences; Health and Social Services, and Engineering. Current research activities supported by this partnership include a pilot project where investigators Shirley Beresford (FHCRC), India Ornelas (University of Washington), and Kevin A. Lombard (NMSU) collaborate with New Mexico Navajo Nation in order to decrease cancer risk among the members of the Nation. Another pilot project led by Chris Kemp (FHCRC) and Amanda Ashley (NMSU) aims to study newly identified gene targets that would increase suppression of p53 mutant cancer cells exposed to Doxorubicin, a widely used chemotherapy agent for breast cancer.

This partnership currently supports two full research projects. In one, principal investigators Chris Li and Peggy Porter from FHCRC and NMSU's Ryan Ashley aim to understand the influence of membrane-associated steroid receptors on multiple phases of breast cancer progression. In the second project, investigators Roger Brent (FHCRC) and Jessica Houston (NMSU) develop fluorescent lifetime methods to quantify signaling in living cells. Directed by Rebecca Palacios, NMSU's associate professor of Public Health Sciences, and Beti Thompson, a member of the FHCRC's cancer prevention program, the outreach component of the FHCRC/NMSU partnership disseminates research findings to the public and raises awareness about nutrition and lifestyle practices that could prevent cancer. This highly competitive award from NIH extends NMSU/FHCRC collaborations for another 5 years.

Amanda Ashley
Research Assistant Professor, Animal and Range Sciences

Ryan Ashley
Assistant Professor, Animal and Range Sciences

Jessica Houston
Assistant Professor, Chemical Engineering

Kevin A. Lombard
Associate Professor, Agricultural Science Center at Farmington

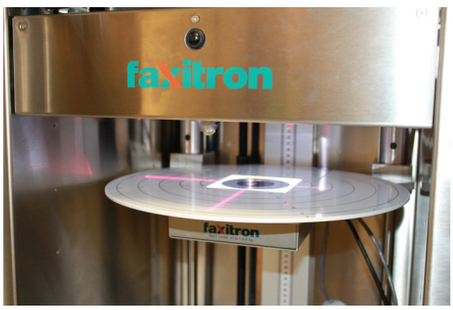
Rebecca Palacios
Associate Professor, Public Health Sciences

Michele Shuster
Associate Professor, Biology

CHEMICAL AND BIOLOGICAL SCIENCES

State-of-the-Art X-Ray Irradiator Boosts NMSU's Research

Biochemistry professor Shelley Lusetti, right, works with student Inoka Menikpurage in her laboratory (Photo by Darren Phillips).



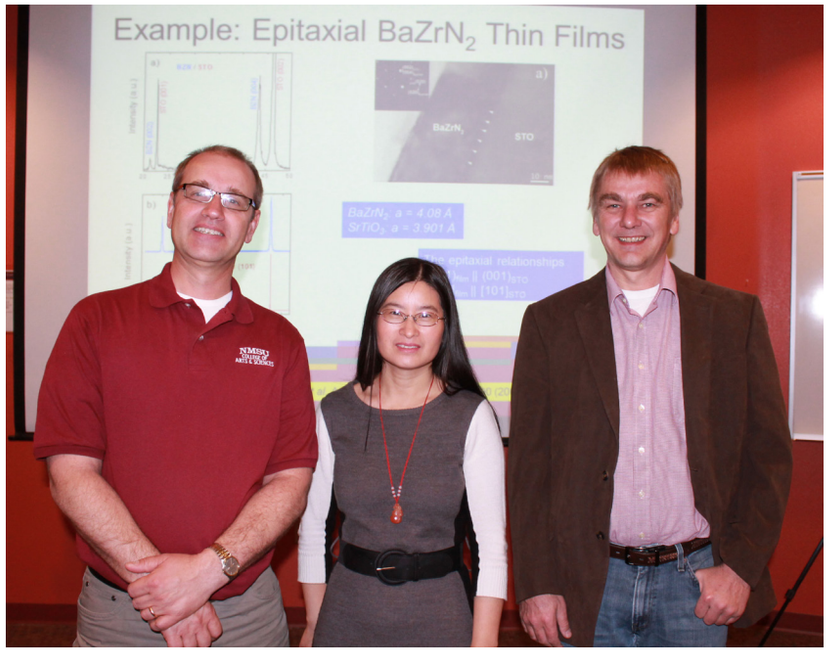
Addition of an X-ray irradiator and dosimetry system enables NMSU faulty in the chemical and biochemical sciences to conduct innovative research in diverse areas. The equipment was recently purchased through a $260,000 National Science Foundation grant awarded to Shelley Lusetti, NMSU Associate Professor of Chemistry and Biochemistry. Researchers are using the equipment to study DNA damage and repair mechanisms, insect stress physiology, sterile insect technique, developmental biology, plant physiology, and plant breeding (including algal biofuels). The equipment also helps with career development of faculty in several scientific fields, and provides training and educational opportunities for both graduate and undergraduate students. Dr. Lusetti is also the Co-Director of the NMSU RISE Graduate Training Program and the Program Coordinator for the NM IDeA Network for Biomedical Research Excellence.

NMSU's X-ray irradiator and dosimetry housed in the Foster Hall (Photo by Hamid Mansouri Rad).

PHYSICS

High-Resolution, High-Intensity X-Ray Diffractometer and Reflectometer Enhances Materials Research at NMSU

NMSU's XRD housed at the Gardiner Hall (Photo by Hamid Mansouri Rad)



Stefan Zollner (left), Chair of the Physics Department, Hongmei Luo, associate professor of Chemical Engineering, and Heinz Nakotte, professor of physics (Photo by Hamid Mansouri Rad)

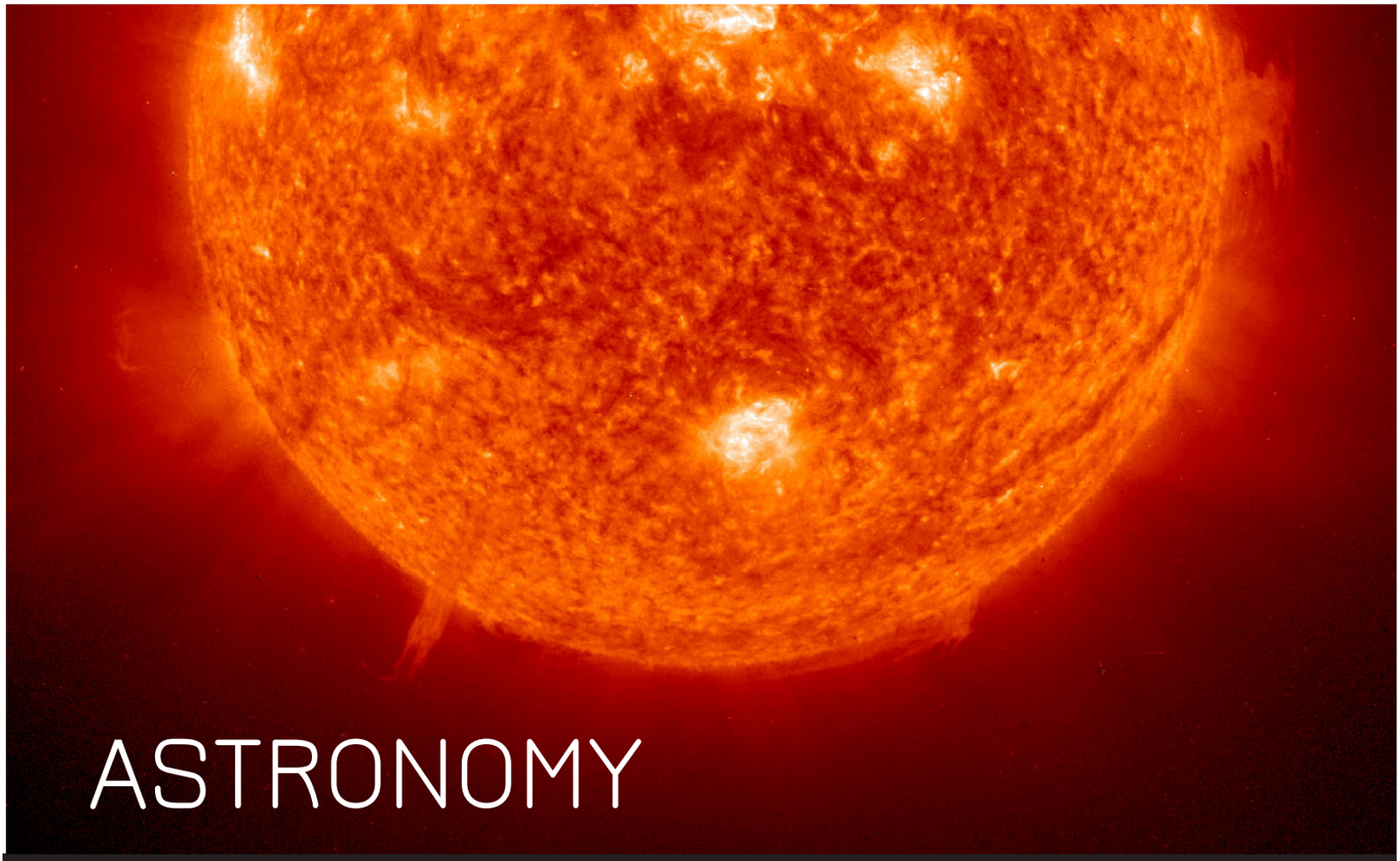
A team of NMSU faculty led by Stefan Zollner, professor and chair of the Department of Physics, received a $300,000 competitive grant from the Army Research Laboratory for acquisition of a high-resolution, high-intensity X-ray diffractometer and reflectometer (XRD). The device which can be used to measure distances between atoms, dimensions of crystal structures, and film thickness supports research activities of NMSU faculty and students in various disciplines, in particular, physics and chemical engineering.

Physics professor, Heinz Nakotte employs the XRD for studying structural features of Prussian Blue Analogs (PBA). These materials are of interest for a variety of applications due to their negative thermal expansion (NTE) behavior. Unlike most materials that will expand when heated (positive thermal expansion), NTE materials contract. The underlying mechanism for NTE in PBAs is still highly debated, and Nakotte's research focuses on structural features that may play an important role.

The XRD also helps physics professor Edwin Fohtung's research on multiferroics, magnetoelectric, electronic, straintronics, and magnetic phases arising due to competing and/or coupled charge, spin, orbital ordering and lattice interactions. He uses the XRD to study such materials due to their application in ultrafast electronics and magnetism. Another frequent user of the XRD is Hongmei Luo, associate professor of chemical engineering, whose research activities include metal oxide and metal sulfide nanoparticles and nanowires for lithium-ion batteries, supercapacitors, photocatalysts and solar cells. In addition, her research group works on epitaxal metal oxide and nitride thin films for superconductors and magnetic applications.

Hongmei Luo, Edwin Fohtung, Heinz Nakotte, and Shuguang Deng (professor of chemical engineering) are co-PIs for the acquisition of the XRD.

Edwin Fohtung, assistant professor of physics

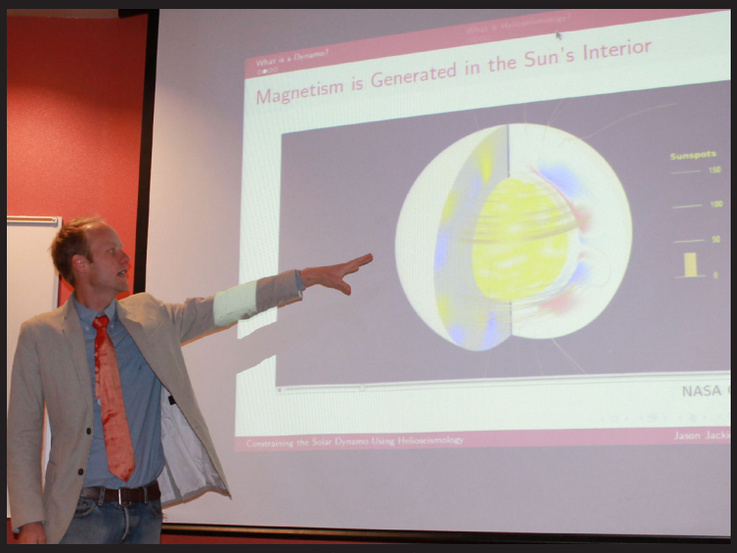


ASTRONOMY

Astronomy Associate Professor Uses Helioseismology to Study Solar Dynamo

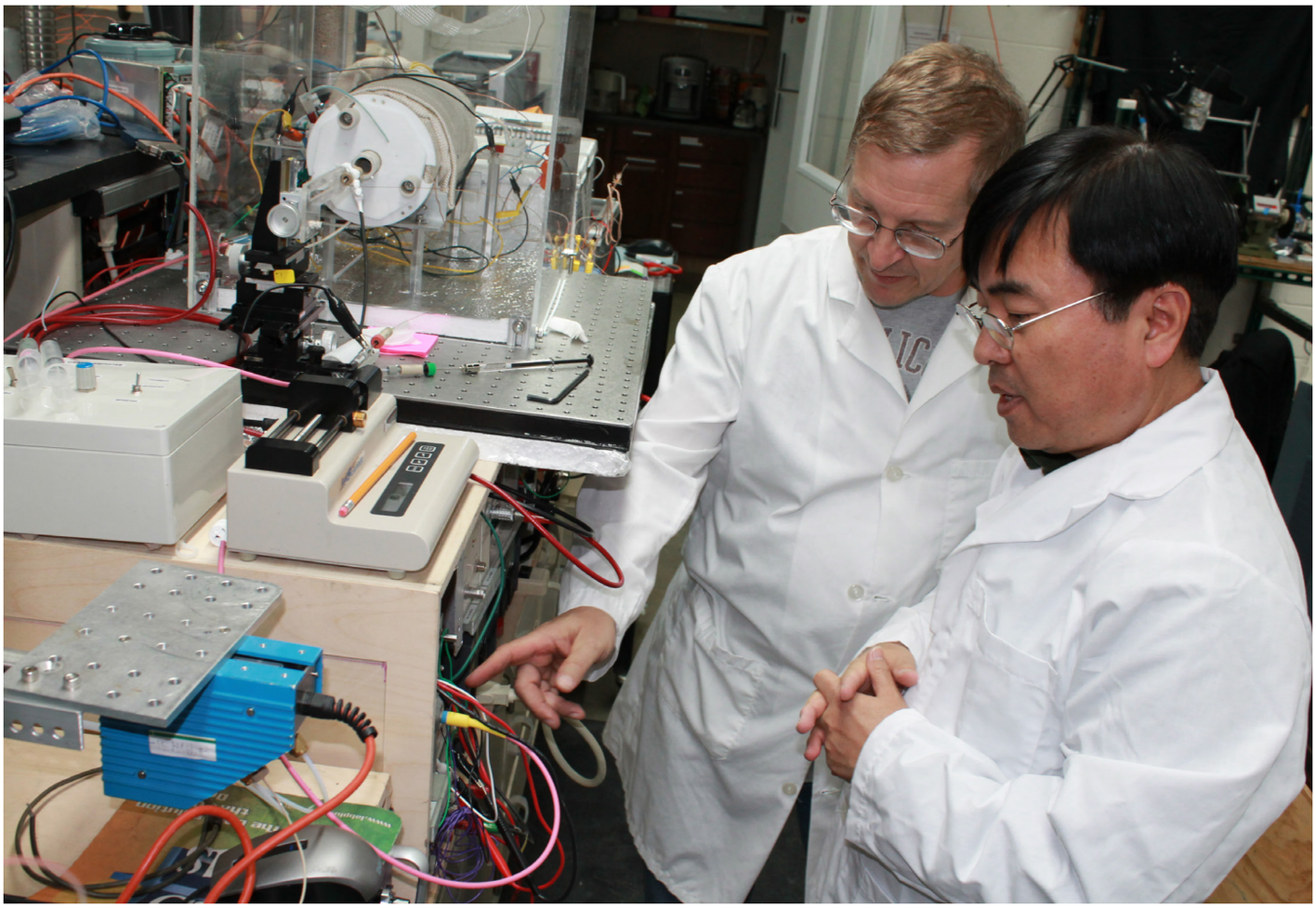
Jason Jackiewicz, associate professor of astronomy, received a $593,000 NSF CAREER award for his research on studying the solar dynamo using helioseismology in order to forecast the Sun's future activities. In addition to the research opportunities that this project provides to NMSU students, Jackiewicz also collaborates with Susan Brown, the director of NMSU's NASA-funded Science, Engineering, Mathematics, and Aerospace Academy, to educate sixth grade teachers about the Sun and equip them with new STEM education strategies to employ in their classrooms.

Jackiewicz was also awarded a $750,000 NASA EPSCoR grant to build an instrument for studying the interior of Jupiter. The result of this study will increase our knowledge about how the solar system was formed. In addition, Dr. Jackiewicz received $330,000 for a NASA Astrophysical Data Analysis project to study red-giant stars in eclipsing binary systems as probes of fundamental stellar physics.



Jason Jackiewicz, associate professor of Astronomy, delivering a presentation about his NSF CAREER project. Picture of the Sun, courtesy of NASA/European Space Agency. (Photo by Hamid Mansouri Rad)

FACULTY SPOTLIGHT



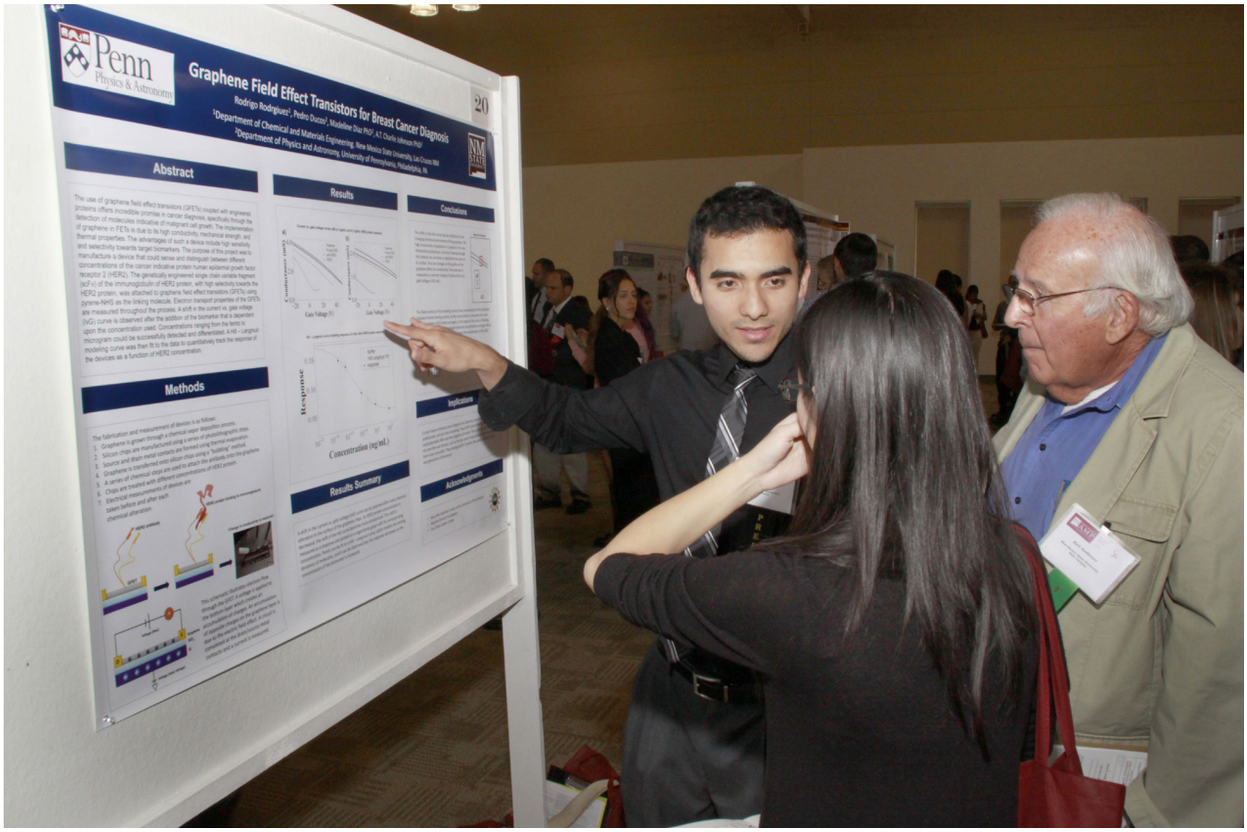
Chemistry Professor Gary A. Eiceman (left) and post-doctoral fellow Gyoungil Lee (Photo by Hamid Mansouri Rad)

Stellar 34-Year Career of Professor Gary A. Eiceman

During the past 34 years at NMSU, Gary A. Eiceman has mentored hundreds of students, garnered in excess of $15 million in external funding, holds 23 patents, and published more than 200 research articles on the foundations of gas phase ion molecule reactions in air at ambient pressure and the behavior of gas ions in electric fields. Additionally, he has developed chemical instruments for fast measurements of toxic organic compounds in airborne vapors. His efforts have resulted in development of technology to access air quality on-board the International Space Station and formerly in Space Shuttles in cooperation with Dr. Thomas Limero of Johnson Space Center, Houston. A recent award from NSF enables Eiceman and his students to 1) redesign and rebuild a proof-of-concept tandem differential mobility spectrometry (DMS) instrument into a stable experimental platform, with detector options for a conventional Faraday plate or a mass spectrometer; 2) explore the selectivity of ion-reagent chemistry implemented in tandem DMS and clarify origins of chemical orthogonality from changed alpha functions or ion transformations; and 3) determine chemical class-based dependences of ion fragmentation by strong RF fields in tandem mobility measurements. Professor Eiceman currently holds a quarter-time appointment as Professor of Analytical Instrumentation in Loughborough University, England.

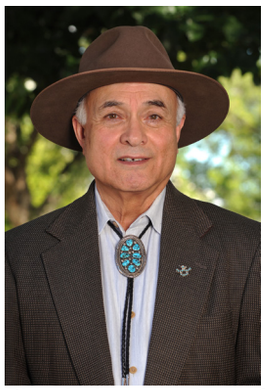
STEM EDUCATION

RENEWED PROGRAMS



NMSU Chemical Engineering student Rodrigo Rodriguez (left) presenting his poster to a visitor and NMSU Astronomy Professor Emeritus Kurt Anderson during the New Mexico Alliance for Minority Participation conference held in October 2014 (Photo by Jack Diven)

NM-AMP



Ricardo Jacquez , Dean of the College of Engineering and Director of the NM AMP program

A $1.3-million grant from the National Science Foundation is allowing New Mexico Alliance for Minority Participation (AMP) to continue its important mission to increase the enrollment, quality of education, and graduation rate of historically underrepresented minority students (URM) in STEM fields. According to Dr. Ricardo Jacquez, Dean of the College of Engineering and the project director of the New Mexico AMP since the inception of the program in 1993, the number of baccalaureate degrees in STEM areas has more than doubled, from 253 in 1992-1993 to 665 in 2012-2013, with a total of 9,388 STEM degrees awarded over the life of the program. The program also provides direct student support to enable students to attend academic year and summer enrichment activities without unnecessary loss of income. The recent funding will enable the program to continue its goal of increasing URM STEM graduates, including a contribution of 10% or higher from transfer students. In addition, the program aims to increase the progression of undergraduate students to graduate school entry and continue to build meaningful partnerships with New Mexico's educational institutions, government agencies, national laboratories and centers, industry, private foundations, and STEM professional organizations to support student development and success across New Mexico.

Math Snacks

Karin Wiburg, Distinguished Professor of Learning Design and Technologies

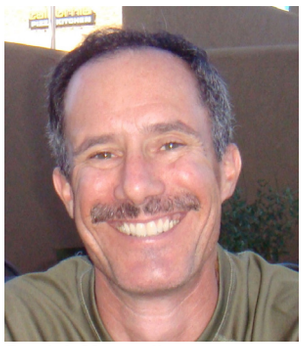
Karin Wiburg, Distinguished Professor of Learning Design and Technologies in the College of Education, received $669,820 from NSF for the Math Snacks project. Initiated in 2009, the Math Snacks project conducts research on ways that innovative media can be used to fill gaps in existing math education efforts in the State of New Mexico. Informed by research results, the project participants develop educational media, including games, video, and print material to aid middle school students in understanding mathematics concepts identified as difficult to learn. The Math Snack co-investigators include Professor Barbara Chamberlin, the director of NMSU's Learning Games Lab, and Theodore Stanford, associate professor of mathematical sciences. In addition to leading the Math Snacks project, Professor Wiburg is one of the founders of NMSU's Institute for Equity in Mathematics and Science Education and collaborates with the Bridge of Southern New Mexico, a non-profit organization that supports educational excellence in Doña Ana County.

Barbara Chamberlin, Assistant Department Head, Agricultural Communications

MC^2

Wanda Maria Bulger-Tamez, Director of the MC^2 Program

The Mathematically Connected Communities project (MC^2) received a new grant in the amount of $1,169,441 from the New Mexico Public Education Department. Begun in 2006, MC^2 has improved student achievement and the teaching and learning of K-12 mathematics by building a statewide learning community of mathematics educators, mathematicians, and public school leaders. This state-wide project offers professional learning opportunities for teachers of mathematics as well as district leadership and assists districts with implementing new standards-based curricula and assessment tools. This project is the result of the collaboration between NMSU's College of Education and the Department of Mathematical Sciences, New Mexico Public Education Department, University of New Mexico, Western New Mexico University, and school districts across the state. Wanda Maria Bulger-Tamez, College of Education, directs the project as the principal investigator, in collaboration with Patrick Morandi, Department of Mathematical Sciences, as the co-PI. The MC^2 is part of the Institute for Equity in Math and Science Education within the College of Education.



Patrick Morandi, Distinguished Professor of Mathematical Sciences

SC^2

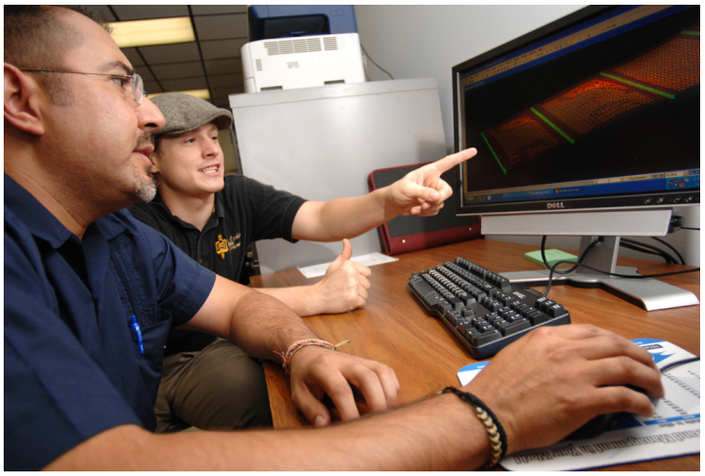
Susan Brown, Research Associate Professor of Math and Science Education

Susan Brown, Research Associate Professor in NMSU's Institute for Equity in Math and Science Education, has garnered over $1.3 million in external funding for her efforts in K-20 STEM education at NMSU and across the State of New Mexico. As the principal investigator of the Scientifically Connected Communities (SC^2), Dr. Brown collaborates with scientists and educators in southern New Mexico to provide excellent professional development opportunities to K-12 teachers, equipping them with strategies to improve scientific literacy of their students. She also leads the 21st Century Community Learning Centers effort that aims to increase student appreciation of and participation in STEM disciplines. This outreach project provides services to Gadsden and Las Cruces school districts by offering hands-on training in science, rocketry, and digital media among others.

ENGINEERING

Photo by Darrell Pehr

The Bridge Inspection Program



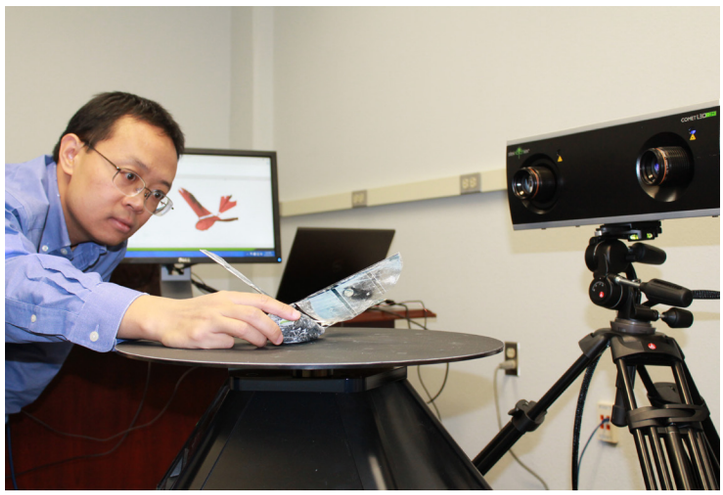
Dr. David Jáuregui, left, and graduate student Brice Carpenter discuss a computer model of a bridge created by Carpenter (Photo by Darren Phillips).

NMSU has been conducting bridge inspection in support of the New Mexico Department of Transportation (NMDOT) since 1989. Under the direction of David V. Jáuregui, Professor of Civil Engineering, and thanks to the expertise of NMSU engineering faculty, such as Professor Kenneth R. White, P.E., the program continues to support NMDOT by inspecting complex bridges across the state in accordance with the National Bridge Inspection Standards. In addition to helping the state of New Mexico maintain compliance with the Federal Highway Administration, the Bridge Inspection Program provides NMSU students with unique education opportunities in bridge engineering design, construction, inspection, evaluation, and maintenance. The program also accords NMSU Civil Engineering students hands-on experience in bridge inspection through six-month co-op assignments under the supervision of NMSU engineering faculty and staff.

NMSU Mechanical and Aerospace Engineering Professors Mingjun Wei (left), Young Lee, and Fangjun Shu measure flow downstream turbulence generated in a diesel engine intake using particle image velocimetry system (Photo by Darren Phillips).

Advances in Fluid Dynamics Research

NMSU's College of Engineering faculty members are actively engaged in various aspects of fluid dynamics research. Recent accomplishments of three faculty members in the Department of Mechanical and Aerospace Engineering have significantly advanced NMSU capabilities in these areas. Since joining NMSU in 2006, Associate Professor Mingjun Wei has garnered in excess of $2 million from the Department of Defense for his research activities in numerical simulation and optimization of hummingbird-size, flapping-wing micro-air vehicles (MAV), as well as developing reduced-order models for complex fluid or fluid-solid systems. Lately, Young Lee and Fangjun Shu, assistant professors of mechanical and aerospace engineering, in collaboration with Mingjun Wei, were funded $493,567 from the Army Research Laboratory for acquisition of a Polytec PSV-500 scanning vibrometer, a LaVision time-resolved 3D PIV system, and an ATOS core essential 2MP 3D scanner to form an integrated system for laser-based, non-intrusive experimentation and data-driven reduced modeling of multidisciplinary phenomena occurring in structural and fluid dynamics.



Mingjun Wei preparing a flapping-wing micro-air vehicle model to be scanned by the Polytec PSV-500 scanning vibrometer (Photo by Hamid Mansouri Rad).

PHYSICAL SCIENCE LABORATORY

Seven Decades of Service to the Nation

A PSL flight control technician landing a UAS.

Founded in 1946 to address the needs of the nation's space and rocket initiatives, the Physical Science Laboratory (PSL) today is involved in suborbital platforms, unmanned aircraft systems (UAS), cyber security, missile instrumentation, and other related aerospace support services to Department of Defense (DoD) and NASA programs.

For 27 years, PSL supported NASA's unmanned, high altitude (120,000 ft.) scientific balloon operations and managed the Columbia Scientific Balloon Facility (CSBF) in Palestine, Texas. After a two-year development phase, PSL successfully participated in JPL's Low Density Supersonic Decelerator project, as part of a ($250M) project to develop new decelerators to land larger and heavier payloads on Mars, including humans. The tests were carried out in the Navy's Pacific Missile Range Facility in Kauai, Hawaii, where PSL provided the key personnel to carry out the most challenging balloon flights in the history of CSBF.

PSL supports the DoD and other agencies with UAS testing and evaluation. In partnership with the Federal Aviation Administration, PSL created the UAS Flight Test Center with facilities that include a 15,000-square foot hangar at the Las Cruces International Airport that is used for collecting data on, testing, and evaluation of various classes of UAS. Some areas of focus include airworthiness testing and evaluation for safe integration of UAS for civilian uses operating in the same airspace with manned aircraft. In addition to supporting the DoD, PSL performs testing and evaluation for industry of UAS civil applications. In 2014 it performed aeronautical research with a UAS while surveying a mine in Colorado. The results of this type of research are used to develop procedures for mine sites to enhance safety and mine operations. PSL has accomplished many "firsts" with UAS recently, including electric power infrastructure inspection, inspections of dams as well as other public infrastructure, as well as performing law enforcement, firefighting, and agriculture applications.

PSL's support of DoD is not limited to UAS research. PSL provides vehicle avionics system development and operational support for programs involving a wide variety of weapon development, target/evaluation, and scientific research platforms. In addition, PSL has been involved, for several decades, in research and development of electronic countermeasures, and electronic warfare systems, and also supports development of weapon system performance databases, vulnerability and susceptibility analyses, and post-flight data reports. PSL has a team of software developers and military analysts to develop models and simulations of system of systems for small tactical units in the modern battlefield. This activity directly supports the warfighter.

To address our homeland security needs, PSL develops solutions to protect our nation's critical infrastructures against global threats, from kinetic to cyberattacks. It provides support in vulnerability/survivability assessments, penetration testing, ethical hacking, and design of software and tools for analysis. PSL continues to provide student employment in the STEM areas providing experiential activities with mentors ranging from engineers to software developers and other technical specialists.

Meet the Director of NMSU's Southwest Institute of Health Disparities Research

Jill McDonald (left), Director of NMSU's Southwest Institute of Health Disparities Research, and Alison Gilbert, graduate student of Public Health Sciences (Photo by Hamid Mansouri Rad)

Jill McDonald, the Stan Fulton Endowed Chair in Health Disparities Research and professor of public health sciences at the College of Health and Social Services, was appointed the director of the Southwest Institute of Health Disparities Research. Before joining NMSU, Dr. McDonald was an epidemiologist with the Division of Reproductive Health at the Centers for Disease Control and Prevention (CDC) and served as the PI or Co-PI for several large research and training initiatives, including the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Women's Contraceptive and Reproductive Experiences Study Data Coordinating Center, the Brownsville-Matamoros Sister City Project for Women's Health, and the Border Maternal And Child Health (BorderMACH) project.

In recent years, McDonald's research has focused, increasingly, on reproductive health and chronic disease disparities in the US-Mexico border region. In 2006, she became the CDC Maternal and Child Health Assignee to the US-Mexico border region and in 2009, through a memorandum of understanding between CDC and the HHS Office of Global Health, her position and activities were relocated to the offices of the US-Mexico Border Health Commission in El Paso, Texas. McDonald enjoys working collaboratively; most of her research involves working across disciplines with diverse groups of individuals, including US and Mexican health care providers, health department staff, and individuals from community-based organizations. Currently, she is directing vital record linkage efforts in the US and Mexico to explain relatively high infant mortality rates in Mexican border states and looks forward to developing NMSU expertise in this and related areas. Dr. McDonald has authored numerous peer-reviewed publications and has been the recipient of many awards, including CDC's Charles C. Shepard Science Award for Assessment and Epidemiology.

Family and Child Welfare Training Project Prepares New Mexico Students to Serve the Vulnerable across New Mexico

Tina Hancock, Director of the School of Social Work (Photo by Darren Phillips)

Tina U. Hancock, the Director of the School of Social Work and Associate Dean for the College of Health and Social Services, received in excess of $1 million for the Family and Child Welfare Training (FCWT) project. The program is funded through the Title IV-E and Title IV-B Child Welfare Training programs of the Social Security Act, as well as the Child Abuse Prevention and Treatment Act (CAPTA). Through the FCWT project, NMSU's School of Social Work and New Mexico Children, Youth and Families Department (CYFD) collaborate to increase the number of bachelors and masters of social work at NMSU, assist students with taking their licensure examination, and provide employment opportunities with the CYFD. The program also offers the CYFD staff training in child welfare and supervision. In addition to leading the FCWT project, Tina Hancock is also the Principal Investigator on a federally funded program that trains health professionals across New Mexico in screening, brief intervention, and referral to treatment of vulnerable and underserved individuals who are at risk of substance abuse. This program is funded by the Substance Abuse and Mental Health Services Administration within the US Department of Health and Human Services. The funding for this program is in excess of $860,000 and is for a three-year period from 2014- 2017.

BEYOND RESEARCH

NMSU's Outreach Projects Support New Mexico Families

Shelly Bucher, middle, and Brooke Stanley Tou presented with a "millionaire" award from NMSU President Garrey Carruthers (Photo by Hamid Mansouri Rad).

Shelly A. Bucher, Licensed Master Social Worker and the Director of the Southwest Institute for Family and Child Advocacy, has been actively working to prevent child abuse and neglect in the U.S. Southwest. One of the dire situations that causes trauma to children is witnessing parents undergo an arrest by the law enforcement. As part of her efforts, Bucher, in collaboration with NMSU's Creative Media Institute and law enforcement, created an award-winning educational video depicting a realistic situation that led to the arrest of adults in presence of minors. The video, funded by the Criminal Justice Act Advisory Group, won the Telly Awards' Bronze Medal, the Accolade Award of Merit, and the Communicator Award of Distinction. Bucher continues her work providing public oversight of judicial cases alleging child abuse and is supported by a recent $792,702 award from the New Mexico Department of Finance and Administration.

Brooke Stanley Tou, Assistant Director of NMSU's Southwest Region National Child Protection Training Center, recently received an $881,000 award from the New Mexico Children, Youth, and Families Department's Children's Behavioral Health Division to continue to expand the Communities of Care (COC) Initiative throughout the state. The COC Initiative works to expand community capacity to serve children and adolescents with Severe Emotional Disturbance (SED) and their families. Youth, children, and families directly impacted by the behavioral health system are engaged in their community and work together with state agencies, service providers, and community advocates to improve the behavioral health system locally and statewide.

Professor Esther L. Devall and Associate Professor Marcel Montanez. Not pictured: Lisa Shields, Program Manager for Strengthening Families Initiative (Photo by Hamid Mansouri Rad)

Esther L. Devall, Professor of Family and Consumer Sciences and a certified Family Life Educator, leads the New Mexico Border Communities Healthy Marriage and Relationship Project. Funded by the Administration for Children and Families (ACF) within the Department of Health and Human Services, the project is administered through NMSU's Department of Family and Consumer Sciences and provides marriage and relationship classes, as well as workforce readiness services to low-income adults, including single and cohabiting parents and married couples, in Doña Ana County. Since its inception in 2005, the program has reached over 2,000 individuals. In 2014, Esther L. Devall and her Co-PIs Marcel Montanez and Lisa Shields received $800,000 from ACF to continue the project.

WATER RESEARCH

Assistant Professors Advance Water Research at NMSU

NMSU possesses comprehensive capabilities in water-related research, education, outreach, and economic development. More than 80 faculty, researchers, and staff from 15 departments, as well as the Agriculture Science Centers and Extension Services, within five colleges offer extensive expertise and experience in water, ranging from hydrology, irrigation, desalination, and environmental effects to water economics, policy, management, and sustainability. Faculty from the college of Engineering, and college of Agricultural Consumer and Environmental Sciences, have been engaged in critical research efforts on water delivery, treatment, usage, and reusage across the nation as part of the NSF funded Re-inventing America's Urban Water Infrastructure project. In addition, NMSU faculty collaborate with researchers in Mexico and have extended outreach assistance to other nations including Afghanistan, Ethiopia, and Iraq. NMSU continues to help the state of New Mexico solve its water-related issues, including desalination, produced water treatment, water management during drought, and water security. Faculty members who have recently joined NMSU have enhanced our water-related capabilities. Since joining the Department of Plant and Environmental Sciences, Kenneth C. Carroll's research activities, funded by US Army Corps of Engineers, have helped reduce the adverse health risks of groundwater contaminants by developing a novel cost-effective in situ chemical oxidation as a viable technology for 1, 4-dioxane. Similarly, Pei Xu, assistant professor of civil engineering, an expert in desalination, produced water treatment, and biological-bioeletrochemical disinfection, has been involved in multi-million dollar projects. She is funded by the Department of Energy and institutions such as Research Partnership to Secure Energy for America, Water Research Foundation, and USA Environment.

Kenneth C. Carroll, Plant and Environmental Sciences

Pei Xu, Civil Engineering

New Mexico Water Research Resources Institute

New Mexico Water Resources Research Institute (WRRI) was founded in 1963 to address the state's water issues. Based at NMSU, WRRI provides seed funding to researchers across the state to explore innovative approaches for critical activities such as remote sensing, modeling and water management, treatment of produced water generated by oil and gas operations, desalination of brackish water, and utilization of saline water for turfgrass irrigation. WRRI also provides research grants to students in the state's universities to help train the future generation of water professionals. The institute's activities are, in part, made possible by the State Legislature and the Office of the Governor. In 2014, New Mexico Legislature appropriated $1 million to WRRI to conduct a state-wide comprehensive water assessment. This funding is in response to the severe drought that the state has been experiencing for the past five years. The massive amount of data collected during this project on inflows and outflows from the state will be condensed and delivered to researchers and policy makers dynamically via a web-based interface to assist them with their activities. For more information, visit http://wrri.nmsu.edu.

Sam Fernald (left), director of the New Mexico Water Research Resources Institute and John D'Antonio, Deputy District Engineer, U.S. Army Corps of Engineers (right), during a press conference on Water Policy Day at New Mexico State Capitol in Santa Fe (Photo courtesy of New Mexico First)

RESEARCH FOCUS AREAS

Computer Science and Computer and Electrical Engineering

Energy and Biofuels

Biochemistry, Molecular Biology, and Genetics

Animal and Range Sciences

Medical and Health Sciences

NM STATE UNIVERSITY

Environment and Ecology

Space and Aerospace

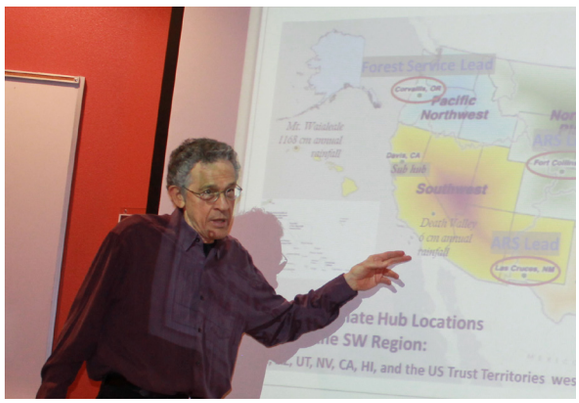
Plant and Soil Science

Water

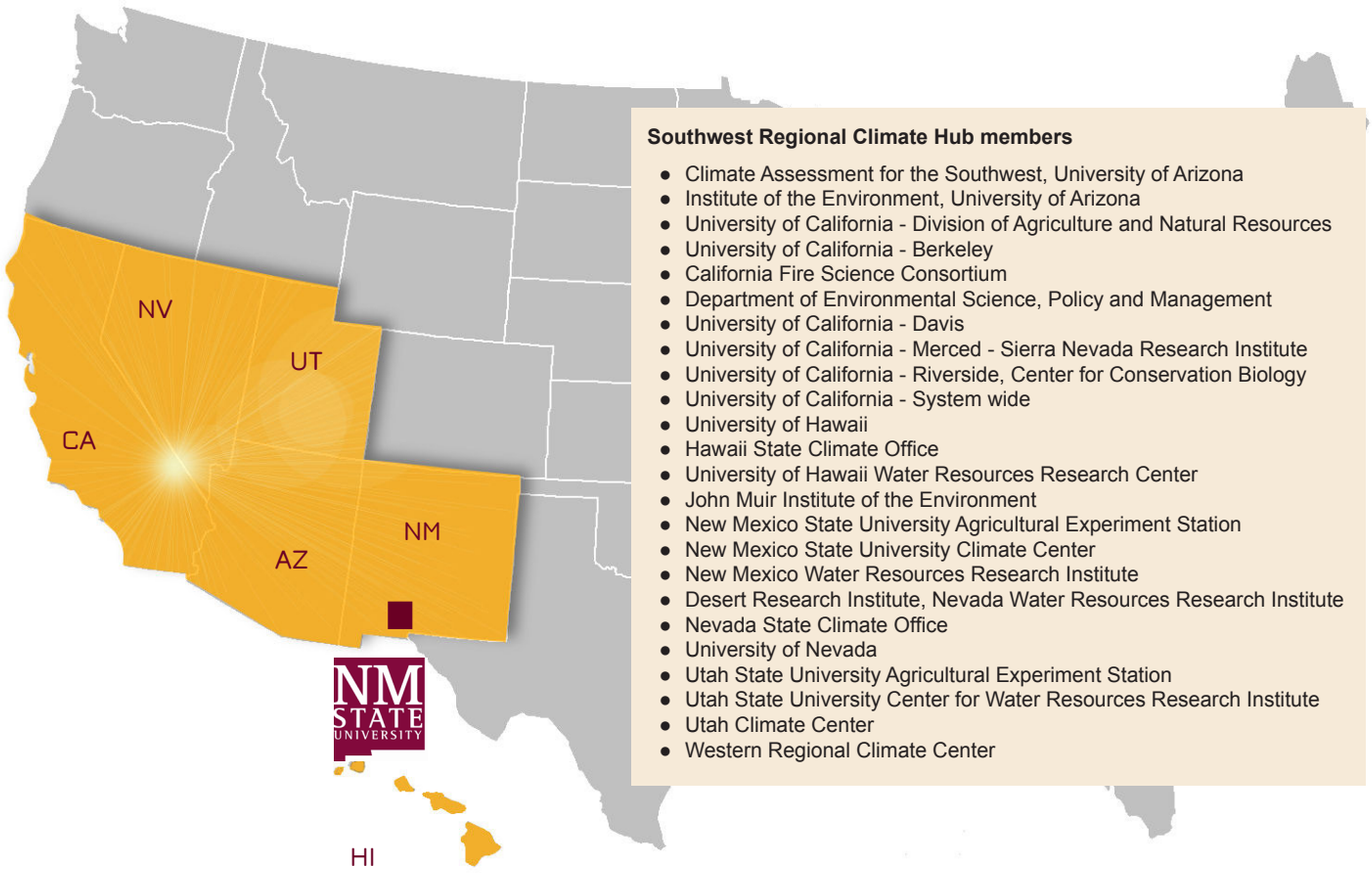
CLIMATE CHANGE

NMSU Researchers Collaborate on the USDA Southwest Regional Climate Hub

The US Department of Agriculture has chosen Jornada Experimental Range's Rangeland Management Research Unit and Agricultural Research Service at NMSU as the Southwest Regional Climate Hub to coordinate the efforts of federal, state, and private agencies, as well as universities, to support farmers, ranchers, and other stakeholders in the region in responding to the effects of climate change. The hub functions are managed by Dr. Al Rango, Senior Research Hydrologist at Jornada Experiment Station and an affiliated faculty at NMSU. This hub allows collaboration of 24 academic units within the states of Arizona, California, Hawaii, New Mexico, Nevada, and Utah to provide valuable information to farmers, forest land owners, and other stakeholders to help them deal with the implications of climate change. Three NMSU units are involved in these effort: the Agricultural Experiment Station, the Climate Center, and New Mexico Water Research Resources Institute.



Al Rango, Senior Research Hydrologist, at Jornada Experimental Range

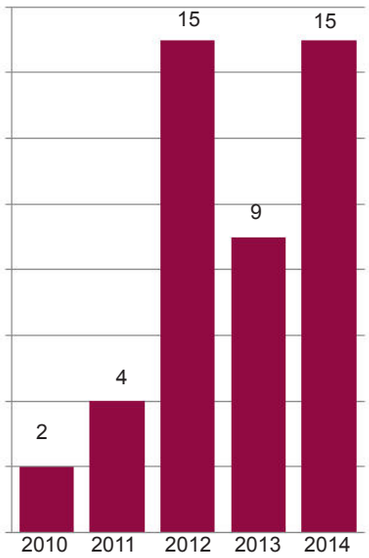


Southwest Regional Climate Hub members

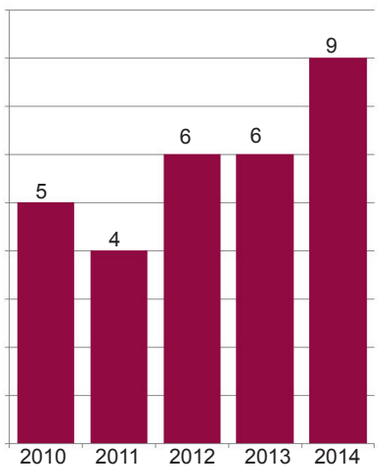
- Climate Assessment for the Southwest, University of Arizona
- Institute of the Environment, University of Arizona
- University of California - Division of Agriculture and Natural Resources
- University of California - Berkeley
- California Fire Science Consortium
- Department of Environmental Science, Policy and Management
- University of California - Davis
- University of California - Merced - Sierra Nevada Research Institute
- University of California - Riverside, Center for Conservation Biology
- University of California - System wide
- University of Hawaii
- Hawaii State Climate Office
- University of Hawaii Water Resources Research Center
- John Muir Institute of the Environment
- New Mexico State University Agricultural Experiment Station
- New Mexico State University Climate Center
- New Mexico Water Resources Research Institute
- Desert Research Institute, Nevada Water Resources Research Institute
- Nevada State Climate Office
- University of Nevada
- Utah State University Agricultural Experiment Station
- Utah State University Center for Water Resources Research Institute
- Utah Climate Center
- Western Regional Climate Center

ANNUAL REPORT

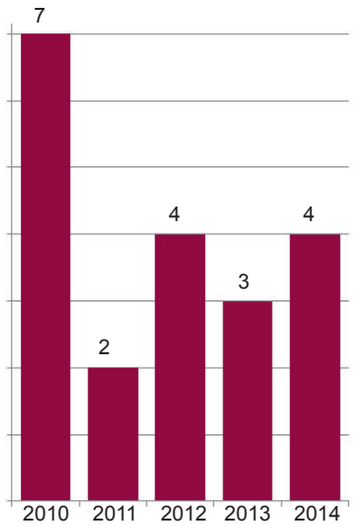
At NMSU, ideas and discoveries translate into economic development.



Number of Invention Disclosures



Number of Patents Filings



Number of Patents Issued

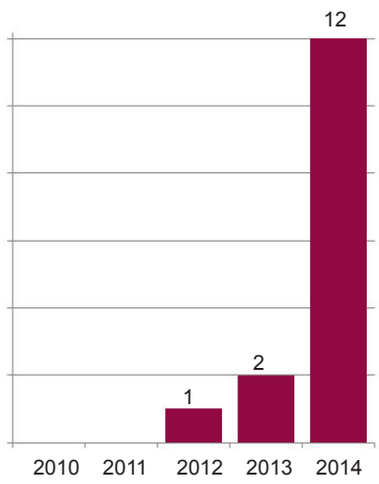
2014 Patents

Laura Boucheron
Assistant Professor of Electrical and Computer Engineering

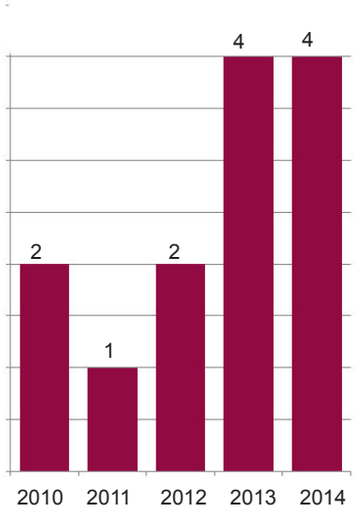
Muhammad Dawood
Associate Professor of Electrical and Computer Engineering

Phillip De Leon
Associate Professor of Electrical and Computer Engineering

Joel Diemer
Professor of Agricultural Economics and Agricultural Business



Number of Startup Companies Formed



Number of Exclusive Licenses Signed

Speaker Model-based Speech Enhancement System
US 8639502 B1
Laura Boucheron and Phillip De Leon

Extended Optimal Filters for Adaptive Radar Systems Using Binary Codes
US 8610621 B1
Ana Alejos and Muhammad Dawood

Method, Technique, and System for Detecting Brillouin Precursors at Microwave Frequencies for Enhanced Performance in Various Applications
US 8570207 B1
Muhammad Dawood, Habeeb Mohammed, and Ana Alejos

Method and Apparatus for Treating Tissue
US 8644942 B1
Joel Diemer

Research Expenditures, Awards, and Sources

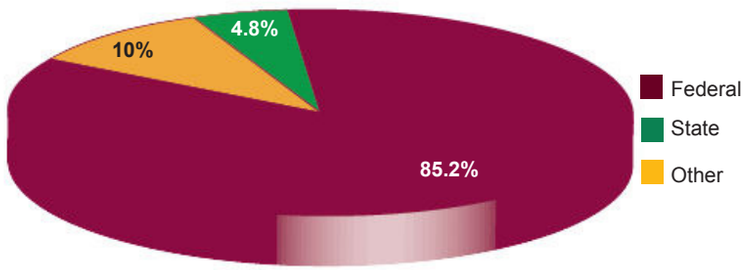
Expenditures
Fiscal Years 2005-2014

Expenditures

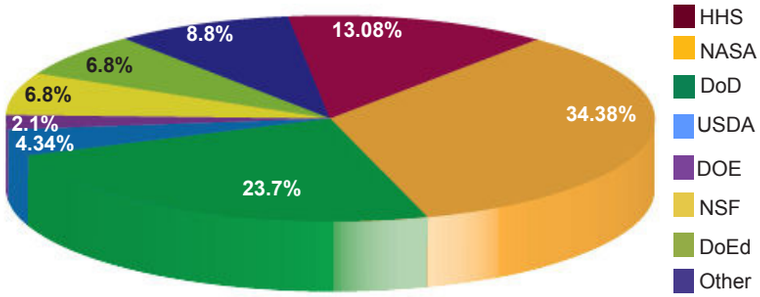
UNITS	FY 2014
College of Agriculture	$23,161,140
College of Arts and Sciences	$19,627,045
College of Business	$1,172,596
College of Education	$8,260,779
College of Engineering	$12,568,422
College of Health and Social Services	$2,892,706
Physical Science Laboratory	$46,177,591
New Mexico Department of Agriculture	$1,696,567
Community Colleges	$6,597,648
Other	$6,627,461
Total	**$128,781,955**

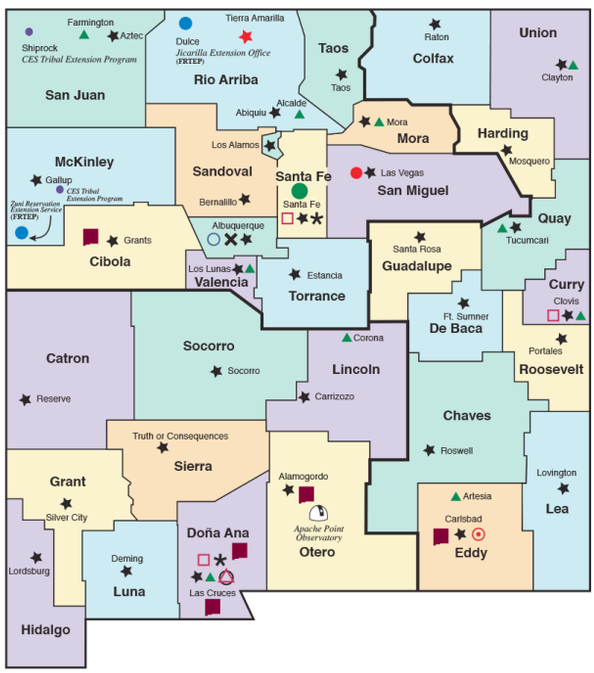
NMSU's FY 2014 Source of Awards in Percentage

Total Awards FY 2014 = $139,950,465



Federal Awards Broken Down by Agency





Facility Locations

- County Extension Offices
- County Extension Satellite Office
- Tribal Extension Offices
- Federally Recognized Tribes Extension Program (FRTEP)
- Cooperative Extension Service District Offices
- Agricultural Science and Research Centers
- University Government Affairs
- Carlsbad Environmental and Research Center
- Arrowhead Center
- NMSU Albuquerque Center
- Santa Fe Ranch Demonstration Site
- NMSU Campuses
- Apache Point Observatory
- Memorial Middle School Agricultural Extension and Education Center
- Admissions Office

New Mexico State University
Research+Resources

MSC 3AS
NEW MEXICO STATE UNIVERSITY
P.O. BOX 30001
LAS CRUCES, NM 88003-8001
www.research.nmsu.edu

NMSU CORE RESEARCH STRENGTHS IN STEM AREAS AT A GLANCE

NMSU has demonstrated strengths in these areas based on the number of researchers actively working in the area, the graduate curriculum and number of advanced degrees awarded, and the impact evidenced by publications and external funding.

- Animal and Range Sciences
- Biochemistry, Molecular Biology, and Genetics
- Computer Science and Electrical and Computer Engineering
- Energy and Biofuels
- Environment and Ecology
- Medical and Health Sciences
- Plant and Soil Science
- Space and Aerospace
- Water

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