$42,100 in ECE Scholarships: Planting Futures in New Mexico

$2,000 - Paul Wright Memorial Scholarships
$400 - Christopher Evangel Memorial Scholarship
$3,000 - three Harry & Mabel Lowendall Scholarships
$2,500 - Association of Old Crowes Scholarship
$500 - Arnold Koschmann Memorial Prize in EE
$400 - ten Walter King Memorial Scholarships
$24,000 - ten Walter King Memorial Scholarships

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Message from Department Chair Chaouki Abdallah

On behalf of our twenty-eight faculty members, our four new professors, our nineteen PhD graduates, our 280 graduate and 250 undergraduate students, our dedicated staff, and myself, I present to you the ECE 2005-06 annual report.

This past year our department found opportunities to recruit more students from more diverse backgrounds, to attract stellar faculty in exciting areas, and to establish new programs while enhancing our traditional ones. The report you hold in your hands is meant to inform our friends and colleagues of how the ECE department at UNM is meeting the challenges of educating the engineers of the 21st century.

From new research thrusts to our novel recruiting and educational initiatives to the awards and achievements of our faculty and students, I believe that you will find this report informative and hopeful.

If engineering is the science and art of solving problems, then these are exciting times for us. Looking for better ways to convert energy, to safeguard and maintain our various infrastructures, and to improve the physical and mental health of our population are challenges that cry out for collaborations and ingenuity across all disciplines.

Our future engineers will be leaders of multidisciplinary teams that work across continents and areas of expertise to chip away at these formidable challenges. Advances in nanotechnology, breakthroughs in biomedical imaging, and a leap in understanding of social networks can combine to form a new power storage device used by a teacher to spread knowledge by informing the opinion leaders of a remote village.

What effect, if any, does this have on the rest of us? Such a village may, if left alone, become the birthplace of a particular epidemic or the home of a future terrorist. It is not, as we are being told, that our world has become flat, but rather that it has become efficiently connected. This dynamic that makes us one people can help us thrive if it’s used to propagate knowledge and hope, or it can make us suffer if it’s used to spread disease and despair.

Engineers are weaving such networks, and educational institutions must teach not only how to connect the networks but how to decide why and where to connect.

Educators are wary of looking in the rearview mirror, but as we try to go forward it is beneficial to take stock of our past promises and plans. Last year...
I promised to press forward with new international agreements and programs and to make available to our students new opportunities and capabilities. I also planned to better integrate our department within our local community and to reshape our curriculum to address global needs and challenges. Our record has been mixed: We did expand our international agreements to include Jia Tong University in China and additional universities in Latin America, although our students have not yet embraced international education.

We have reached out into our community to introduce students to engineering concepts as career options, and to make available to our students mentors for our students.

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Undergraduate Program - Expanding Options

During our graduation festivities in May, ECE was fortunate to receive visits from Mr. Saul Miano and Mr. Joe Quintana, both of whom were on campus to celebrate their 50-year graduation reunion. These distinguished alumni received electrical engineering degrees from our department in 1956 (see photos, next page).

At our graduation reception, they entertained us with stories about what it was like to be an undergraduate in this department 50 years ago. Many things are still the same. The camaraderie and closeness that these gentlemen displayed after 50 years was clearly forged from their years spent learning and working together in this department. We continue to see this same spirit in every graduating class, and it is gratifying to know that the bonds formed by classmates through shared trials, tribulations and triumphs will in some cases last a lifetime.

Many things have also changed in the engineering profession during the past 50 years. Preparing our graduates for careers in computer and electrical engineering requires that we monitor these changes. Our continual challenge is to provide curricula that are relevant to current engineering practice, that foster the problem solving and an emphasis on the roles in society that our graduates play, we also see that our undergraduate students do not treat a bachelor of science as a terminal degree. Last year nearly 50 percent of the graduating class indicated that they intended to pursue additional degrees in a variety of areas. To address the opportunities described above, our students take the same core curriculum that all undergraduates at UNM complete. This core—which accounts for roughly one-third of a student’s credit hours—provides a broad knowledge base and helps develop important writing, communication and foreign language skills as well as a solid grounding in math and science that ECE’s curricula then build upon.

Recognizing the new and more diverse roles in society that our graduates play, we offer more courses that include team-based problem solving and an emphasis on the ability to communicate effectively. Here are two examples that give a sense of the progress we are making.

To expose students to engineering design activities during their freshman year, we have created a new programming course that is required of all majors in the department. Programming tasks are integrated with team-oriented robot building assignments, and at the end of the term the teams compete to perform various robotics tasks. The course relates programming to both hardware and software design activities that students will undertake later in their studies. It also provides a rewarding and challenging experience that gives students a base for developing other important engineering skills.

We are pleased to report that students have shown an enthusiastic response to this class, with many expressing a desire to immediately learn more about engineering. This is an important contrast to the lack of excitement often reported by first-year engineering students who are facing the rigorous engineering curriculum for the first time.

At the other end of the spectrum are our capstone senior-design classes, also required of all majors in the department (see page 9). We recently modified this two-course sequence to accommodate engineering students who are facing the breadth of experiences available to undergraduates in our department. All ECE students now take the sequence together during their senior year, whereas in the past the courses were segregated into computer or electrical engineering sections according to the student’s major.

This broadened both the scope of projects and the lessons learned by the students. In their careers, they will need to know how to work with project teammates who have different backgrounds in order to solve an engineering design problem and produce a product.

We take seriously our role in preparing students to thrive in the real-world engineering field. We are especially gratified when we hear the rich and exciting stories our alumni tell about the careers they are enjoying.

The bonds formed by classmates through shared trials, tribulations and triumphs will in some cases last a lifetime.

At ECE in 1956 . . .

Joe Quintana, left, and Saul “Vic” Miano, right, display team projects during their senior year at ECE in 1956. They were among the Golden Grads honored by UNM during commencement 2006.

. . . and 50 Years Later

Joe Quintana, left, and Saul “Vic” Miano flank ECE Chair Chaouki Abdallah during ECE’s spring graduation reception.

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Gregory Heileman

Director

Roberta M. Menicucci

Academic Advisor

rmenicucci@ece.unm.edu

ECE’s new freshman programming course gives future engineers a taste of electrical and computer engineering right off the bat, including some of the competitive fun that can be had.
ECE Proudly Welcomes Four New Professors

Sudharman Jayaweera
Professor
Ph.D., Electrical Engineering, Stanford University, 2001
M.Sc., Electrical Engineering, Stanford University, 1998
M.A., Electrical Engineering, Princeton University, 1995
B.Sc. (First Class Hons.), Electrical Engineering, Allahabad University, 1991
Assistant Professor

Pradeep Sen
Assistant Professor
Ph.D., Electrical Engineering, Stanford University, 1998
M.Sc., Electrical Engineering, Stanford University, 1996
M.A., Computer and Electrical Engineering, Purdue University, 1996
Assistant Professor

Payman Zakha-Ha
Assistant Professor
Ph.D., Electrical Engineering, Stanford University, 1998
M.Sc., Electrical Engineering, Sharif University of Technology, Tehran, 1997
B.Sc., Electrical Engineering, Sharif University of Technology, Tehran, 1994
Assistant Professor

Yasamin Mostofi
Assistant Professor
Ph.D., Electrical Engineering, Stanford University, 2006
M.S., Electrical Engineering, Stanford University, 2001
B.S., Electrical Engineering, Sharif University of Technology, Tehran, 1997
Assistant Professor

Sudharman Jayaweera’s journey to New Mexico began in Colombo, Sri Lanka, where he worked as a sub-editor for a science newspaper. In 1998 he joined US Wireless Corporation in San Ramon, Calif., as a member of the Wireless Signal Processing Algorithms Development Group, where he developed wireless geo-location and tracking algorithms for the company’s proprietary RadioCamera™ technology.

After founding the Advanced Wireless Sensor Research Lab at Wichita State University, he was hired in 2006 as an assistant professor at ECE. Dr. Jayaweera has published more than 45 peer-reviewed journal and conference papers. His research interests include wireless communications, statistical signal/image processing, wireless sensor networks, information theory, quantum information processing and biomedical signal.

Pradeep Sen joined ECE after graduating from Stanford University, where he was a member of the Stanford Graphics Lab. His research interests include real-time graphics and graphics hardware, global illumination algorithms, computational photography and graphics algorithms.

His research into Dual Photography recently created excitement within the mainstream media and his exploration of real-time rendering techniques will make him a welcome member of the university’s new Graphics Lab. Dr. Sen is a recipient of the NVIDIA Graduate Fellowship, a scholarship program sponsored by NVIDIA Corp. in memory of Anthony D. Laplace, that recognizes outstanding academic work in any field of computer science.

Payman Zakha-Ha was a senior research engineer at LSI Logic Corporation before arriving at UNM. His interests include analysis of signal and power integrity in high-performance and low-power VLSI systems, innovative design techniques to deal with random/systematic variations, and robust and manufacturable circuit design approaches.

He won the Khwarizmi Award, the most prestigious scientific award in Iran, in 1997. He is inventor or co-inventor of nine patents and author or co-author of more than 30 peer-reviewed journals and conference proceedings. He has been an industry liaison with Semiconductor Research Corporation since 2001.

Dr. Zakha-Ha is a senior member of the IEEE and a member of the New York Academy of Sciences.

Yasamin Mostofi’s research interests are in the areas of sensor networks, distributed estimation and control, wireless communication networks, and control and dynamical systems, where she has developed theoretical foundations and design optimization algorithms.

Her current work includes sensing, estimation and control of dynamical systems over a network; collaborative information processing in multi-agent mobile networks; optimization of real-time wireless networks; optimum allocation of computation and communication resources; cross-layer designs and development of decentralized solutions.

Yasamin’s industry experience includes working at Bell Labs, NJ, in the summer of 1999 and at National Semiconductor in California in the summer of 2001.

A recipient of the Bellcore fellow-award at Stanford, she is an elected member of Sigma Xi.

Senior Flex Their Mental Muscles

During their senior year in ECE, students complete a research project that emphasizes teamwork, problem solving and the practical application of skills they’ve learned during their undergraduate studies.

The projects are conducted as part of Prof. Marvin Daniel’s ECE 420 class, and they culminate at the end of each semester in a day of presentations, shared learning, and celebration.

Here are four of the exemplary senior projects completed during 2005-06.

A device called “X-Drive” was designed by a team of seniors to help a quadriplegic control a wheelchair. The project team consisted of students from engineering and medicine.

The device would be useful to improve competitors’ speed and power.

Voice-Activated Wheelchair

Designed and implemented a control system to optimally move rooftop solar arrays based on position of the sun, time of day, time of year, realignment from evening to morning, etc. Sponsor: Solar Automation.

Superluminescent Diode

Designed, built and tested a superluminescent diode that is optimized for use in optical coherence tomography. The application is an optical technique used in the medical field to microscopically image human tissue. The goal is to produce a practical device that is more cost-effective and power efficient than currently available SLDs. Sponsor: Prof. Luke Lester at CHTM.

Control System for Solar Array

Designed, built and tested a voice-activated wheelchair that can recognize and respond to normal voice commands, such as forward, back, left, right. The design is based on the output of a VoiceDirect II voice-recognition motherboard. These outputs are processed by a micro-controller to mimic the voltages that would come from a manual joystick controller, allowing the wheelchair user to have hands-free control. Applicable to use by a quadriplegic or other mobility-impaired user. Sponsor: Nextek Mobility Corp.

Taekwondo Training and Measurement Device

Designed, built and tested a Taekwondo scoring device that is more cost-effective and power-efficient than currently available devices. The device is a device that can be strapped to a hogu or kicking bag and will display which competitor scored first and with how much force. The device would be used only in training to improve competitors’ speed and power.

In Olympic-style Taekwondo, points are awarded for delivering a kick with reasonable power to the hogs (chest protectors) or to the head. This requires speed and power delivered together. This project designed, built and tested a device that can be strapped to a hogu or kicking bag and will display which competitor scored first and with how much force. The device would be used only in training to improve competitors’ speed and power.
Recent Research Initiatives at ECE

Plasma, Energy and Fusion

As we know, energy is conserved. Unfortunately, it is usually stored in inconvenient forms. As it is converted into a useful form, some of it escapes as unused heat. At ECE, the Plasma and Fusion Science group is conducting research in energy and basic plasma science with a number of applications, including fusion energy, pulsed power technology, and astrophysics.

Much of the group’s research takes place in the new HELCAT (helicon-cathode) plasma device at ECE.

The linear lab plasma device in ECE's Plasma and Fusion Lab is popularly known as HELCAT, or helicon-cathode. It has two plasma sources: an RF helicon plasma and a thermionic cathode.

Hui Li of Los Alamos National Laboratory, in collaboration with doctors Scott Hsu and Christopher Watts and Dr. Alan Lynn, is helping to build tools for cleaner, more comprehensive neuroimages that are more true to raw data. This work will make analysis of the images easier for the neuroscience community.

For his doctoral dissertation Franco plans to develop a tool that uses nonlinear independent component analysis for fMRI data. “I love doing this work,” he says. “It is not just pure engineering, but rather can be directly applied to try and help humanity.”

The MIND Institute is a 501(c)3 nonprofit research and education partnership that, although it is independent of UNM, is located in Domenici Hall on the university’s north campus. The institute is committed to expanding neuroscience research by discovering new ways to understand human behavior as well as to treat and cure brain disease and mental illness. Led by many of the country’s leading neuroscientists, the MIND Institute partnership combines more than 400 researchers and staff with an annual budget of $50 million to unlock the brain’s remaining secrets. For more information, go to www.themindinstitute.org.

Seeing Into the Human Mind

Improving our understanding, diagnosis and treatment of the mind and mental illness is the focus of the MIND Institute and its collaborative partners, UNM, the University of Minnesota, and Massachusetts General Hospital (Harvard Medical School and MIT).

Neuroimaging technologies—both developing and using them—are a key component of the institute’s work. ECE doctoral student Alexandre Franco can be found every day at the MIND Institute, where he works as a research assistant doing signal processing analysis of functional magnetic resonance imaging (fMRI) data.

FMRI is a technique for determining which parts of the brain are activated by different physical sensations, such as the person’s sense of touch, hearing or sight. It is one of the most recently developed forms of neuroimaging.

Under the guidance of Dr. Andrew Mayer, a research scientist at the MIND Institute, and ECE Prof. Greg Heileman, Franco applies his engineering skills—including mathematics and programming—to perform signal and image processing on fMRI data. The signal-to-noise ratio of fMRI machines is very low, and Franco is helping to build tools for cleaner, more comprehensive neuroimages that are more true to raw data. This work will make analysis of the images easier for the neuroscience community.

Future Internet Design

While the Internet has touched almost every aspect of our lives, its current implementation is based on fixed connections, thus limiting mobility, portability and services.

The Internet is neither secure nor trustworthy in its current form. Moreover, the Internet is based on concepts developed almost four decades ago, and it should be reconsidered in the light of experience gained during that period. Finally, more and more services and applications on the Internet—primarily those based on peer-to-peer networks—continue to challenge the use of structured communication paths in favor of a more flexible and even ad-hoc approach.

Professors Heileman, Shu, and Abdallah are currently involved in an NSF project to design the Future Internet (FINID), in collaboration with the Corporation of National Research Initiatives. NSF has a wide network of research organizations working in the area.

ECE’s project combines concepts from control theory, networking, and digital-rights management to design a more agile and transient network and to guarantee security as well as continuous connectivity across multiple networks and devices.

Reconfigurable Systems

Over the past several years, a number of reconfigurable materials, technologies and components have emerged, including micro-electromechanical systems (MEMS), field programmable gate arrays (FPGAs), nanomaterials, and chalcogenide phase change materials, to name only a few.

Such materials, technologies and products promise a future where diverse technologies are integrated to create systems far more flexible and capable than those designed and manufactured today. The potential for such systems includes

Continued next page
Advances in Nanomaterials, Nanoscale Devices

Nanotechnology, quantum dot devices, and nanoscale lithography continue to be major research interests at UNM’s Center for High Technology Materials. Significant advances have been made in the areas of nanoheteroepitaxy, immersion interference lithography, nanophotonics, quantum dot detectors and lasers, and nanofluidics.

Among many firsts for this year are the first near-infrared negative index materials, GaN nanowires using selective nanoscale growth, and new approaches to directed self-assembly—combining nanolithography and self-assembly to fabricate biomimetic structures.

The educational aspects of the CHTM program have received added emphasis with the award of two new NSF IGERTs in nano-photonics related topics (see stories, page 13 and 16). A highlight of the center’s 2005-06 activity was the continued progress of the NSF National Nanotechnology Infrastructure Network program (NNIN). This is a multi-institution program under which each of 13 universities maintains nanofabrication and nanoscale characterization facilities open to external users, both academic and industrial. The program includes diversity and societal goals.

NNIN support for CHTM’s nanoscale lithography, cleanroom fabrication and molecular-beam epitaxy growth facilities provides needed resources to maintain and expand state-of-the-art capabilities. The program has had an enthusiastic reception from the local and national communities, with more than 32 external scientists from both academia and industry working at the CHTM facilities. In January 2006, the program sponsored a workshop titled “Nanoscale Processes in the Earth and Planetary Sciences” that attracted an international audience of participants.

Other funding during 2005-06 included Army Research Laboratory support for development of GaN nanowires, continuing support from the Air Force Office of Scientific Research for optoelectronics work, and ongoing funding from the Defense Advanced Research Projects Agency for nanophotonics and infrared detectors.

CHTM provides a research environment for graduate and undergraduate students in photonics, optoelectronics, and materials science, complementing ECE’s academic program. During 2005-06, five ECE students received their PhD and two received their MS degree in electrical engineering through CHTM. More than 80 graduate students are conducting their research at CHTM, more than half of whom are associated with ECE. In addition, nine ECE faculty and eight ECE research faculty members conduct their research through CHTM.

A collaboration between the groups of professors Stephen Hersee and Steven Brueck has developed a new technique for the growth of gallium nitride nanowires in a predetermined geometry using selective nanoscale growth. This research was recently published in Nano Letters (6, 1808 (2006)) and is highlighted on the Nature Nanomaterials Web site (www.nature.com/nnano/reshigh/2006/0806/full/nnano.2006.35.html).

As a result of the unique nanoscale growth dynamics, the nanowires appear to be free of structural defects such as threading dislocations. Importantly, contact to the bottom of the nanowires is through the substrate and is free of barrier effects associated with other nanowire contacting approaches. Work is continuing with the goal of light-emitting diodes and lasers.

ECE graduate student Deying Xia in Professor Brueck’s group has demonstrated a new, simple, and facile approach to the fabrication of various nanopatterned films composed of nanoparticles. The findings could lead to nanoparticle sensors for both biological and chemical species. This work is highlighted on the Nanowerk web site (www.nanowerk.com/spotlight/spotid=489.php) and was published in Advanced Materials (18, 230 (2006)).

Most previous work has proceeded by an additive process of first defining mesoscopic areas (lines, circles, interconnects, etc.) using a lithographic process and then attempting to fill these patterns with nanoparticles using any of a number of directed self-assembly approaches. In this work, the process was turned around by depositing a uniform layer of nanoparticles, which can be done easily over macroscopic dimensions, followed by deposition, exposure and development of a layer of photoresist that is used as an etch mask to transfer the pattern into the nanoparticles. The end result is a much larger area of nanoparticle patterns with better pattern fidelity and with the flexibility to fabricate patterns with a larger range of sizes and complexity.

For more information about the Center for High Technology Materials, go to www.chtm.unm.edu.
ECE Expands Its Global Presence

ECE’s international summer internship program, Expand Your Engineering Skills (EYES), had a rewarding second year bringing high-caliber undergraduate students to UNM.

This year, in addition to its students from the Indian Institute of Technology in Kharagpur, program director Prof. Sanjay Krishna extended the program to include students from Tsinghua University in Beijing and the University of Science and Technology of China in Hefei, China. Competition for admission into the internship was fierce: it had an acceptance rate of about 10%. Ten students were admitted—seven from IIT and three from Tsinghua.

The students spent eight weeks undertaking research in a variety of topics that ranged from defining nanoscale materials and devices to developing novel signal processing techniques for design of sensors.

EYES students’ research has already led to some publications in peer-reviewed journals. A student working with Prof. Krishna last year, Mr. V. Tripathi, was the second author cited in a joint publication with researchers from Tsinghua University.

In just the past year, UNM entered into 10 collaborative agreements and exchanges. These agreements, or “convenios,” establish both academic and cultural cooperation. “The goal is to organize joint research projects as well as to organize faculty and student exchanges,” Torres said.

Other outcomes include joint scientific activities in classes, conferences, seminars, symposia and lectures.

Rubén Côté, coordinator of agreements and study abroad at UNM’s Latin America and Iberian Institute, says that “visiting faculty bring a different perspective on life that they pass on to students. They often conduct research while they’re here and work with our graduate students. Latin American study students get research grants. The visiting faculty they work with become their contacts across the globe.”

The international students that the convenios bring to UNM “teach the academic and cultural life of our students,” said the visiting student Jorge Pezoa from Argentina. “They also expand their horizons and make them global citizens,” Côté said.

For a list of all 58 UNM convenios, visit: http://laii.unm.edu/exchange/convenios.php.

MEMS Promises Noninvasive Medical Treatment

Fast, that’s how ECE Prof. Jingkuang Chen runs along La Luz Trail in Albuquerque’s Sandia Mountains. Fast and thinking.

Running provides a form of contemplation for Chen, who trains his mind on his research as he speeds along the trail.

Chen’s research centers on tiny devices that can deliver life-saving drugs on a cell-by-cell basis, take ultrasound images from inside living tissue and freeze targeted areas of tissue less than half the diameter of a hair.

Micro-electromechanical systems (MEMS) serve to integrate minute sensors, electronics and mechanical elements on a silicon substrate. When Chen heard about the MEMS technology developed at UC Berkeley in the mid-1980s, he was hooked. So after receiving his bachelor’s and master’s degrees in Taiwan, Taiwan, he went to the University of Michigan at Ann Arbor for his doctoral work.

After completing his doctoral dissertation on a “Multifunction Neuroprobe and Related Devices Using Buried Silicon Microchannels,” Chen spent eight years working for Xerox Research. While there, he developed an idea for a novel ultrasonic transducer array. This prompted him to find an environment where he could develop it, and that brought him to UNM.

His current research interests include MEMS-based ultrasound transducers and smart microfluidic systems for biomedical applications.

“My research is quite interesting to me,” Chen explained, “because it has practical application. It’s not some basic theory; it’s a real device. I know it can be used in surgery and in saving lives.”

He has designed an implantable ultrasound transducer array—a miniaturized probe that can, at the cellular level, create ultrasound images, freeze or heat cells, sense temperature, and deliver drugs or electrical stimulation.

The potential uses for Chen’s transducer are many. The tiny probe is able to reach cells and tumors deep inside of tissue without significant disruption. In medical diagnosis, besides its higher-resolution medical imaging, it can be used to monitor tissue temperature, measure blood flow rate in fine vessels, introduce high-frequency acoustic waves, and serve as a visual aid on a microsurgery tool.

In medical treatment, the device can be used to heat tissue locally using high-power ultrasound waves, clear plaque when inserted into blood vessels, heal wounded cells using acoustic waves, change cell activities, and trigger neurons.

Because of its relatively noninvasive size, it can be used to perform surgery in delicate organs such as the liver and brain and to freeze or heat single, targeted cells.

In cryosurgery, which uses extreme cold to kill cells, the device can cool an area 30 microns in diameter. “So it has very high precision,” Chen said. “We integrate three functions on that one chip: the ultrasound array, the freeze, and the temperature sensor.”

When the device is used for targeted drug delivery, it can also use ultrasound to increase the cell membrane’s permeability, thereby increasing the efficiency of drug delivery into the cell. Neuroscience applications include inserting an array of probes to monitor and control epilepsy.

Not yet being tested on humans, the transducer is under patent review. Meanwhile, Chen has not slackened his pace. He is now developing a tiny ultrasound-imaging device that fits into a capsule that can be swallowed.

“ ‘It’s not some basic theory; it’s a real device. I know it can be used in surgery and in saving lives.’ ”

EYES internship awards for summer 2006 are welcomed by faculty members and program director Prof. Sanjay Krishna (far right).
Pioneering on the NanoFrontier

In the technology industry, the quest is well underway to increase data transmission speeds, decrease semiconductor size, and reduce chip costs. And the big innovations are being made on the nano scale.

"The science that takes place at these nanoscale dimensions is a new phenomenon," says ECE Prof. Diana Huffaker. "It’s only been in the last decade that we’ve been able to measure things on the nanoscale. Now technology exists for us to study things we never knew about.”

Huffaker’s doctoral research, completed in 1995, was in small low-power lasers.

"The next step was quantum dots," she says. "It wasn’t called nanotechnology then, but catch phrases can be useful.”

"If we look at an electron in its 10 nm wavelength range, its properties become different," Huffaker says.

By learning how molecules organize in nanoscale patterns, researchers can identify new phenomena and design materials with new properties. For instance, if researchers can find ways to make things cheaper, they can improve the cost of everything from your cell phone to your medical care.

One way to make semiconductors cheaper is to find new combinations of materials to use in building them. But new combinations must avoid the defects that result when two materials with different physical properties—such as expansion rates when heated—are placed adjacent to each other in a wafer’s layers. Differing expansion rates can distort the arrangement of atoms in a crystal (its lattice). Distortion causes strain, which results in defects.

Elemental Opportunities

An approach to reducing this lattice mismatch is to grow quantum dots of the chemical elements indium-arsenide on top of a gallium-arsenide (GaAs) surface. Quantum dots—tiny clusters of semiconductor crystal—are just a few nanometers in size. Tiny as they are, they have a relatively large surface area, and this serves to prevent distortion from lattice mismatch. A product of Huffaker’s doctoral research during the late 1990s was a cost-saving semiconductor laser that’s used for data transmission. Her research team figured out how to use quantum dots and GaAs to create a laser with a 1.3-micron wavelength. Telecommunications devices use this wavelength of light because it enables the optical fibers in telephone lines to transmit large amounts of information over long distances with good sound and image quality.

By obtaining the requisite wavelength, the team was able to use GaAs instead of indium phosphide (InP), which is a more expensive and less heat-tolerant semiconductor.

Tackling Disease

"There are all kinds of applications for nanotechnology," Huffaker says. "For example, thermodynamics take place at the nano scale. But that’s not covered in any physics classes. So we’re developing course work to apply at that scale.”

Toward this end, Huffaker in October 2004 pursued a $2.95 million grant to establish multidisciplinary training for doctoral students to study nanoscience and technology with applications for cancer research. The funds were awarded in September 2005 by the National Science Foundation and the National Cancer Institute.

"With nanobiotechnology, we can do things like making molecule-sized channels in diagnostic devices that can collect tiny biological samples," she said.

The grant is part of the Integrative Graduate Education and Research Traineeship (IGERT) program that NSF created to train PhD scientists and engineers with the interdisciplinary, technical, professional, personal and leadership skills needed to address the global questions of the future.

Dr. Huffaker’s program, which supports doctoral students in engineering, science and mathematics, is titled Integrative Nanoscience and Microsystems. As the principal investigator, Huffaker is working with thirty UNM professors in electrical engineering, computer engineering, mathematics, physics, mechanical engineering, biology, health sciences, chemical engineering, nuclear engineering, chemistry, earth and planetary sciences and business administration.

Nine UNM students received fellowships in this program for 2006. For information about applying, go to www.chtm.unm.edu/igert/.

Prof. Huffaker’s Web site is www.chtm.unm.edu/huffaker/.

$1.2M Supports FPGA Research

ECE received a $1.2 million Air Force Research Lab grant in 2006 to develop "reconfigurable parallel architectures for space applications.”

The designs will allow the Air Force to reconfigure devices wirelessly to perform a variety of functions in flight. Researchers will use a field-programmable gate array made by Xilinx.

The project supports four ECE students. Prof. Marios Pattichis is the principal investigator.

$1.2M Grant for Research in High-Power Microwaves

The number-one cause of U.S. casualties overseas is improvised explosive devices (IEDs), and dealing with them is a priority for the Office of Naval Research. Researchers in academia and industry nationwide are finding ways to detect and defeat these devices, commonly known as roadside bombs, and ECE is contributing to the work.

This year, ECE launched its Directed Energy Microwaves for Remote Destruction of IEDs project, a basic research program in collaboration with the University of Michigan and Science Applications Inc’s Albuquerque office. As part of this research, ECE will study ways to improve the performance of commercial magnetrons, which are higher power versions of the source that is at the heart of microwave ovens. In addition, ECE researchers will study various antenna concepts as well as electromagnetic scattering with applications to this project.

Prof. Edl Schamiloglu is the principal investigator.

"If we look at an electron in its 10 nm wavelength range, its properties become different.”
Bots Spread the Word

Students interested in learning about robotics find a world of possibilities in ECE’s Intelligent Distributed Multi-Agent Robotic Systems (IDMARS) laboratory.

They use the lab to design, simulate, build, and fabricate their projects. The lab’s director, Prof. Nader Vadee, said, “The lab’s doors are open to everyone who has a robot idea and would like to try it out or bring it to life.”

The lab’s students and mentors are actively involved in the local community, providing lab tours to visiting high school students and bringing samples of their work to schools and expositions.

During 2005-06 they gave more than twenty lab tours and provided numerous internships. They collaborate with other educational institutions in training students using robotics, including mentoring high school students for the state’s annual RoboRAVE competitions. And they bring their robots to demonstrate various engineering feats at community events such as the City of Albuquerque’s tricentennial celebration and UNM’s open-house events.

Students use the lab’s ever-expanding fleet of mobile robots to make learning and research in engineering a fun, community-oriented process.

Graduate’s Research Gets High Honors

Bradley Ratliff, an ECE 2004 doctoral graduate, was awarded UNM’s Popejoy Dissertation Prize at the university’s May 13, 2006, commencement.

The Popejoy Prize recognizes outstanding dissertations that represent the highest level of academic excellence among doctoral students at UNM. It is awarded each year in one of the university’s three major research areas in a three-year rotation.

UNM Provost Reed Dasenbrook presented the award to Brad after honors graduates were saluted following remarks by keynote speaker Gov. Bill Richardson.


Such cameras have a range of uses—from astronomical imaging to remote sensing and security. However, the cameras tend to produce unclear images, as if seen through a dirty screen. This image noise has traditionally been removed by repeatedly recalibrating the camera, but the calibration equipment is expensive and the process disrupts use of the camera. Brad said that the process “effectively blinds the camera during the calibration procedure.”

He developed a set of algorithms that calibrate cameras without the pricey equipment and without disrupting the camera’s use.

Brad was also a graduate finalist in the National Inventor’s Hall of Fame 2003 awards. He developed a set of algorithms that calibrate cameras without the pricey equipment and without disrupting the camera’s use.

“Ideas come from a need, and Brad’s dissertation was motivated by a real-world need for improving camera technology,” said UNM Provost Brad Dunning. "This work is a testament to Brad’s creativity and dedication to excellence in his research field.”
Students Excel

ECE recognized 21 students for their performance in 2005-06:

Outstanding Graduate Students

Vipin Sachdeva, CompE, fall semester
Hua Wei, EE, fall
Mierna Armanious, spring

Outstanding Sophomores:

Karl Chambers, CompE, fall
Theresa Saiz, EE, fall
Frank Hemingway, EE, spring
David Steele, EE, spring
Jason Finn, CompE, spring
Natasha Boteh, CompE, spring

Outstanding Juniors:

Craig Vineyard, CompE, fall
Shirli Sisic, EE, fall
Sebastian Mata Bruni, EE, spring
Mark Learn, CompE, spring

Outstanding Sophomores:

Michael Basile, CompE, fall
Gregory Eshima Smith, EE, fall
Devin Jelinek, EE, spring
Nathan Dautenhahn, CompE, spring

Outstanding Student Service to ECE:

Malay Gupta, fall
Todd Barrick, Thao Tran,
Craig Vineyard and Jeremy Wheelis, spring

The exemplary scholarship and service to UNM of ECE senior David Steele earned him UNM’s 2006 Clauye Outstanding Senior Award. A UNM Presidential Scholar, David’s many service roles included being an ASUNM senator for three semesters. He also worked half time as an intern at Sandia National Labs and graduated summa cum laude.

Frank Hemingway—besides being a Regents’ Scholar in the University Honors Program, a 2005 Goldwater Scholar, a Dept. of Homeland Security Scholar in 2004 and '05, and graduating summa cum laude—was a valued four-year member of UNM’s track and cross-country teams. He was named in July 2006 to ESPN department. See http://soemep.unm.edu.

ECE Research Labs

- Plasma & Fusion Science
- Pulsed Power, Beams and Microwaves
- High Performance Computing
- Antenna & Computational EM
- Crystal Growth Facility
- CHTM Labs
- Optical Spectroscopy
- Visualization Lab
- Networked Control Systems
- Optical Communication Systems
- Digital Signal & Image Processing
- High Performance Algorithms & Applications Research Group
- Image & Video Processing and Communications
- Networked Multimedia & Parallel Computing

Best Wishes, Spankey

Senior Electronics Tech Gregory Spankey Speis, a 22-year veteran of ECE, received the School of Engineering’s Outstanding Staff Volunteer Award in 2006. Spankey retired in June 2006. His many talents—his laser shows, Van de Graaff generator and Tesla coil demonstrations, and the musical talent he shared at UNM events, never mind the technical skills he brought to his job—will be missed. His colleagues wish him many grand adventures in the years to come.

Support = Success

Freshmen and sophomores preparing for admission into ECE have a valuable resource in ECE’s undergraduate academic advisor, who can help schedule a course of study that will meet each student’s goals.

There are also several student groups that provide networks and resources to ECE students. These include the student chapter of IEEE and the honor societies Etta Kappa Nu, Sigma Xi, and Tau Beta Pi. Etta Kappa Nu’s activities this year included an induction ceremony for the Order of the Engineer.

Another resource is Engineering Student Services, a School of Engineering program. ESS helps students stay engaged in learning and connects them with student groups and professional organizations.

ESS supports four student groups: the Hispanic Engineering and Science Organization, the American Indian Science and Engineering Society, the National Society of Black Engineers, and the Society of Women Engineers.

It also includes the campus-wide Women in Science and Engineering program, which offers job-shadowing, industry tours, mock interviews, networking and outreach to female students. See www.unm.edu/~unmwise.

ESS provides tutoring, study groups, mentoring, general SOE scholarships, computer lab facilities, internships and co-ops. It can also advise students who are completing their prerequisite courses (calculus, programming, physics, chemistry, etc.) for acceptance into the ECE department. See http://soemep.unm.edu.

The School of Engineering recognized three exceptional ECE students during its spring 2006 awards ceremony:

Shirli K. Sisic, Outstanding Junior
Holly Kathleen Victorson, Outstanding Senior
Ivan Lopez-Hurtado, Outstanding Graduate Student
### Faculty Awards

**IEEE 2006 John Kraus Antenna Award—Baum**

Distinguished Research Professor Carl Baum and two longtime colleagues received the IEEE Antennas & Propagation Society’s 2006 John Kraus Antenna Award for “development of novel and innovative ultra-wideband antenna concepts that have enabled a new area of electromagnetics.”

Baum shares the award with Everett Farr, owner of Farr Research, Inc., in Albuquerque, and D.V. Giri, owner of Pro-Tech, which is located near U.C. Berkeley. Pro-Tech conducts research in electromagnetic propagation, antenna analysis and microwave engineering. Farr Research produces ultra-wideband antennas.

ECE welcomed Dr. Baum to its faculty in August 2005.

### Engineering Awards Go Greek—Christodoulou/Pattichis

Two ECE professors earned recognition from the School of Engineering this year. Prof. Christos Christodoulou received the Senior Faculty Research Excellence award, and Prof. Marios Pattichis received the Harrison Faculty Recognition.

### EMP Fellow—Schamiloglu

Prof. Ed Schamiloglu was elected an EMP Fellow to the Summa Foundation.

### IEEE SMC Norbert Wiener Award—Jamshidi

The IEEE Society for Systems, Man and Cybernetics Professor of the Year award is given each year to a faculty member who has made significant contributions in the area of systems, man and cybernetics.

The 2005 award cited “truly outstanding contributions to research and scholarship in the systems area and soft computing theory and applications.”

Prof. Jamshidi was also chosen as founding editor of the IEEE Systems Journal, a publication of IEEE’s new Systems Council. This council was created in response to the surge in popularity of systems engineering and a technology called system of systems. The council is represented by fourteen IEEE societies, and Prof. Jamshidi is a representative of the Systems, Man and Cybernetics Society on the council.

### University Libraries Faculty Award—Lester

UNM’s University Libraries joined the School of Engineering in January to recognize ECE Prof. Luke Lester “for the exemplary contribution he has made to his students, his colleagues and the library and field of education.”

Prof. Lester’s pioneering efforts in collaboration with professors Kevin Malloy and Andreas Stritzel in the field of quantum dots led to development of a semiconductor laser that has a lower threshold, purer signal, and wider-wavelength range than other existing semiconductor lasers.

### Faculty Profiles

#### Chaukiki T. Abdallah

Chaukiki Abdallah joined ECE in 1988 and served as professor, associate chair, and director of the graduate program before being assigned chair in 2005.

He has been active in designing and implementing various international graduate programs with Latin American and European countries. He was co-founder in 1990 of the ISTEC consortium, which currently includes more than 150 universities in the U.S., Spain and Latin America. He has published four books and more than 200 peer-reviewed papers.

Professor Abdallah conducts research and teaches courses in the general area of systems theory with a focus on control and communications systems. He is a senior member of IEEE, a recipient of the IEEE Millennium Medal, and a recipient of the Gardner-Zemke Professorship for 2002-2005.

#### Steven R.J. Brueck

Steven Brueck provides technical and administrative leadership as director of UNM’s Center for High Technology Materials. Generating more than $9 million annually in grants and contracts, CHTM has grown into an internationally recognized center for optoelectronics, microelectronics and nanotechnology research.

He is the founding editor of the IEEE Journal of Special Topics in Quantum Electronics and is a Fellow of the IEEE, OSA and AAAS. He received the School of Engineering’s Outstanding Researcher Award and in 2000 the IEEE Millennium Medal.

Dr. Brueck’s research explores the extension of optical lithography/microscopy to the high-resolution necessary for future generations of ICs, and applying the capabilities of interferometric lithography to expand nanophotonic, nanoscale growth and nanofluidic science and technology.

#### Professor Thomas P. Caudell

Professor Thomas P. Caudell teaches classes in neural networks, virtual reality, data structures and algorithms, computer graphics, pattern recognition, computer vision, parallel processing and computer games. He is an active member of the IEEE, the International Neural Network Society and the Association for Computing Machinery.

Thomas Caudell has spent the last seven years designing and building a piece of software he calls Flatland, named in honor of Edwin Abbott’s 1884 book by the same name. Using 3D graphics, sound, smell, touch and speech, the operator of Flatland interacts with the workspace by using custom handheld wands and voice commands.

He hopes to create a virtual laboratory that enables scientists to conduct experiments on computational problems in a natural and intuitive manner, in particular models of cognitive neural systems.

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#### Jingkuang Chen

Jingkuang Chen joined ECE as an associate professor in July 2004. Prior to that he worked as a member of the technical staff at Xerox Corporation and was involved in the development of MEMS microfluidic systems for printing applications.

His current research holds the promise of delivering life-saving drugs to patients on a cell-by-cell basis using implantable transducers, high-resolution ultrasound imaging arrays, thermoelectric coolers, and magnetic deep brain stimulators.

Dr. Chen is looking forward to the building of a silicon fabrication facility at UNM in 2007. Having convenient access to this local facility will help speed the practical development of his research. In the meantime, he keeps busy teaching classes that deal with MEMS Transducer Devices and Analog Circuit Design.

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Christos G. Christodoulou
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B.S. in Physics with an option in Solid State Electronics, American University in Cairo, Egypt, 1979

Christos Christodoulou began teaching at ECE in January of 1999 where he also served as its chairman for six years. During this time he developed a microwave engineering lab and antenna lab that is used by undergraduate and graduate students. He is a Fellow member of IEEE and an associate editor for many of its publications. He has published over 250 papers in journals, conferences and co-authored four books. He has also been selected as the Antennas and Propagation Society Distinguished Lecturer for 2006-2008. He also received the SOE Outstanding Senior Researcher of the Year Award.

Dr. Christodoulou research is in the areas of modeling of electromagnetic systems, reconfigurable systems, machine learning applications in electromagnetics, and smart antennas.

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B.E.E., Electrical Engineering, University of Bielefeld, 1959

Mark Gilmore joined the ECE Department in 2003 as an Assistant Professor. He has been active in plasma science research for 20 years in both industry and academia. His current research focuses on the physics and control of turbulence and transport in both laboratory and fusion plasmas. He also has collaborations on energy reprocessing and plasma astrophysics with Los Alamos National Laboratory, pulsed power with Sandia Labs, and high power microwave devices with colleagues at UNM and APL in Albuquerque.

Dr. Gilmore received the IEEE student chapter “Outstanding Student Chapter” award in 2004. He is a member of the IEEE, American Physical Society, American Society for Engineering Education, the University Fusion Association.

Chuck Hawkins arrived in UNM in August of 1972 as a visiting assistant professor. He teaches and does research in CMOS Electronics, Test, Reliability, and Failure Analysis. He has worked with Sandia National Labs ITC Development Group since 1984, and has been a consultant with Intel, Phillips Research Labs, Xilinx, and AMD Corp. He was the Editor of the Electron Device Failure Analysis magazine from 1999-2003, and the past General Chair of the International Test Conference. With co-workers at Sandia Labs, Intel, and AMD, Dr. Hawkins has won several Best and Honorable mention papers at ITC and the International Symposium on Test & Failure Analysis (ISETFA). He co-authored three books including a recent work with Jaume Segura titled: “CMOS Electronics: How it Works, How it Fails,” IEEE Press 2004. He is working on a fourth book titled, “Introduction to CMOS Digital Electronics.”

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M.S., Electrical Engineering, University of Wisconsin-Madison, 1990
B.S., Electrical Engineering, University of the Pacific (Stockton, Calif.), 1985

Majeed Hayat arrived at ECE in 2001. His research covers a broad range of topics in statistical communication theory, signal/image processing, optronics, and applied probability and stochastic processes. His research topics include low-noise and single-photon avalanche photodiodes, ultrafast optical receivers, algorithms for infrared, radar, and spectral sensing and imaging systems, as well as resource-optimization methods for distributed-computing and sensor-network systems.

Dr. Hayat is a senior member of IEEE and a member of SPIE and OSA. He is an associate editor of Optics Express and a member of the editorial board of the IEEE Control Systems Society. He has published over 50 peer-reviewed articles and has received over $3.5M in research grants as a PI or Co-PI. In 1998 he received the NSF CAREER Award.

Manuel Hermengildo
Professor
PhD in Computer Science
Promoted to full professor at the Universidad Carlos III de Madrid, in 2005

Manuel Hermengildo has been a project leader at the MCC research center in Austin, Texas and taught computer architecture and programming at the University of Texas.

He moved to Spain in 1990 as a full professor and later Director of the Spanish National Research Directorate. In Feb. 2003 he accepted the Prince of Asturias Chair in Information Science and Technology at UNM.

He has published over 150 refereed papers in areas ranging from compilers to parallel architectures. He has also developed a number of public domain practical systems, some of them with tens of thousands of users, such as the Ciao programming system.

Dr. Hermengildo is a Fulbright Scholar, invited speaker, editor, referee and active member of many prestigious professional journals and organizations.

Gregory J. Heileman
Professor
Chair, ECE Undergraduate Program
Ph.D. in Electrical Engineering, University of Wisconsin-Madison, 1989
M.S., Electrical Engineering and Computer Science, University of Central Florida, 1986
B.S., Electrical Engineering, University of Michigan, 1984

Gregory Heileman has been with ECE since August, 1990. His research interests are in digital rights management, information security, the theory of computing and information, machine learning, and data structures and algorithmic analysis.

He received the SOE Teaching Excellence award in 1995, the ECE Department Distinguished Teacher Award in 2000, the ECE Department Lawton-Ellis Award in 2001. He is the faculty advisor for the UNM student branch of the IEEE Computer Society, an associate editor for the ACM Journal of Experimental Algorithmics and a senior member of the IEEE.

He wrote “Data Structures, Algorithms and Object-Oriented Programming.” In 1998 he held a research fellowship at the Universidad Carlos III de Madrid, and in 2005 he held a position at the Universidad Polîtècnica de Madrid.

Stephen D. Hersee
Professor
PhD in Computer Science
Elected Chair of Information Science & Technology

Stephen Hersee joined ECE in 1991. His advanced semiconductor materials and devices research program at CHTM is based on nanostructures and devices. Dr. Hersee received the ECE Gardner-Zemke research award in 2006. Since joining UNM Dr. Hersee has taught undergraduate and graduate level courses in microelectronics, circuit analysis and semiconductor devices. He has graduated 9 Ph.D and 4 MS students while at UNM and was named UNM 2001/2002 Outstanding Teacher of the Year.

Dr. Hersee is a Fellow of the IEEE. He has published and presented more than 160 papers and has been awarded 8 patents.
Faculty Profiles

Diana L. Huffaker
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Ph.D., Electrical Engineering, University of Texas-Austin, 1998
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Diana Huffaker has been actively involved in a wide range of semiconductor device areas including III-V/Si photonics, directed self-assembly, quantum dot lasers and emitters, nonlinear QD processes and QD solar cells since she arrived at ECE in 2001. She directs the new NSF/NCI IGERT Fellowship program in Nanoscience and Microsystems.

In addition to serving as a Professor at ECE, Ravinder K. Jain also holds the position of Professor in the Physics and Astronomy Department. He is the Endowed Chair of Microelectronics from 1970 to 1997. His research activities have included optical interconnects, fiber telecom and datacom subsystems and devices, fiber lasers and amplifiers, fiber and waveguide devices, fiber sensors, fluorescence lifetime- and depolarization-based biosensors, and silicon-based semiconductor devices. He has been issued over 20 patents and foreign patents with others pending. His research has been published in over 75 scientific and technical journals and he has made over 125 presentations to major professional societies.

Sanjay Krishna
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Sanjay Krishna joined ECE in 2001. His research interests include growth, fabrication and characterization of nanoscale quantum dots and strain layer superlattices for mid-infrared sensors.

Luke Lester came to UNM in 1994 and has taught courses in semiconductor lasers, semiconductor physics, field effect devices, microelectronics processing, quantum theory of solids, optoelectronics, and introduction to semiconductor materials and devices.

Sanjay Krishna joined ECE in 2001. His research interests include growth, fabrication and characterization of nanoscale quantum dots and strain layer superlattices for mid-infrared sensors.

In addition to serving as the Associate Dean for Research at SOE, Kevin Malloy is also a member of the Center for High Technology Materials and an Associate Professor at ECE.

Kevin J. Malloy
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Phone: (505) 272-7868
Kevin Malloy has published over 85 technical papers as the author or co-author and has authored or co-authored 26 conference presentations and invited talks. He has 10 US patents and has co-authored two books. He is a Fellow of the OSA (2003) and a Fellow of the SPIE (2002).

In addition to serving as the Associate Dean for Research at SOE, Kevin Malloy is also a member of the Center for High Technology Materials and an Associate Professor at ECE.

Kevin Malloy has published over 85 conference papers and invited talks, and has co-authored 4 books. He serves as an associate editor to the international journal Pattern Recognition.
Elizabeth Ritchie joined the faculty at UNM in 2005. From 1995-1996, she was a Postdoctoral Scholar at the Pennsylvania State University, University Park, PA. From 1997-2001, she was a member of the faculty of the meteorology department at the US Naval Postgraduate School in Monterey, CA.

From 2001-2005, she was a member of the faculty of the ECE and EAPS departments at UNM as a research professor. Her research focuses on numerical modeling, observational, and remote sensing applications to enhance understanding of tropical cyclone intensity and structure change. Dr. Ritchie is a member of the American Meteorological Society, and the American Geophysical Union. She served as Associate Editor of the Monthly Weather Review from 2000-2004 and has been a reviewer for ten international meteorological journals.

Ed Schamiloglu was appointed Assistant Professor at ECE in 1988. He directs the Pulsed Power, Beams, and Microwaves Laboratory as well as the recently formed Institute for Infrastructure Security.

Dr. Schamiloglu has authored over 60 refereed journal papers, 100 reviewed conference papers, and four patents. His research interests are in the physics and technology of charged particle beam generation and propagation, high-power microwave sources, plasma physics and diagnostics, electromagnetic wave propagation, pulsed power, and complex systems and infrastructure security.

Dr. Schamiloglu is a Fellow of the IEEE, a Senior Editor of the IEEE Transactions on Plasma Science, and has served on a National Academies Panel on Directed Energy Testing (2003-2004), and has received numerous awards.
Joint Faculty Appointments

Edward S. Angel  
Professor; Computer Science  
Ph.D., USC  
Interests: Computer graphics, scientific visualization

Jean-Claude M. Diels  
Professor; Physics & Astronomy  
Ph.D., Brussels, Belgium  
Interests: Laser physics and nonlinear optics, ultrafast phenomena

Robert V. Duncan  
Professor; Physics & Astronomy; Associate Dean, College of Arts & Sciences  
Ph.D., UC-Santa Barbara  
Interests: Precision measurements, remote sensing, experimental tests of fundamental physics

Frank L. Gillenwater  
Professor; Mathematics & Statistics  
Ph.D., University of California at Irvine  
Interests: High-performance computing applications and functional analysis

Vladimir I. Koltchinskii  
Professor; Mathematics & Statistics  
Ph.D., Kiev, Ukraine  
Interests: Probability in Banach spaces, limit theorems, empirical processes, concentration inequalities; nonparametric statistics; learning theory and its applications to control

Terran D.R. Lane  
Assistant Professor; Computer Science  
Ph.D., Purdue University  
Interests: Machine learning and its applications to bioinformatics, information security, user and cognitive modeling, and neuroimaging; reinforcement learning, behavior and control; artificial intelligence

Ronald Lumia  
Professor; Mechanical Engineering  
Ph.D., Virginia  
Interests: Robotics, automatics, image processing

Jack K. Milton  
Professor; Physics & Astronomy; Sr. Associate VP for Research  
Ph.D., Rochester  
Interests: Laser physics and nonlinear optics, quantum optics, nonlinear science

Bernard M.E. Moret  
Professor; Computer Science  
Ph.D., Tennessee  
Interests: Algorithm engineering, experimental algorithms

Timothy J. Ross  
Professor; Civil Engineering  
Ph.D., Stanford  
Interests: Structural system reliability, structural dynamics, autonomous control, fuzzy logic, fuzzy set theory, risk assessment

Wolfgang G. Rudolph  
Professor; Physics & Astronomy  
Ph.D., Jena, Germany  
Interests: Laser physics, ultrafast light pulses, time-resolved spectroscopy and imaging

Mahmoud Rafa Taha  
Assistant Professor; Civil Engineering  
Ph.D., Calgary, Canada  
Interests: Structural health monitoring, application of artificial intelligence in structural engineering and biomechanics

Herbert Tanner  
Assistant Professor; Mechanical Engineering  
Ph.D., NTUA, Greece  
Interests: Robotics, cooperative control, multi-agent systems coordination and planning

Dr. Edward D. Graham, Jr. joined ECE in June 2006 as a professor and lecturer. His new position bolsters ECE’s focus on graduate and undergraduate offerings, and his experience in industry and research bring an invaluable resource to the department’s students and faculty.

Dr. Graham’s research interests include semiconducting devices and circuits, noise theory, and statistical analysis and probabilistic considerations. He was senior director for Consortia Interfaces at Semiconductor Equipment and Materials International, joining SEMI in 2001 after serving as president and CEO of the Semiconductor Industry Suppliers Association.

Before he was employed at Sandia National Labs for 30 years, ultimately retiring as director of Operations and Engineering, Dr. Graham earned his masters in EE at UNM and his Ph.D. at North Carolina State University.

Research Professors

Carl E. Baum  
Research Professor  
Ph.D., California Institute of Technology

James R. Boger  
Research Scholar  
M.S., Montana State University

Herman Lambert Bosman  
Post-Doctoral Fellow  
Ph.D., University of Michigan at Ann Arbor

Lester A. Bowes  
Research Scholar  
B.S., Highlands University, New Mexico

C. Jerold Buchanan  
Research Professor  
Ph.D., Cornell University

Hongtan Cao  
Post-Doctoral Fellow  
Ph.D., University of New Mexico

Larry Ralph Dawson  
Research Professor  
Ph.D., University of Southern California

David Dietz  
Research Professor  
Ph.D., Indiana University

Abdel-Rahman A. El-Emary  
Research Associate Professor  
Ph.D., Colorado State University

Vipal G. Elavu  
Research Scholar  
Ph.D., University of Southern California

Art Gauthier  
Research Professor  
Ph.D., Giskiy University, Russia

Michael John Healy  
Research Professor  
Ph.D., University of Wisconsin at Madison

Ihab El-Kady  
Research Assistant Professor  
Ph.D., Iowa State University

Mikhail Isaakovich Fuks  
Research Associate Professor  
Ph.D., University of California at Irvine

Gennady Smolyakov  
Research Professor  
Ph.D., Saratov State University, Russia

Edward W. Taylor  
Research Scholar  
M.S., University of New Mexico

Vasiliki Zachou  
Research Associate Professor  
Ph.D., University of New Mexico

Christopher Watts  
Research Associate Professor  
Ph.D., University of Wisconsin at Madison

Harry T. Weaver  
Research Professor  
Ph.D., Auburn University

Stefan Posse  
Research Professor  
Ph.D., University of Berne, Switzerland

Panagiotis  
Research Assistant Professor  
Ph.D., University of California at San Diego

Samuel D. Stewner  
Research Professor  
D.Sc., University of New Mexico

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Ph.D., University of Wisconsin at Madison

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D.Sc., University of New Mexico

Edward W. Taylor  
Research Scholar  
M.S., University of New Mexico

Vasiliki Zachou  
Research Associate Professor  
Ph.D., University of New Mexico

Diana G. Zizola  
Research Professor  
Ph.D., University of Belgrade, Yugoslavia

Research Professors
Rankings Climb for EE, CompE

U.S. News & World Report’s 2007 edition of “America’s Best Graduate Schools” ranks UNM’s Computer Engineering graduate program #31 among public universities nationwide, and Electrical Engineering is #35.

The EE program rose three points to #61 in the overall rankings for all universities, public and private. The CompE program’s overall ranking of #54 is up from its previous ranking of #62.

UNM’s EE and CompE graduate programs are the only ones in New Mexico ranked by U.S. News & World Report.

Both the EE and CompE undergraduate programs are accredited by the Accreditation Board for Engineering and Technology—UNM has the only accredited CompE program in New Mexico.

133 Degrees Conferred 2005-06

Awarding More Graduate Degrees: 2000-06

Number of graduate degrees conferred