PHYSICS NEWS

Michigan Technological University

1885

DEPARTMENT OF PHYSICS NEWSLETTER VOL. 27

Note from Chair Ravi Pandey

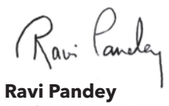
This year, 2025, marks the centenary of the foundational work of Heisenberg, Schrödinger, and Dirac, whose papers from 1925 to 1927 established the mathematically consistent theory of quantum mechanics. To commemorate this significant milestone, 2025 has been designated as the International Year of Quantum Science and Technology, aiming to inspire global scientific institutions to initiate programs and collaborations that promote quantum research, education, and technology worldwide. The importance of this field is further highlighted by the award of the Nobel Prize in Physics to Profs. Clarke, Devoret, and Martinis, which reinforces its significance. Their work established macroscopic quantum mechanical tunneling and energy quantization in electric circuits containing Josephson junctions. These superconducting quantum circuits now form the basis of quantum computers and power advanced technologies, including ultraprecise measurements in fields such as magnetoencephalography (a technique in neuroscience) and specialized imaging in ultra-low-field MRI machines.

Our department has maintained a strong commitment to quantum mechanics research since the 1980s, beginning with significant contributions from Profs. Kunz, Beck, Seel, and Suits. The subsequent arrivals of Prof. Borysow (Atomic and Molecular Physics) and Pandey (Electronic Structure Theory) marked a new era of expansion, bringing significant support from federal and industrial sources. The current quantum research group is highly diversified, engaging in cutting-edge areas such as quantum light-matter interactions (Levy), quantum spin filters (Pati), low-dimensional materials (Yap and Jaszczak), and quantum optics and photonics (Suh and Zhong). Prof. Weidman has been notably impactful in mentoring students for careers in quantum physics. This broad range of teaching and scholarly activities ensures the successful placement of both undergraduate and graduate alumni in diverse academic, federal, and industrial careers.

The commitment of our faculty and students was reflected in numerous successes this year. We are proud to see our students launch their careers: Jonathan Willis is headed to the U.S. Air Force Academy for pilot training, and Nico Cifani is innovating new energy technologies at a startup company in Michigan. Graduate student Ian Norwood (advised by Mazzoleni) secured a prestigious Department of Energy award for aerosol research at Los Alamos National Laboratory. Faculty achievements reflect high-impact science, notably with Profs. Suh, Levy, and Pandey received a $2 million grant from the U.S. Army Research Laboratory to develop future photonic devices. Our strength in atmospheric physics has received international recognition, with Profs. Mazzoleni and Cantrell receiving the 2024 Juan Fernandez de la Mora Prize for their advancements in experimental aerosol science. Additionally, Prof Mazzoleni was named a 2025 Distinguished Professor for his substantial contributions to atmospheric physics. These accomplishments were complemented by the department's successful hosting of the APS Conference for Undergraduate Women and Gender Minorities in Physics.

We recognize that many of these achievements would not have been possible without your generous support and belief in our mission. As you plan your year-end charitable giving, we kindly ask you to consider contributing to the department's endowment (**mtu.edu/physics/giving**). Thank you for your continued support of our efforts in physics education at Michigan Tech.

Best wishes for a joyous holiday season and a happy and prosperous new year,



Ravi Pandey
Professor and Department Chair
Fellow of the American Physical Society
pandey@mtu.edu

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Executive Editor: Ravi Pandey

Managing Editor: Mauricio Reyes Hurtado

Comments to the editor: **mrhurtad@mtu.edu**

Research Spotlight

Assistant Professor Qi Zhong joined the physics department faculty in Fall 2025. His research spans micro- and nano-photonics, quantum optics, and quantum-inspired photonics. In particular, his work explores light propagation and light–matter interactions in micro- and nano-photonic structures, the behavior of single and entangled photons, and the application of quantum concepts within optical platforms.

Zhong received his Ph.D. in Physics from Michigan Tech in 2019. He then conducted postdoctoral research at CREOL, the College of Optics and Photonics at the University of Central Florida, supported in part by the Preeminent Postdoctoral Program. His research there focused on the emerging field of optical thermodynamics, which investigates how weak nonlinearities in multimode optical systems enable interactions between modes, facilitating energy flow, redistribution, and thermodynamic-like behavior. Subsequently, Zhong worked at The Pennsylvania State University, where he conducted experimental research in quantum optics and non-Hermitian electronics. His work involved building a single-photon interferometer that used photon polarization states to explore non-Hermitian physics in the quantum domain, with potential applications in highly sensitive quantum sensors. He later extended these concepts from optics to electronic systems.

At Michigan Tech, Zhong aims to establish both a computational electromagnetic simulation group and an experimental photonics and quantum optics laboratory, focusing on the behavior of light and photons at the micro- and nano-scales to bridge classical optics and quantum science. He plans to utilize the Microfabrication Shared Facility at Michigan Technological University for device fabrication, including 3D printing of optical components. In addition, he will collaborate with ongoing photonics research groups working on metal and semiconductor nanocavities, metamaterials, and metasurfaces. These efforts will contribute to Michigan Tech's growing strength in quantum optics and photonics research.

Dr. Manpreet Boora (Meera) joined Michigan Tech Physics in Fall 2025 as a Visiting Teaching Assistant Professor. She is currently teaching the optics lab, guiding experiments for the quantum optics course, and serving as a workshop instructor for PH2100 - Classical Mechanics.

Meera earned her PhD in Applied Physics from Michigan Tech Physics in 2023 under the mentorship of Dr. Jae Yong Suh. Her doctoral research included synthesis of two-dimensional materials using chemical vapor deposition (CVD) techniques, fabrication of nanostructures to study plasmon-exciton coupling, thin film transfers, and investigations of dispersion relations in 3D chiral nanocubes.

She was a recipient of the NSF-supported 2-Dimensional Crystal Consortium (2DCC) Resident Scholar Visitor Program (RSVP) fellowship which led her to work in Penn State Materials Research Institute (MRI) on fabricating twisted bilayers of transition metal dichalcogenides (TMDs) and using Raman spectroscopy to probe interlayer phonons. After her PhD, she worked at Athinoula A. Martinos Center for Biomedical Imaging at Massachusetts General Hospital in Boston before joining Intel as a Module Development Engineer in the Logic Technology Development (LTD) module for Metals. At Intel, she worked on developing processes for semiconductor manufacturing and driving improvements in yield, efficiency and process integration.

Looking ahead, Meera is excited to develop engaging, hands-on learning opportunities in quantum optics, mechanics, and materials physics and integrate her research expertise into teaching, bridging materials science and optics to inspire innovative student projects. She is also eager to continue her research in materials science and optics and explore new avenues utilizing AI/ML-driven materials discovery.

Meera finishing a 7-mile, 900 ft hike at Smith Rock State Park in Oregon.

Graduate Spotlight

Yi Zhi Chu is a PhD candidate working with Prof. Ravindra Pandey. He joined Michigan Tech in Fall 2021. His research area focuses on theoretical and computational modeling of materials using first-principles atomistic simulations, including Density Functional Theory (DFT). Yi Zhi spent the Fall 2022 semester at Los Alamos National Laboratory working on the modeling of photocathode materials. Since Spring 2023, he has been working as a visiting PhD research assistant, co-advised by Prof. Kah Chun Lau, at California State University, Northridge (CSUN), on a U.S. Department of Energy (DOE)-funded collaborative project studying the hydrogen storage application of a novel material known as MXene. He co-authored several papers predicting the structural and electronic properties of materials, including scanning tunneling spectroscopy (STS) spectra, as well as their hydrogen storage properties and capacities using revised quantum-thermodynamic models. He has also presented his research findings at multiple international conferences, including the American Chemical Society (ACS) and American Physical Society (APS) meetings, as well as the International Conference on Materials for Advanced Technologies (ICMAT) in Singapore. He was awarded the prestigious merit-based Ovshinsky Student Travel Award at the APS Global Physics Summit 2025 by the APS Division of Materials Physics (DMP) and an honorary mention of the ACS Division of Energy and Fuel (ENFL) Student Travel Award in 2024.

From left to right: Mukesh Choudhary, Tong Gao, Casey Aldrich, Jester Itliong, Alyssa Horne, Yi Zhi Chu, Siddharth Karkhanis, Rishi Babu.

Alyssa Horne is a PhD candidate in Physics at Michigan Technological University, working with Professor Ranjit Pati. She joined MTU in Fall 2021, and her research focuses on modeling quantum phenomena in low-dimensional materials using density functional theory for spintronics applications. During her first three years, she investigated a quasi-one-dimensional van der Waals crystal that is an intrinsic ferromagnetic semiconductor. Through compositional change, her team discovered the first predicted quasi-one-dimensional van der Waals ferromagnetic half-metal, published in *The Journal of Physical Chemistry C* on June 10. Currently, Alyssa is exploring other low-dimensional quantum materials, with a particular interest in artificially designing one-dimensional magnets and studying altermagnetism. Outside of her research, she has helped foster an open and welcoming community within the Physics Department. Last spring, she co-organized the 2025 Conference for Undergraduate Women and Gender Minorities in Physics (CU*iP) at MTU, which brought together a diverse group of undergraduates to explore their potential as physicists. She now serves as the Physics Write-D facilitator, where she helps build a supportive writing community among graduate students.

Undergraduate Spotlight

Andrew Konop is a senior at Michigan Tech pursuing a degree in physics with a minor in mathematical sciences. He is actively involved in undergraduate research in the Environmental Optics Laboratory, where he works with Dr. Claudio Mazzoleni and Dr. Jacek Borysow on improving photoacoustic detection methods for aerosols using Fabry-Pérot optical cavities.

Within the physics department, Andrew serves as the President of the Society of Physics Students (SPS), organizing academic and social events and connecting students with departmental opportunities. His service also includes working with the Demonstration Crew, preparing and presenting physics demonstrations for lectures and facilitating learning workshops, and as a coach in the Physics Learning Center (PLC), providing one-on-one tutoring. Andrew has been recognized as the Physics Departmental Scholar for the class of 2026 and a fellow of the Elizabeth and Richard Henes Center for Quantum Phenomena.

Andrew plans to pursue graduate studies in optics, atmospheric science, or environmental physics, with an ultimate goal of teaching at the collegiate level, driven by his enjoyment of working with undergraduates. In his free time, he enjoys biking, skiing, playing board games, and spending time with his significant other, Arry.

Staff Spotlight

Administrative Aide Jae Jeong Lee (JJ Lee) joined the Physics Department in December 2024. Her responsibilities include managing administrative tasks related to the departmental graduate program, which requires a solid understanding of university policies and procedures concerning graduate students. She also processes financial operations, manages departmental accounts—including general and research funds—and coordinates departmental events.

Prior to joining the department, JJ worked at the Swedish Trade & Invest Council, part of the Swedish Embassy in Korea, beginning in 2001. She served as a Project Manager for 12 years, where she was responsible for financial management, market analysis of Sweden–Korea business relations, business partner search and management, and writing reports on business opportunities between the two countries.

In her free time, JJ enjoys watching cooking shows, reading cookbooks, and exploring literature.

Alumni Spotlight

Suresh Sampath is currently a Fellow at Atomica Corporation, which is a Micro Electro-Mechanical Systems (MEMS)/ Semiconductor foundry based in Santa Barbara, CA. Suresh received his Ph.D. from Michigan Tech in December 1998 for his study on Spinel oxides. He began his work under the guidance of James Cordaro, focusing on the experimental synthesis and characterization of Spinel oxides. He then completed his graduate research under the supervision of Prof. Ravi Pandey, utilizing simulations to explain some of the experimental findings, which led to multiple publications.

After graduation, Suresh joined a research engineering position at NJIT in February 1999 to develop MEMS devices as part of the NJ MEMS initiative that was launched to explore new sensors. MEMS is an interdisciplinary area that requires science and engineering to create products, as it utilizes the mechanical and material properties of substrates like Si through standard semiconductor processing techniques. After gaining expertise in fabricating MEMS/Semiconductor devices, he took on a process development engineering position at an optical MEMS startup near Los Angeles, where he was involved in developing MEMS-based etalon and Fabry-Pérot devices. He later moved to Santa Barbara in late 2001 to take up a Process engineer position at Innovative Micro Technology, which was later renamed as Atomica. Here, Suresh used his experimental Physics background, along with semiconductor processing skills, to develop new thin-film and dry-etch processes for various products. He then managed the thin film and dry etch group for nearly five years before taking on a technical program manager role. He led over eight programs from proof of concept to commercialization in this role. He was promoted to the Director of Development role, which involved supervising other engineers and mentoring new staff members. His current designation as Fellow is the highest engineering position in the company's technical ladder, and he leads some of the larger programs that are heading towards mass production. The greatest satisfaction in his current role is enabling customer success by bringing their ideas to life through innovation and rapid prototyping. His pet projects include a gas sensor that detects methane, a mass sensor capable of detecting bacteria, an accelerometer for oil exploration, and a laser submount for an optical transceiver in a data center application. His work resulted in multiple patents and publications on MEMS fabrication methods and thin film development. Being hands-on, working hard, and creating manufacturable processes are some of the key attributes that contributed to his success.

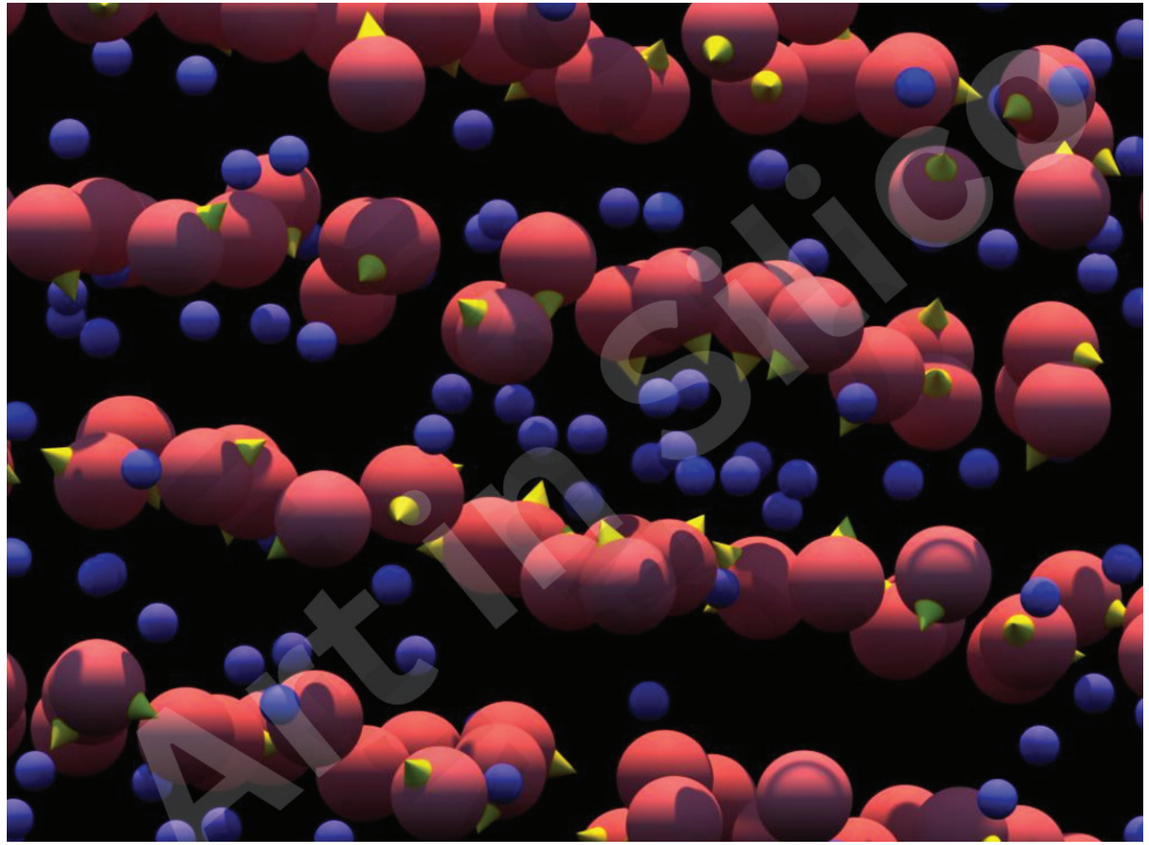
Suresh enjoys sports, nature and spending time with family & friends. He also volunteers and participates in local community events.

Dr. Dean Thelen is a Senior Staff Scientist at Corning Research & Development Corporation, where he applies his deep expertise in physics and electrical engineering to develop next-generation technologies.

Dean began his academic journey at Michigan Technological University, earning his B.S. degree in applied physics and electrical engineering in 1988, which was recognized by the Ian W. Shepherd Award from the Physics Department. He went on to receive his Ph.D. in Solid State Physics from the University of Illinois at Urbana-Champaign in 1993. His doctoral thesis, focused on 'The magnetic properties of the cuprate superconductors' under Prof. David Pines, contributed to fundamental research in superconductivity and resulted in a publication in *Physical Review (PRB 47, 9151(R) 1993*).

Throughout his career, Dean has published several research papers in high-impact journals and holds an impressive portfolio of 27 US patents. A recent highlight of his work involves collaborative modeling studies to design a transparent, antimicrobial nanostructured copper surface. This work has significant potential for use in public and personal touch-enabled displays, enhancing hygiene and safety (*Nature Communications Materials 5, 39 (2024)*).

Dean's contributions to both fundamental science and industrial innovation exemplify a successful transition from academic research to applied technology development.



"Dance of Domains" LAMMPS Molecular Dynamics software and OVITO Visualization Tool

by Jester Itliong

Technical Description: This in silico artwork is a snapshot of a simulation of a coarse-grained ethylammonium nitrate ionic liquid system. It illustrates the possibility of microphase separation in a pure and homogeneous ionic liquid, where the ethylammonium cations (large red spheres with yellow arrows) and the nitrate anions (small blue spheres) segregate into layered domains. It was hypothesized that this scenario occurs when the asymmetry between the sizes of the ions in the liquid is high and when the liquid is composed of polar parts (i.e., ethylammonium cations, yellow arrows represent polarity) and non-polar parts (i.e., nitrate anions, absence of arrows means no polarity). Nevertheless, the major driving force for microphase separation in ionic liquids remains largely mysterious, and thus it has become the focus of ongoing research.

Artist's Statement: "The Dance of Domains" is a vibrant digital artwork that explores the intricate and mesmerizing patterns that emerge from the phenomenon of microphase separation. The black background illuminates the alternating layers of pale red and electric blue colors. The perfectly spherical shapes with added shadows create a flowing illusion that seems to weave its way through space. The pointing arrows establish an intricate choreography that results in either bold or dramatic outcomes. The overall effect is one dynamic movement that is alive and pulsing with energy. "The Dance of Domains" is a celebration of the beauty and complexity of microphase separation, a reminder that even the most microscopic of realms hide hidden beauty and elegance waiting to be discovered.

Artist Biography: Jester is a PhD candidate in the Physics Department at Michigan Tech. He was born and raised in Manila, Philippines, where he discovered his passions for science and art. He was the first in his clan to finish college and the first to pursue graduate studies. He may be considered the first and only scientist in his family. He taught at two universities in the Philippines before starting his doctorate. He loves to sketch and sings a variety of music genres during his spare time. He is always in awe of the existence of symmetry in physics and art.

Awards and Achievements

Faculty and Staff Recognition

Jesse Nordeng retired after nearly 20 years of service.

Claudio Mazzoleni was named *Distinguished Professor for 2025*.

Kartik Iyer received the *Fall 2024 Research Excellence Fund (REF) award*.

Claudio Mazzoleni and **Will Cantrell** were recipients of the *2024 Juan Fernandez de la Mora Prize* from the *American Association for Aerosol Research*.

Issei Nakamura was selected for the *Dean's Teaching Showcase* by Dean LaReesa Wolfenbarger.

John Jaszczak and the mineral named after him (jaszczakite) were featured in *Rocks & Minerals* journal.

Tiffany Lewis and **Jacek Borysow** assisted *Women in Physics (WiP)* in hosting the *2025 APS Conference for Undergraduate Women in Physics (CUWiP)* at Michigan Tech.

Student Awards and Achievements

Outstanding Scholarship Awards:

- *Fall 2024:* Nithin Allwayin (Shaw), Shreya Joshi (Mazzoleni), Jeffrey Kabel (Yap)
- *Spring 2025:* Seth Nelson (Levy), Rhiannon Turner (Huentemeyer)

Outstanding Student Teaching Award: Casey Aldrich (Fall 2024) and Tanner Sether (Spring 2025).

Finishing Fellowships: Nithin Allwayin (Shaw), Samuel Groetsch (Huentemeyer), Jeff Kabel (Yap), Shreya Joshi (Mazzoleni), Seth Nelson (Levy), Rhiannon Turner (Huentemeyer).

Fellowships and Scholarships:

- *GEM Fellowship:* Daniel Watson (Levy)
- *KCP Fellowship:* Alan Larson (Pati)
- *Henes Fellowships:* Nithin Allwayin (Shaw), Seth Nelson (Levy)
- *Miles Fellowships:* Samuel Groetsch (Huentemeyer), Jeff Kabel (Yap)
- *DOE SCGSR Award:* Ian Norwood (Mazzoleni) – research at Los Alamos National Lab

Poster and Oral Presentation Awards: Raksha (Yap) and Nilanjana Ghosh (Huentemeyer).

MSGC Awards: Ian Norwood (Mazzoleni) and Tanner Sether (Giusarma).

WiP CUWiP Conference 2025 successfully hosted at Michigan Tech.

Departmental Scholar: Andrew Konop.

Ian Shepherd Award: Austin West and Grant Schlaff.

Elizabeth Henes Award (outstanding graduating woman): Estyn LaMotte.

Recent Funding

Tiffany Lewis (Physics/EPSSI) is the principal investigator (PI) on a project that has received a $49,776 research and development grant from the National Aeronautics and Space Administration (NASA).

The project is titled "Models & Simulations for Blazar Polarization in Gamma-Rays with COSI."

Petra Huentemeyer (Physics/EPSSI) is the principal investigator and **Tiffany Lewis** (Physic/EPSSI) is the co-PI on a project that has received a $150,000 research and development grant from the National Science Foundation.

The project is titled "WoU-MMA: Tracking Cosmic-ray Dynamics in our Galaxy by Combining HAWC with Multi-Messenger Data."

Ravi Pandey, Jae Yong Suh, and **Miguel Levy** received a *$2 million U.S. Army Research Office grant* for work on polaritonic quantum structures.

Elena Giusarma received an *NSF MRI award* for a *GPU-accelerated cluster* to support research, training and outreach ($432,075).

At the CERN Science Gateway. From left to right: Josh Rolfe, Estyn LaMotte, Rita Wilson, Grant Schlaff, Daniel Barr, Josiah Jahncke, Rose Harvey, Lucas Hetrick, Nico Cifani, Cooper Chiarino.

Senior Trip

Michigan Tech Physics Seniors' Swiss Adventure and European Excursion

The Michigan Tech Department of Physics senior trip took students on an unforgettable journey to Switzerland. The adventure began and ended at CERN, where students toured both modern and historic laboratories and explored the world-renowned public exhibits. Between these scientific highlights, they immersed themselves in the culture and scenery of the region—exploring Geneva, Bern (where Einstein lived during his annus mirabilis), Zurich, and even crossing the border to Lyon, France. Along the way, they also experienced Switzerland's natural beauty in Interlaken, where many challenged themselves on the area's extensive hiking trails.

Thank You!

We extend our deepest appreciation to our friends and alumni who have made recent gifts or pledges to Michigan Tech. As always, we appreciate your continued interest in the Department of Physics at Michigan Technological University.

Did we miss your contributions? If so, please contact **physics@mtu.edu**

Gary P. Agin

Edward Augustyniak ‘94 & Monika Sujczynska

Ramakrishnan Bashyam ‘96 & Harini Sampathkumar

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Susan Causey

Russell ‘63 & Joan Compton

Paul ‘73 & Leslie Cupal

Thomas ‘63 & Judith (dec) Essig

Eugenia & John ‘50 (dec) Evans

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James ‘66 & Kathleen Kortge

Thomas ‘84 & Renee Kugler

Jack ‘62 & Kaethe Labo

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Miguel & Anita Levy

Joanne & Paul ‘71 (dec) Michaels

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Thomas ‘76 & Margaret Mohr

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Glen J. Tauke ‘72

Steven L. Tomsovic ‘80

C. John ‘64 & Kathryn Umbarger

Roger ‘66 & Linda Urbaniak

SriramaSwaminat Venkataraman ‘98 & Kalpana Chandrasekharan

William ‘78 & Kathleen ‘77 Wilson

LaReesa L Wolfenbarger

David E. Woon ‘84

William E. Wuerthele ‘66

Crystal Zhou ‘09 & Phillip Huang ‘07

Michigan Technological University

Physics News
1400 Townsend Drive
Houghton, Michigan 49931-1295

The Department of Physics' 2025 senior class. Back row from left to right: Robert Standen, Jonathan Willis, Austin West, Grant Schaff, Josiah Jahncke, Josh Rolfe, Lucas Hetrick. Front row from left to right: Cooper Chianino, Estyn LaMotte, Nico Cifani, Rita Wilson, Rose Harvey, Daniel Barr, Devon Miner.

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