DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

TEXAS TECH
Whitacre College of Engineering

Fall 2025

Newsletter

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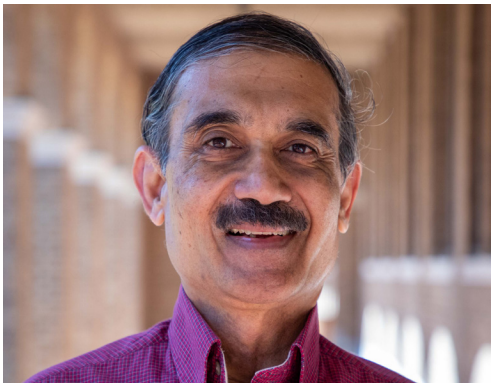
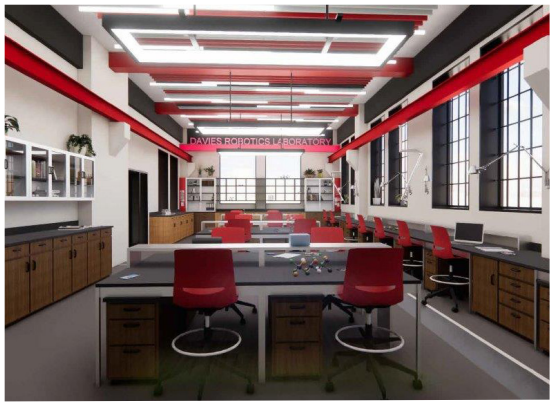
The 2025 Texas Tech Electrical & Computer Engineering Fall Newsletter





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Message from the Chair

Dear Alumni and Friends,

I am pleased to welcome you to the Department of Electrical & Computer Engineering (ECE) at Texas Tech University which has a long-standing tradition of excellence in both teaching and research. Our programs blend strong fundamentals with hands-on learning and prepare students to thrive in the ever-evolving technological landscape. With more than $9 million in endowments for scholarships, we ensure financial support for many of our students.

ECE is home to approximately 995 undergraduate and 150 graduate students. We offer ABET-accredited bachelor's degrees in Electrical & Computer Engineering and M.S. degrees in both Electrical & Computer Engineering, as well as Ph.D. degrees in Electrical Engineering. Undergraduate students can accelerate their studies by taking up to nine credit hours of graduate coursework that count toward both degrees. Undergraduate students in the department take core subjects that introduce fundamental concepts in Electrical & Computer engineering, and then systematically build up their knowledge base to greater depth in different areas that match the individual student interests. A series of coordinated project-laboratory courses meant to provide hands-on involvement, foster critical thinking, and nurture comprehensive engineering skills towards analysis, design, and experimentation are a hallmark of the unique experience at ECE-TTU.

Our faculty leads cutting-edge research in areas such as pulsed power, nanophotonics, power electronics, cybersecurity, alternate energy, artificial intelligence, image processing, and bioengineering. With 30 full-time faculty, including 7 Fellows of major professional societies (e.g., IEEE, AAAS, APS, IOP, SPIE, the National Academy of Inventors (NCI), and many others), several Horn Professors, endowed chairs, and licensed professional engineers, and 12 qualified instructors; we're proud of our academic leadership and innovative contributions.

I am delighted to share the news that the ECE Department has recently been awarded a large share of additional faculty positions from the Texas University (TUF) Fund. The Texas University Fund is a voter approved multi-billion-dollar endowment created from the state surplus, the National Research University Fund and charitable contributions. This initiative will provide one of the largest growth opportunities for the ECE Department since its founding. Three new faculty have already been hired in the past 6 months, and 6 more positions have been approved in the research areas of:

- *Critical Infrastructure Security*
- *Pulsed Power / Electromagnetic Pulse Research*
- *Telecommunications*
- *Human Molecular Aging – AI Bioinformatics*

All hires will have a home in existing centers of excellence and will be synergistically contributing to the research mission of the ECE Department, the Whitacre College of Engineering, and Texas Tech University.

Prof. Ravi Joshi

Chairperson

Department of Electrical & Computer Engineering

FACULTY SPOTLIGHT

Joshi Named IEEE Life Fellow

IEEE Life Fellow is one of the most prestigious honors awarded by the IEEE, the world's largest technical professional organization. The designation is reserved for Fellows of the IEEE, already the highest grade of membership who have demonstrated extraordinary accomplishments in their fields and a sustained commitment to the organization. Life Fellow status further recognizes those whose combined age and years of IEEE service exceed 100.

Dr. Ravi Joshi was elevated to IEEE Fellow in 2008 for his contributions to the fields of pulsed power, high-power microwaves, high field transport and semiconductor modeling, electrophysics, and bio-electrics. His continued professional achievements and longstanding service to the IEEE community have now earned him the rare distinction of Life Fellow, an honor held by less than 0.1 percent of the total IEEE membership.

New ECE Faculty
Assistant Professor Argenis Bilbao

Dr. Argenis Bilbao obtained his Bachelor's, Master's, and PhD in Electrical Engineering from Texas Tech University. Before joining Texas Tech, he worked as a software engineer, developing and maintaining computer networks and proprietary software for pharmaceutical companies like Farmax. His current research focuses on cybersecurity for power grids, microgrids, and microgrid control algorithms using artificial intelligence (AI) and machine learning (ML). In this research, he investigates how to leverage machine learning and blockchain technology to enhance power system reliability, resilience, and security. AI/ML can be used for anomaly detection and network traffic analysis, as well as for predicting two critical factors in any power system: energy demand and energy availability. For this reason, artificial neural network models are being developed to identify unknown functions related to user behavior and weather.

Bilbao has also led multiple workforce development programs in the cybersecurity field aimed at providing participants with hands-on experience with computer networks, cyber-attacks and their effects, and defensive/recovery techniques. In addition to this, Bilbao conducts research on Semiconductor Opening Switches (SOS) to generate narrow-width pulses for directed energy applications. In his previous position at the U.S. Army Research Laboratory (ARL), he researched inductive-resonant Wireless Power Transfer (WPT) and AI/ML applications in power electronic systems. This research resulted in significant contributions to the Versatile Tactical Power & Propulsion (VICTOR) Essential Research Program (ERP), the Next Generation Combat Vehicle (NGCV) initiative, and the Vertical Lift (VL) program. He has also conducted extensive research on ultra-high-voltage SiC insulated gate bipolar transistors (IGBT) and metal-oxide field effect transistors (MOSFET), which are rated to block 20 kV and 15 kV, respectively.

New ECE Faculty
Assistant Professor Lyu Zhou

Dr. Lyu Zhou earned his bachelor's degree from the University of Electronic Science and Technology of China in 2015 and his PhD degree from the State University of New York at Buffalo in 2022. From 2022 to 2025, he was a Research Associate at the University of Texas at Dallas. His main research focuses on functional materials for photothermal energy harvesting, storage, and management, targeting applications of building energy efficiency, optoelectronic devices, atmospheric water harvesting, and concentrated solar power plants.

Zhou has published over 20 research papers in journals such as *Nature Sustainability*, *Joule, Nature Communications*, *Nature Reviews Clean Technology*, *Advanced Materials*, *Advanced Energy Materials*, *Nano Energy*, and received over 1500 citations in Google Scholar. His works were also highlighted by *Nature* several times. In 2022, he was awarded with the Chinese government award for outstanding self-financed students abroad.

Connor's Work Focuses On Rural, Remote Critical Infrastructure

Dr. Brenda Connor, one of Texas Tech's first faculty hires supported by the Texas University Fund (TUF), is advancing research that fortifies the nation's critical infrastructure through secure telecommunications and artificial intelligence.

A former Ericsson executive with a doctorate in engineering and industrial management and CISSP certification, Connor serves as senior technical managing director of the Critical Infrastructure Security Institute and professor of practice in Electrical & Computer Engineering. Her work directly aligns with TUF's mission to enhance Texas research capacity in areas vital to state and national security.

Connor's team develops private telecommunication networks and AI-driven sensing systems to strengthen communications across remote regions such as West Texas. A key focus is Integrated Sensing and Communications (ISAC)—technology that merges radar with cellular systems to detect drones, vehicles, and livestock movement, improving situational awareness and biosecurity.

Her forthcoming Critical Infrastructure Telecommunications Ecosystem Incubator (CITEI) will foster collaboration, accelerate technology transfer, and address defense-related challenges highlighted by recent global attacks on infrastructure.

Connor's research also improves Supervisory Control and Data Acquisition (SCADA) automation, enabling real-time monitoring and remote control of assets such as oil wells, water systems, and microgrids. These systems can reduce operational downtime, mitigate theft losses, and enhance worker safety through reliable two-way communication—even in areas lacking public network coverage.

"Private cellular communications may have a positive financial impact—or even a life-saving one," Connor noted. By merging academic expertise with industry insight, her work positions Texas Tech University as a leader in critical-infrastructure security and next-generation telecommunications innovation.

Ashlyn Grotegut
Octobery 6, 2025

Nguyen and Dallas Receive NSF Grant for Semiconductor Research Program

The project, titled Wide/Ultrawide Bandgap Semiconductor Technologies and Applications (WUBSTA), will be led by principal investigator Dr. Hieu Nguyen, associate professor and co-principal investigator Dr. Tim Dallas, professor.

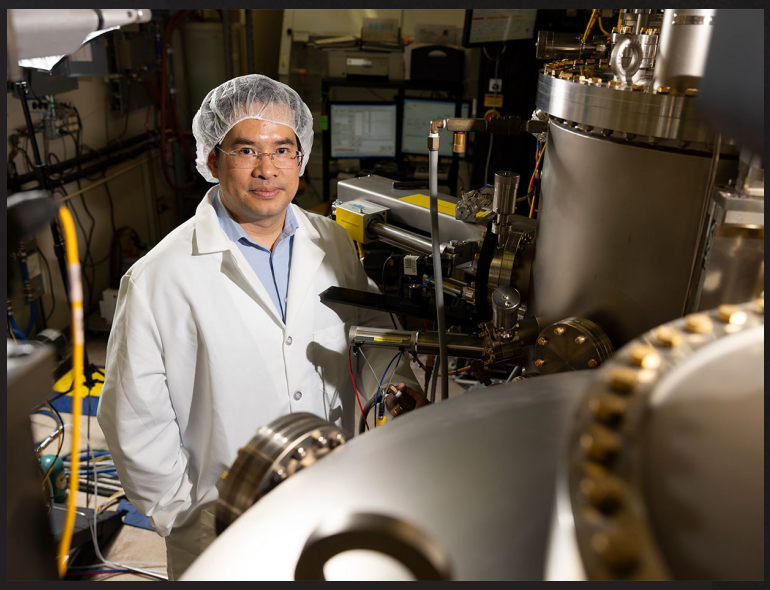
The three-year program, set to begin Nov. 1, 2025, aims to foster a comprehensive research and training environment for undergraduate students pursuing advanced studies in nanoelectronics and nanophotonics. Participants will work closely with faculty and graduate student mentors to synthesize, characterize and apply UWBG semiconductor materials such as gallium oxide (Ga_2O_3), aluminum nitride (AlN) and related heterostructures.

Key research activities include epitaxial growth, device fabrication and in-depth testing of high-power transistors, memory devices and light-emitting components. Students will engage in approximately 40 hours per week of hands-on research during the 10-week summer program. Senior personnel involved in the project include Heather Greenhalgh-Spencer, associate professor and associate dean of the Graduate School; Stephen Bayne, vice chancellor for innovation and collaboration; Ayrton Bernussi, professor and co-director of the Nano-Tech Center in the Department of Electrical & Computer Engineering; Ravi Joshi, department chair of the Department of Electrical & Computer Engineering; Argenis Bilbao, assistant professor in the Department of Electrical & Computer Engineering and Taewoo Kim, assistant professor in Department of Electrical & Computer Engineering; and Joseph Gauthier, assistant professor in the Department of Chemical Engineering.

The WUBSTA REU site emphasizes translating theoretical research into real-world applications in high-speed electronics, power systems, radiofrequency devices and optical technologies. The program also aims to promote diversity and inclusion in STEM, offering seminars, mentorship and professional development to help participants build both technical and soft skills.

Lacy Oliver
September 2, 2025

Nguyen Aims to Strengthen Security with Semiconductor Light Sources



Associate Professor Dr. Hieu P. Nguyen earned a Department of Defense grant to create high efficiency/power nanowire light sources that will keep troops safe.

These light sources are suitable not only to provide more efficient lighting and higher resolution entertainment through micro-display, augmented-reality, virtual-reality and mixed-reality equipment, but they could help troops on the ground be safer and better equipped through realistic training simulations.

The national defense applications for these semiconductor light-emitters extend far beyond that, though. They can be used to develop high-power lasers used in directed energy weapons for drone and hypersonic missile defense. In addition, ultraviolet light-emitters can assist the military with air and surface disinfection, precise timing and navigation, and wireless communications, along with critical detection of water pollution, biological and chemical compounds, and bomb-making materials.

Such high potential earned Nguyen a $934,596 grant from the U.S. Department of Defense to further develop high-quality nano structures with emission wavelength in the ultraviolet to visible range for the next four years through the Nano Tech Center.

Similar technologies are made with III-nitride semiconductors, but they cannot withstand extreme temperatures. Instead, Nguyen has chosen to construct a III-nitride light-emitter utilizing nanowire structure, which allows it a wide-energy bandgap. This enables his semiconductor light-emitters to have an improved performance and a higher temperature load. However, he would like to push the limits even more.

The equipment at Texas Tech will enable Nguyen to test device performance at up to 1000 degrees Fahrenheit. Capabilities like this were a draw for him to join the university in 2023. He was impressed by the research facilities and the opportunity to collaborate with fellow experts within his field of wide- and ultrawide- bandgap semiconductors. Nguyen believes this work will only increase in impact once more undergraduate and graduate students join his lab to gain hands-on experience in the device design, epitaxial growth techniques, device fabrication and characterization of semiconductor devices.

Ashlyn Grotegut
June 6, 2025

Dallas Awarded $2 Million to Help Students Join Semiconductor Workforce

The grant is part of NSF's Scholarship in Science, Technology, Engineering and Mathematics (S-STEM) program.

Principal Investigator and Professor of Electrical & Computer Engineering (ECE) Dr. Tim Dallas sees this as a chance for Texas Tech to make an impact on the semiconductor industry, be it the designing, manufacturing or selling of microprocessors and other integrated circuits. Dallas estimates there could be over $50 billion in new semiconductor fabrication plants (fabs) under construction or nearing construction.

Part of the semiconductor industry's growth may soon be attributed to the U.S. government, which recently acquired a nearly 10% stake in Intel. The company designs and produces microchips for everything from self-driving cars to smartphones and laptops.

Over the course of the next five years, this S-STEM grant will provide scholarships to at least 36 ECE students across three cohorts. Students will also have access to industry mentors and various experiential learning opportunities to better understand the semiconductor industry's needs and environment.

By the end of the project's five years, Dallas and his team hope to generate valuable insights on what makes effective educational experiences for students and present their eventual findings through conferences and journal articles.

This S-STEM grant continues to strengthen Texas Tech's commitment to the growing semiconductor industry. Texas Tech and Dallas received a $3.75 million grant in May by the Defense Advanced Research Projects Agency and the State of Texas. That project focused on launching a Master of Science in Electrical Engineering program specializing in 3D Heterogenous Integration.

Dallas sees both grants as not only preparing students to join the semiconductor workforce but perhaps impacting Lubbock's economy as well. X-FAB Texas, located in Lubbock, is the only fab between cities like Albuquerque and Dallas or Austin. Based in a former Texas Instruments site, X-FAB Texas employs about 400 people covering a wide range of engineering responsibilities.

Jacob Gordon
September 22, 2025

ECE Secures $14M for Advanced Semiconductor Power Devices Program

Funding from the U.S. Department of Defense (DoD) Army Research Laboratory will support the design and fabrication of high-electron-mobility transistors, metal-semiconductor field-effect transistors, and broadband high-efficiency power amplifiers.

These devices will enable improvements in high-power systems for defense, radar and communication applications – strengthening technological capabilities, fostering innovation in semiconductor materials and supporting national security in harsh environments.
In addition, the devices will have industrial applications such as controlling and converting large amounts of electrical energy.

This efficiency will promote overall process productivity through precise and reliable operation of machinery with reduced energy consumption. This could impact motor drives for manufacturing, power supplies for heavy equipment, switchgear in electrical grids and industrial heating systems.

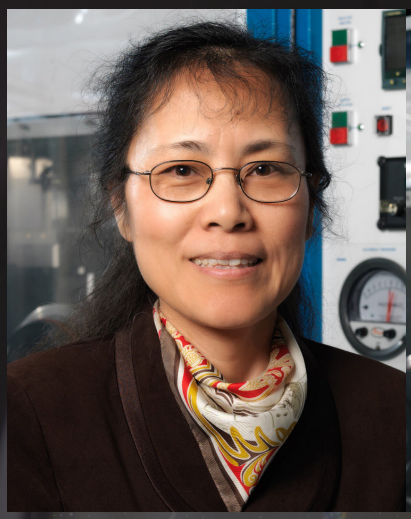
The researchers will conduct comprehensive performance evaluations across various applications, including high-power/high-voltage systems, electronic warfare, surveillance, radar, multifunctional radio frequency communications, sensing, and power electronics for harsh environments. They will emphasize device packaging, failure analysis, heat dissipation and thermal management to ensure robustness and longevity. Additionally, the project will analyze the structure and other qualities of wide and ultrawide bandgap semiconductors, correlating gained insights with experimental results to inform future innovations.

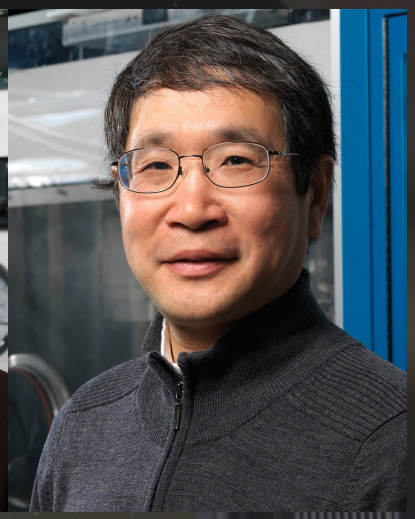
This initiative is led by Dr. Stephen Bayne, Vice President for National Security and the Executive Director of the Critical Infrastructure Security Institute. His team comprises ECE Professors Ayrton Bernussi, Donald Lie and Ravi Joshi; ECE Associate Professors Hieu Nguyen, Brian Nutter; Global Laboratory for Energy Asset Management & Manufacturing (GLEAMM) Senior Director Argenis Bilbao; and Chemical Engineering Assistant Professor Joseph Gauthier.

The program also integrates research and education plans at different levels with Associate Professor Manuel Garcia of Angelo State University and Assistant Professor Pranaya Pokharel of Midwestern State University.

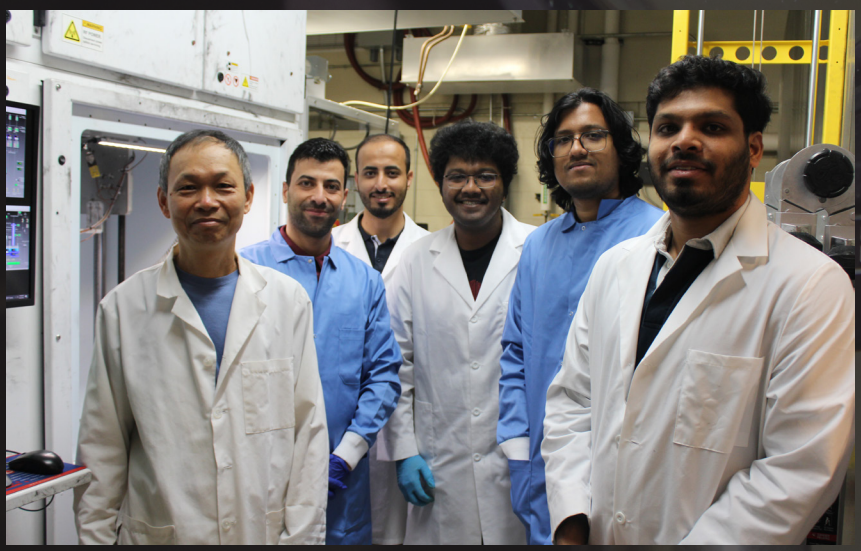
Ashlyn Grotegut
July 22, 2025

Jiang, Lin, and Li Secure Patent In High Energy Laser Technology



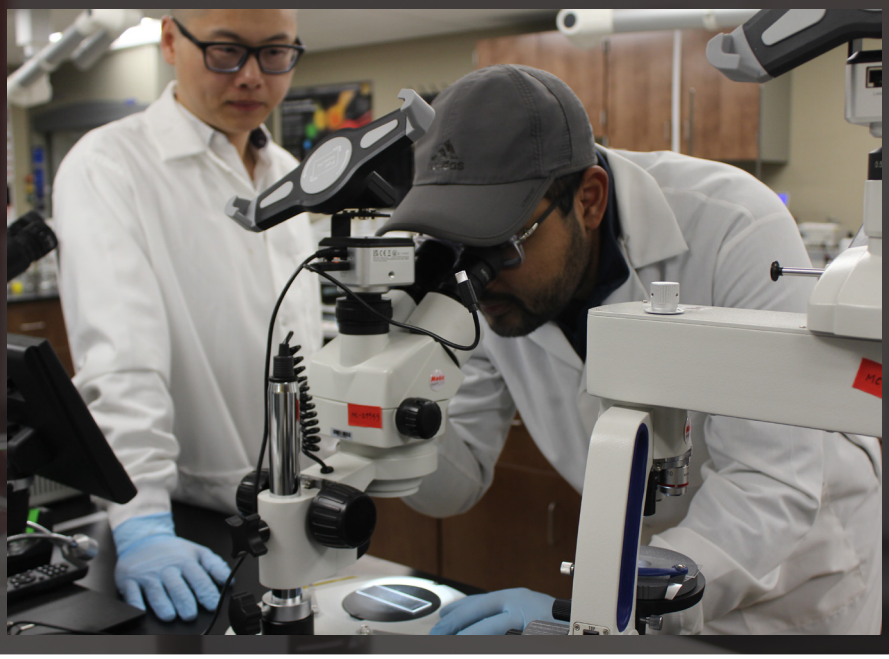


Hongxing Jiang, Jingyu Lin, and Jing Li have secured a U.S. Patent for the Texas Tech University System (TTUS), entitled "Optical Gain Materials for High Energy Lasers and Laser Illuminators and Methods of Making and Using the Same." Their innovation leverages crystals made from erbium doped gallium nitride (Er:GaN), to generate powerful high-quality laser beams at a wavelength that is safer for the eye and more efficient in the atmosphere.



Ashlyn Grotegut
July 22, 2025

Wu and Zeng Awarded NIH Grant to Develop Wearable Cardiac Monitoring Technology



The project, titled "Additive Manufacturing Wearable Magnetic Sensors: Revolutionizing Cardiac Health Monitoring with Machine Learning for Arrhythmia Classification," is led by Dr. Kai Wu, principal investigator and assistant professor in the Department of Electrical & Computer Engineering with co-investigator Dr. Minxiang Zeng, an assistant professor from the Department of Chemical Engineering.

Traditional tools like electrocardiograms (ECGs) measure electrical activity in the heart, but they often fail to capture the full picture of cardiac health. A more advanced method, magnetocardiography (MCG), detects the heart's tiny magnetic fields and can provide more precise information. Current MCG systems, however, are limited by bulky, expensive equipment that requires extreme cooling and shielded environments, making them impractical for routine use.

To address these challenges, the team is developing organic granular magnetoresistive (OgMR) sensors, flexible, low-cost, and highly sensitive devices that can be produced using simple printing techniques. These sensors could be integrated into portable devices or even wearable systems for continuous heart monitoring. The researchers are also creating machine learning models to analyze the data, enabling accurate detection and classification of arrhythmias.

If successful, the research could pave the way for routine, non-invasive monitoring of heart health in clinics, community settings, or through wearable devices. Earlier and more precise detection of abnormal rhythms could lead to better treatment decisions, reduced hospital visits, and lower overall healthcare costs.

Lacy Oliver
August 22, 2025

Wu, Zeng, and Gomez Receive NIH Grant to Advance Multi-Tracer Medical Imaging

The project, titled "Multi-tracer Magnetic Particle Imaging (MMPI): Tracer Design and Multi-tracer Guided Image Reconstruction," is led by Dr. Kai Wu, principal investigator and assistant professor in the Department of Electrical & Computer Engineering. Co-investigators include Minxiang Zeng and Jenifer Pastora Gomez, both assistant professors in the Department of Chemical Engineering.

The research aims to advance a technique called multi-tracer magnetic particle imaging, or MMPI, which could allow doctors to capture multiple biological processes in a single scan. Unlike traditional medical imaging methods that typically observe only one process at a time, MMPI uses specially designed magnetic nanoparticle tracers, each carrying a distinct magnetic signature. When paired with advanced algorithms, these tracers could be separated and analyzed without interference, providing a more complete view of disease progression and treatment response. To validate the approach, the team will use custom 3D-printed phantoms to demonstrate the feasibility of imaging multiple tracers simultaneously.

The project also includes collaboration with Solomon Woods at the National Institute of Standards and Technology (NIST). A graduate student supported through the grant will travel to NIST to conduct imaging experiments.

If successful, the research could not only improve patient outcomes but also enhance biomedical research by offering clearer insights into complex biological processes.
The award reflects growing national interest in advancing non-invasive, high-precision medical imaging technologies.

Lacy Oliver
August 22, 2025

ECE SPOTLIGHT

ECE Unveils New College Robotics Lab

On Friday, July 11, the Whitacre College of Engineering celebrated a transformative gift from Evelyn M. Davies to support robotics innovation and education. In recognition of her generosity, the college has established the new Evelyn M. Davies Robotics Teaching Lab in the Electrical & Computer Engineering building. This will be a dedicated space designed to advance hands-on learning, research, and collaboration in the rapidly growing field of robotics.

ECE Graduate Research Symposium

Dr. Emily Pereira organized and hosted the Inaugural Graduate Research Symposium on Friday, August 22, 2025, which took place in Lankford Lab ECE 101. The event featured 19 graduate student presenters from 12 different research groups within the Electrical & Computer Engineering Department. PhD students Christopher Williams and Victor Gabriel Rizzi Varela, as well as MS student Mason Cole, were recognized as the top presenters for Graduate Research Symposium 2025.

Graduate Student Spotlight

- At the 2025 IEEE International Microwave Biomedical Conference (IMBioC), Dr. Aaron Carman received first place in the Young Professionals Competition. Carman is also a Spring 2025 recipient of the TTU Horn Distinguished Professors Graduate Achievement Award.

- PhD student Hamza Alwan's publication, "Growth and characterization of high-quality Zr doped AlN epilayers," was featured as an Editor's Pick in Applied Physics Letters. The work is supported by DOE ARPA-E's ULTRAFAST program, via a grant awarded to the Center for Nanophotonics directed by P. W. Horn Distinguished Professors, Dr. Hongxing Jiang and Dr. Jingyu Lin.

- PhD students Gaihua Ye and Cynthia Nnokwe are authors on two articles published this year in Nature Communications. Their work is supported by the research lab of Ed and Linda Whitacre Faculty Fellow, Dr. Rui He.

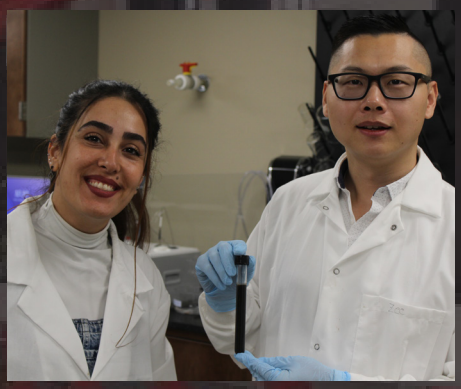
    - Chen, L., Ye, G., Nnokwe, C. et al. Spontaneously formed phonon frequency combs in van der Waals solid CrGeTe3 and CrSiTe3. Nat Commun 16, 5795 (2025)

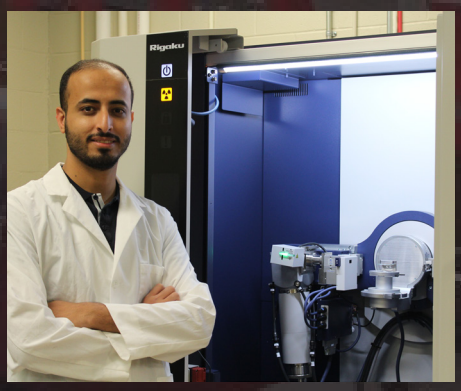
    - Choe, J., Lujan, D., Ye, G. et al. Long-lived zone-boundary magnons in an antiferromagnet. Nat Commun 16, 5486 (2025)

- A recent paper by PhD students Syed Doha Uddin and Christopher Williams was nominated as Finalist for the Best Student Paper Award at the 2025 IEEE International Microwave Biomedical Conference (IMBioC). Their other submission, "Hybrid signal processing framework based on second-order differentiation and harmonic superposition for non-contact heart rhythm monitoring," was the 3rd Prize Winner of the Best Student Paper Award at IMBioC 2025. Uddin and Williams' work is supported by the research lab of Associate Dean of Research and Graduate Programs, Dr. Changzhi Li.

- Congratulations to PhD student, Bahar Rezaei, for her team's paper "Magnetic nanoparticles: A review on synthesis, characterization, functionalization, and biomedical applications," which has been recently recognized as the Top 10% Most Viewed Articles in Small for 2023. It is also one of the Top Cited papers in the journal. Her work is supported by the research lab of Dr. Kai Wu.

- PhD student Clint Sweeney was recognized at the 2025 IEEE Military Communications Conference (MILCOM) for his presentation, "Design and characterization of broadband 5G PAs in 40-nm GaN and 22-nm FDSOI CMOS using NI's VST platform". Under the mentorship of Keh-Shew Lu Regents Chair in Electrical and Computer Engineering, Dr. Donald Lie, this work is partly sponsored by an ARL Instrumentation Grant to TTU, as well as collaboration with National Instruments (now Emerson), and with alumnus Dr. Jerry Lopez's company NoiseFigure Research (NFR).





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