New Mexico State University
Capability Statement

Institution: **New Mexico State University**

DUNS No: **173851965**   Cage Code: **3X352**   NAICS ID(s): **927110, 541712, 326199**   SIC: **8734**
Federal EIN No: **85-6000401**
Certificates, Registrations, Accreditations: ***HLC, ABET, CAEP, ACEND, SRM, ACS, CAC, NASPAA, ASBMB, ANSAC, EAC, ABET-EAC, CCNE, NMBON, CEPH***

POC Information: **Dr. Luis Cifuentes, Vice President of Research and Dean of Graduate School**
Address: New Mexico State University, MSC 3RES PO Box 30001, Las Cruces, NM 88003-8001
Tel: (575) 646-3425   E-mail: lacifuen@nmsu.edu

OVERVIEW

New Mexico State University (NMSU) is the state's land-grant institution and a comprehensive research university dedicated to teaching, research, and service. NMSU is designated as a Hispanic Serving Institution under Title III and Title V programs administered by the U.S. Department of Education. NMSU's Carnegie classification is "R2: Doctoral Universities with Higher Research Activity" and has sponsored awards exceeding $118 million in 2020 fiscal year. In terms of federal research and development expenditures, the NSF has ranked NMSU in the top 17.9% of all institutions (166 out of 922), and sixth among Hispanic Enrollment institutions without a medical school. In 2020, NMSU enrolled 14,227 students, 57.7% of whom were Hispanic and 57.7% female. During the 2019-20 academic year, NMSU awarded 3,281 degrees including 126 doctorate, 658 master's, and 2,429 bachelor's degrees.

RESEARCH CAPABILITIES

Biomedical Research: Cancer research, breast cancer, immunology, cell biology, virus evolutionary ecology, molecular vector biology, plant molecular biology, cell signaling, evolutionary genetics, microbial ecology, behavioral ecology, neuroscience, neuromuscular physiology, developmental neurobiology, genomics, biomedical computing, biomedical sensors.

Chemistry: Bacterial DNA repair mechanisms; synthetic chemistry for cancer drug discovery and the design of novel biological probes; perturbations in DNA replication and repair in cancer biology; developing predictive models of the creation of ion mobility spectra; designing multicomponent reactions that rapidly and reliably transform simple starting materials into complex polycyclic ring systems; exploring ion-molecule gas phase reactions at ambient pressure to develop predictive models of the creation of ion mobility spectra; examining the kinetics and reaction mechanisms of inorganic and bioinorganic reactions; abating heavy metals and pathogens from scarce and contaminated water sources; identifying the active functional form of the signaling molecules Grb7 and DNAJB1-PKAc, and defining the mechanistic details of how these molecules work in the establishment of primary tumors and metastases in breast and liver cancer; identifying novel antibiotic targets by defining regulatory genetic networks that control proliferation in bacteria; analysis of complex environmental and agricultural samples using multivariate analysis of multi-dimensional spectroscopic response surfaces; studying physicochemical aspects of nanomaterials and their applications including hybrid nanoporous materials in drug delivery and sensors, fundamental aspects of CVD growth of 2D materials and their applications in sensors, desalination, photovoltaic devices, and composite materials; harnessing the power of supercomputers for discovery of novel small molecules and machine-learning design of photovoltaic materials and drugs; studying bacterial proteins that mediate zinc import and nitric oxide / oxidative stress sensing;

Mathematics/Computer Science: Data mining; software engineering; human computer interaction; computer supported collaborative work and play; text mining; visualization; graph mining; anonymous, secure and private networking and communication in the Internet of Things and Cyber-Physical Systems; design and development of low-cost and customizable wireless sensors; design of algorithms for online social networks analysis; query optimization; spatial data analysis; indexing; knowledge representation and reasoning; logic programming; statistical computing; quantitative biology; computer vision; game design; wearable computers; mixed reality;

hardware-assisted cryptography; secure outsourced data storage; verifiable encryption and fair exchange; wireless and mobile system security; web security; mobile computing; adversary machine learning;

Physics/Engineering:

Physics: Ellipsometry; characterization of the electronic and atomic structures of thin films and bulk materials; non-perturbative strong interaction physics and the quark/gluon (=parton) structure of hadrons and nuclei; accelerator-based, experimental nuclear and particle physics**;** theoretical physics focused on the low-energy sector of Quantum Chromodynamics; seismology; computational material science; magnetic and related properties in a large variety of materials, such as correlated-electron systems, permanent magnets, superconductors and nanostructured magnets; accelerator-based research in experimental, high-energy, nuclear and particle physics, with emphasis on the structure of the nucleon and the strong interaction; the role of angular momentum in low-energy collisions of medium-mass nuclei; the lifetimes of states of neutron-rich fp- shell nuclei; the measurement of spin-dependent asymmetries in nucleon-nucleon scattering to test models of meson-exchange forces; the use of internal targets in particle storage rings as an important experimental tool; the use of deep-inelastic scattering to explore the quark-gluon structure of nucleons; the adventure of investigating the properties of matter at extremes of energy density and temperature; the study of molecular liquids (e.g. water, HF, acetic acid) and amorphous materials (e.g. high & low density amorphous ice and optically relevant glasses) through the use of neutron and high energy X-ray diffraction techniques combined with molecular dynamic and reverse Monte Carlo simulations as aids in data interpretation; solid state physics and computational materials science;

Engineering*:*

Mechanical and Aerospace Engineering: Nonlinear dynamics, biomemitics/drones/robotics, energy harvesting, MEMS & NEMS, fluid-structure interaction, vibration and control, advanced materials, advanced manufacturing, medical devices, phononic crystals, materials science and engineering, energy materials, additive manufacturing, electrochemistry, materials characterization, materials degradation, corrosion and failure analysis, polymers and composite materials, material evaluation, vibration-based SHM and control, solid mechanics and materials, experimental sold mechanics, computational fluid dynamics, flow control, unmanned aerial vehicles, soft robotics, bio-inspired and bio-mimetic robotics, dynamics and controls, physical human robot interaction, heat transfer, surface nano/micro manufacturing, surface-thermal fluid interactions, energy systems, thermal management, space transportation, model predictive control, small satellite attitude control, aerial robotic manipulation, multi-agent system control, micromechanics of materials, biomechanics, theoretical fluid mechanics, dynamical systems and control, experimental fluid dynamics, bio-inspired flow, biofluidics, microfluidics, turbulent flow, optical metrology, tethered systems, sound source localization, optimal sensor management, nonlinear control/estimation, cooperative control, hybrid spatial sensing, robust network, computational fluid dynamics, Lattice Boltzmann Method, multi-phase and reacting flows, aerospace propulsion, bio/micro-fluidics

Chemical and Materials Engineering*:* Membrane synthesis, phase separation in soft matter, self-assembly of surfactants and block copolymers, nanoemulsions, colloid and interfacial science, flow cytometry, epitaxial thin films of metal oxides, metal nitrides, and their nanocomposites for magnetic, multiferroic, superconducting, and battery applications; quantum dots, nanomaterials for photocatalysts, electrocatalysts, and lithium-ion batteries applications, catalysis

Civil Engineering: Structural engineering, bridge inspection, finite element analysis, virtual reality and close-range photogrammetry, structural health monitoring, nondestructive testing, transportation engineering, intelligent transportation systems, traffic modeling and simulation, surveying,

Electrical and Computer Engineering*:* Computer architectures, high performance computing, optical networks on chip, optical computing, green computing, biomedical image analysis, solar image analysis, signal and image processing, pattern classification, applications of signal and image processing, medical image analysis, bioinformatics, hardware security and trust, embedded systems security, cyber physical security, hardware and software co-design, security protocols and DFT, distributed audio and video coding, polarimetric image processing, audio quality analysis, UWB radar/SAR systems, phased array antennas, advanced signal processing techniques for radar/SAR data, embedded systems, machine learning, mobile application development, speaker recognition, speech enhancement, time frequency analysis, integrated power management, analog and mixed-signal circuit design, high voltage electronics, image metric sensors, wireless networks, compressed sensing, smart grids, optical networks, digital communications, source and channel coding, information theory,

bioelectromagnetics, electromagnetic source imaging, design and test of high performance, low voltage analog and mixed signal VLSI Systems, power system modeling and control, power electronics applications, digital signal processing, particle astrophysics, computer performance, integrated circuits design, signal processing circuits, spectral/polarization sensing, laser communication, sensing systems

Industrial Engineering: Mobile networks, modeling AD Hoc network performance in OPNET, quality and continuous improvement, large scale systems, engineering and public policy, industrial engineering of green manufacturing technologies, mathematical and simulation modeling in industrial engineering, developing industrial models in agronomy

Energy: Renewable energy, concentrating solar power, thermal & thermochemical storage, hydrogen storage, combined heat and power, biofuels and biomass, microgrids

Forensic Science.   Human osteology, criminal investigation and intelligence, forensic law, forensic physics, clinical psychology, abnormal psychology, psychology of personality, zooarcheology

Health Disparities: Mental health, obesity, suicide prevention, substance abuse

Environmental Science: Physical and biological process engineering for removal of organic contaminants from air, soil, groundwater, and wastewater, QSAR techniques for chemical characterization and modeling environmental fate, transport, impact, and risk assessment; computer simulation software of natural and engineered processes; water resources, environmental-remediation, carbon-capture, and energy-production alternatives; experimental and numerical evaluation of coupled multiphase-fluid flow, biogeochemical, and mass-transfer processes; characterization of subsurface physical and chemical heterogeneity and the associated impacts on fluid flow, transport, and fate of chemicals within various geologic systems; development of novel approaches for characterization of contamination natural attenuation and active-remediation enhancement; mass spectroscopy; ecological and biogeochemical dynamics of tropical and temperate grasslands and savannas; assessment of physical, chemical and thermal properties of soil, and chemical fate and transport in the soil; salinity, soil mineralogy, and environmental soil chemistry; aquatic chemistry, surface chemistry of mineral surfaces; spectroscopic investigations of complexes at the mineral/water interface; physicochemical characterization of mineral surfaces; modeling diffusion and adsorption in porous earth materials and adsorbents, water quality; physicochemical water treatment processes; chemical and geochemical fate of trace elements; water and waste water engineering; membrane processes; desalination; potable and non-potable water reuse; produced water treatment; oxidation and photocatalysis; biological and bioelectrochemical processes; removal of emerging contaminants; membrane fouling; remote sensing; water resource management; ground water hydrology and modeling; porous media flow and solute transport modeling; irrigation water management; design of wells and pumps; bio-mediated and bio-inspired methods and solutions in geotechnical engineering; ground improvement, ground reinforcement, deep foundations, restoration of degraded soils; heat induced changes in soils with polymeric admixtures: recycled polymer bonding and dissolution protection coatings; reclaimed asphalt pavements (granular composites): revised characterization, resource recovery and management; geotechnical aspects of pavements: unconventional pavement structures with enhanced performance from unbound aggregate layers; soil-cement mechanistic mixture design: minimizing cement while maximizing performance; smart backfills for geothermal borehole heat exchangers; bioinspired geosensors;

Supply Chain and Logistics: Supply chain analytics, supply chain optimization, lean six sigma, supply chain collaboration, supply chain risk, supplier evaluation and assessment, web-enabled supply chain, consulting and training in different areas of the supply chain (e.g. enterprise systems, lean six sigma, analytics, etc.).

FACILITIES
The Core University Research Resources Laboratory (CURRL)
The CURRL is an evolving research resource on the main campus of NMSU. It comprises three separate disciplines; microscopy, molecular genetic analysis and x-ray diffraction. CURRL facilities include

a) *The Microscopic Imaging Core Suite (MICS)* is a major resource for sponsored and non-sponsored research and education, located in Skeen Hall on the main campus of NMSU. The main instruments include: (1) transmission and (2) scanning electron microscopes for high spatial resolution analysis of nanoscale samples and topographical and Elemental composition of bulk and micrometer-scale samples, (3) a revolutionary scanning probe microscope for superficial nanoscale structure as well as physical properties, (4) a broad band laser scanning fluorescence microscope for 3D imaging of millimeter to micrometer-scale samples and (5) a

stereo-fluorescence microscope for spatial resolution ranging from centimeters to micrometers

b) **The X-ray Diffraction Facility (XRD)** located in Gardiner Hall on the Las Cruces campus and is administered and technically managed through the Department of Physics. This modern instrument offers a variety of platforms for modern x-ray diffraction analysis of materials. https://xrd.nmsu.edu/ This facility also contains several other instruments (J.A. Woollam VASE and FTIR-VASE ellipsometers, ULVAC MILA -5000 rapid thermal annealer), which are also available to the campus community.

The Molecular Analysis Services (MMAS) of NMSU's Molecular Biology Program is physically located in the Chemistry and Biochemistry Building on the Las Cruces campus. It provides complete DNA sequencing services, including Fragment and Microsatellite Analyses, along with technical assistance for other multi-user instrumentation for molecular analyses. The MMAS also maintains several other analytical systems including an ABI 7700 Sequence Detector, Molecular Dynamics STORM system, FOTO/Analyst Electronic Imaging system, Agilent 2100 Bioanalyzer, Tecan GENios, Packard Liquid Scintillation Analyzer, and a Perkin Elmer UV/VIS Spectrometer.

Center for Telemetry and Telemetering: Used for telecommunications research, coding and information theory, wireless networks, digital signal processing, optical and radio frequency communications, and digital image processing.

M-TEC: Manufacturing Technology and Engineering Center helps build prototypes for entrepreneurs and businesses.

Rio Grande Institute for Soft Computing: A NASA Ames funded lab, it provides facilities for research of intelligent autonomous and semi-autonomous systems focused on advanced concepts of energy harvesting/scavenging.

RUVICON Lab: Real-time model predictive control for spacecraft rendezvous and docking, and small satellite attitude control.

VLSI Laboratory: Used for design and analysis of analog and mixed-signal microelectronic circuits and systems.

Major and Specialized Instrumentation Nuclear Magnetic Resonance: up to 500 MHz units, ICP, GC-MS, High Performance Liquid Chromatography (HPLC) System, Malvern Zetasizer Nano ZS, Anton Paar Surpass Electrokinetic analyzer, TOC/TN Analyzer, ASAP 2050 surface area and porosity of solids, Thermogravimetric Analyzer (TGA), Atomic Force Microscopy, Laser Scanning Confocal and Stereofluorescence Microscope Systems, FT Infrared Spectrometer, Ultrasonic Testing Instrumentation, Nondestructive Testing Equipment for SHM.

PAST PERFORMANCE
NMSU has a long history of externally funded research in the areas listed above. The university's funding from the DoD exceeds $40 million in the past 5 years. Similarly, we have garnered in excess of $10 million funding from NASA for various research projects. Our faculty currently have nearly $9 million active awards from the NSF for research projects in areas such as signals processing, robotics, Big Data, and autonomous unmanned aerial and ground systems. In addition, our faculty have more than $9.7 million in active awards from the HHS (including gNIH and NCI), and NSF for biomedical research and training as well as health disparities research. NMSU faculty have secured more than $3.6 million in active funding from NASA and NSF for various astronomy-related projects and more than $2.2 million from the EPA and NOAA among others for environmental research.