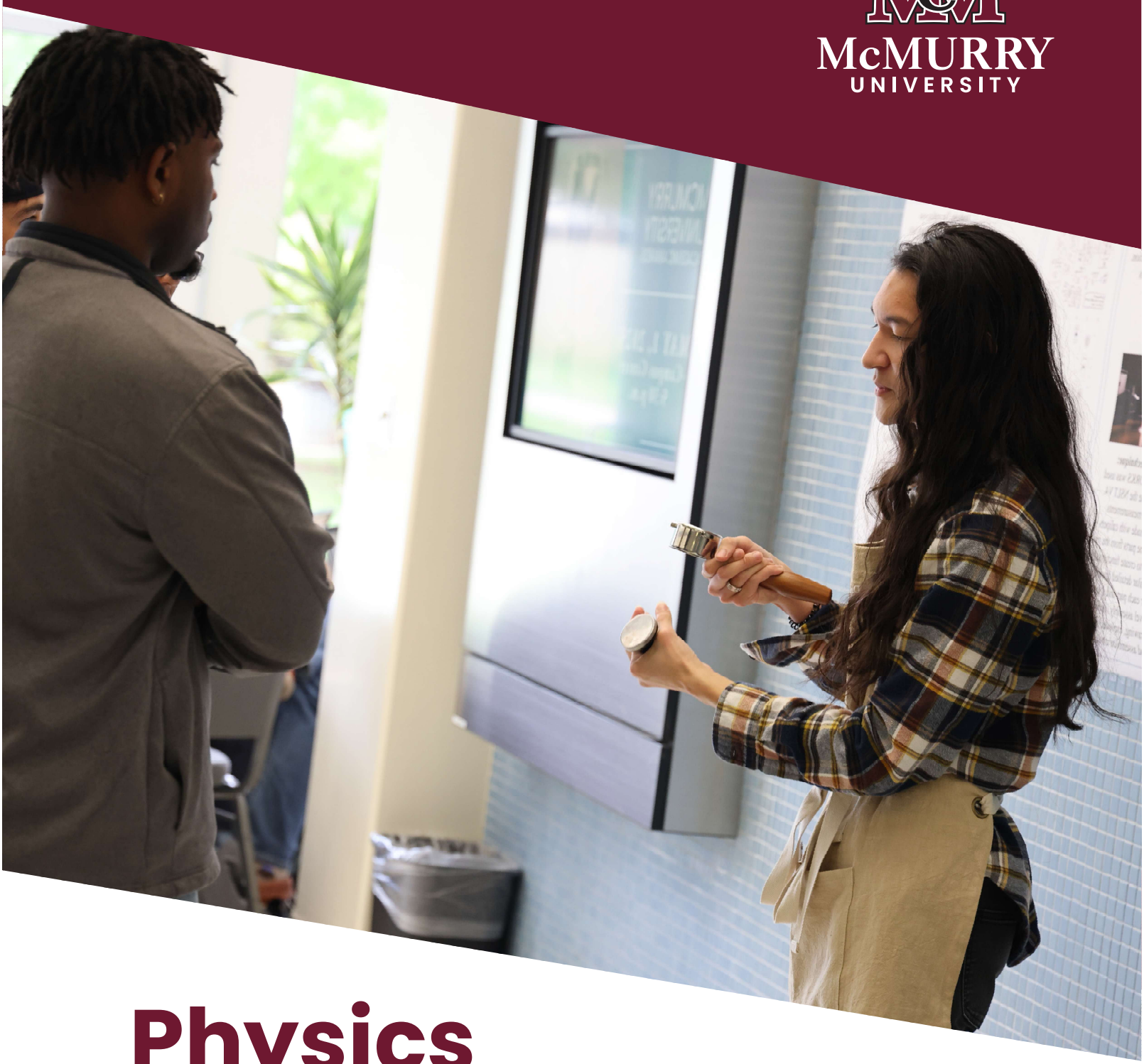
McMURRY UNIVERSITY



Physics Newsletter

2024 - 2025

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Dear Friend

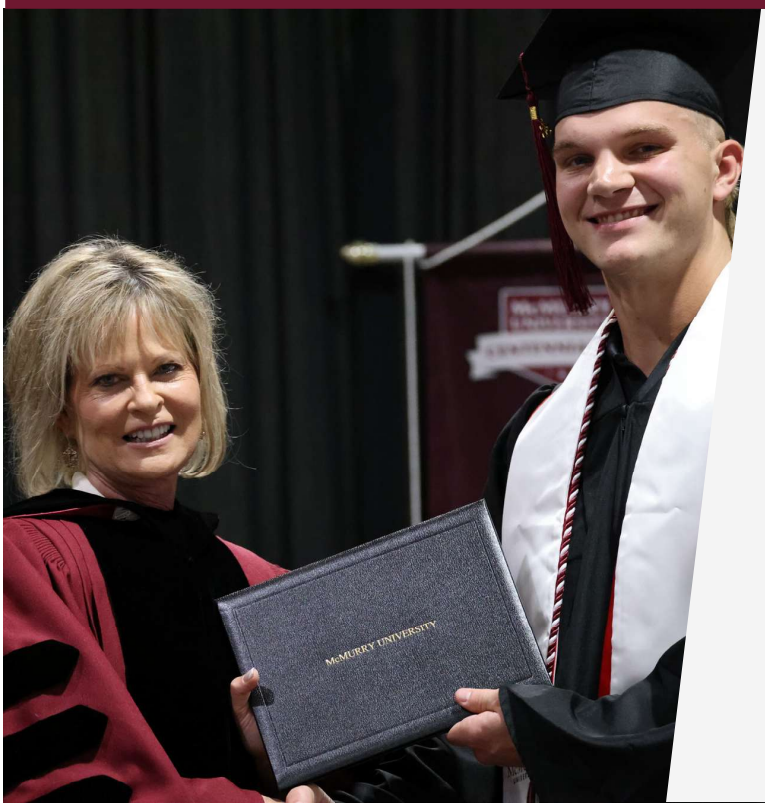
Greetings from the Physics Department at McMurry University! With this newsletter, we are pleased to share updates and highlights from the past academic year. We have two graduates this year. One graduated in December, and another in May.

Senior Student Showcase

Isaiah Alvarez

HOMETOWN: ABILENE, TX

Isaiah Alvarez is our first graduate for the Engineering Physics degree. He completed a senior research project titled "Recycling Revolution: Building a Plastic Bottle Shredder," under the guidance of Dr. Wayne Keith. His project aimed to tackle plastic waste by designing and constructing a specialized shredder for polyethylene terephthalate (#1 plastic), the material most commonly used in disposable water bottles. The end goal was to consistently produce uniform plastic strips between 1.5" and 2" in length, which can then be sold to recycling companies for further processing. Isaiah's project blended engineering, environmental responsibility, and entrepreneurial thinking, demonstrating a practical application of his academic background. The picture shows Isaiah presenting his project to the public in late fall. We are grateful to the Science and Math Advisory Board for supporting Isaiah's project with one of the 2023-2024 Charles and Lisa Bloomer's Student Research Stipends.



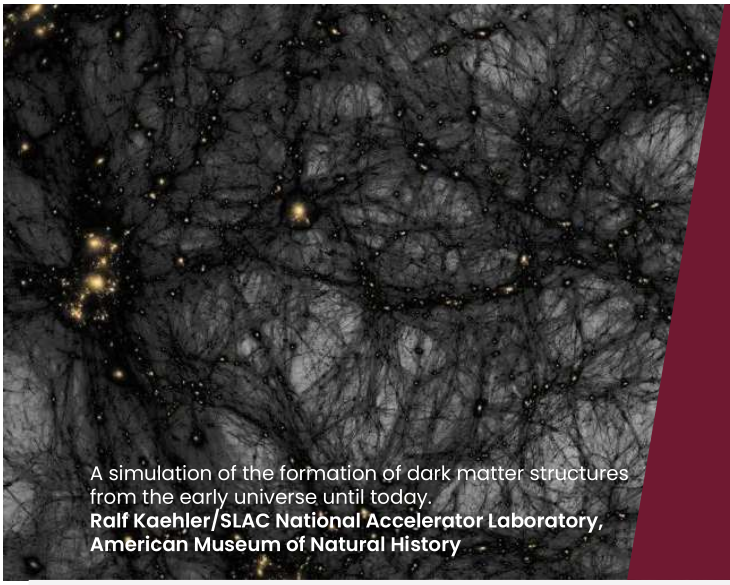
Kane Strohman

HOMETOWN: KATY, TX

Kane Strohman, also majoring in Engineering Physics, completed a senior research project that addresses water accessibility and sustainability. His project, titled "Off-Grid Solar-Powered Rainwater Purifier," focuses on the development of a self-sufficient water purification system designed to operate independently of conventional power and water infrastructure. With mentorship from Dr. Wayne Keith during the proposal phase and Mr. David Upshaw throughout the project execution, Kane engineered a device capable of collecting, purifying, and storing rainwater for safe drinking.

Kane's commitment to leadership and service is reflected not only in his academic pursuits but also in his extracurricular involvement—as captain of the McMurry University Football Team and President of the Ko Sari Men's Fraternity. These roles underscore the qualities that align with his career ambition of becoming a U.S. Navy SEAL Officer. Kane was recognized as the 2025 Outstanding Physics Graduate, and his name was engraved on a plaque honoring all outstanding physics graduates, displayed in our Physics Department display cabinet.

Junior Research Proposals



A simulation of the formation of dark matter structures from the early universe until today.
Ralf Kaehler/SLAC National Accelerator Laboratory, American Museum of Natural History

Hailie Brown

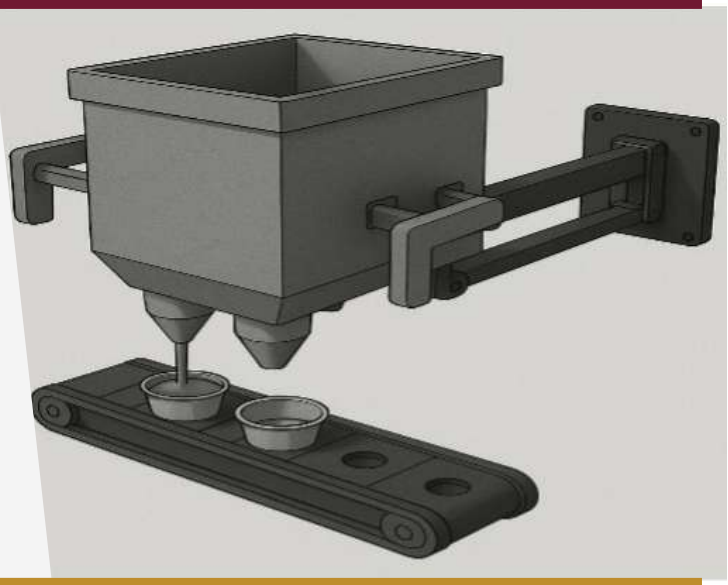
HOMETOWN: GIG HARBOR,WA

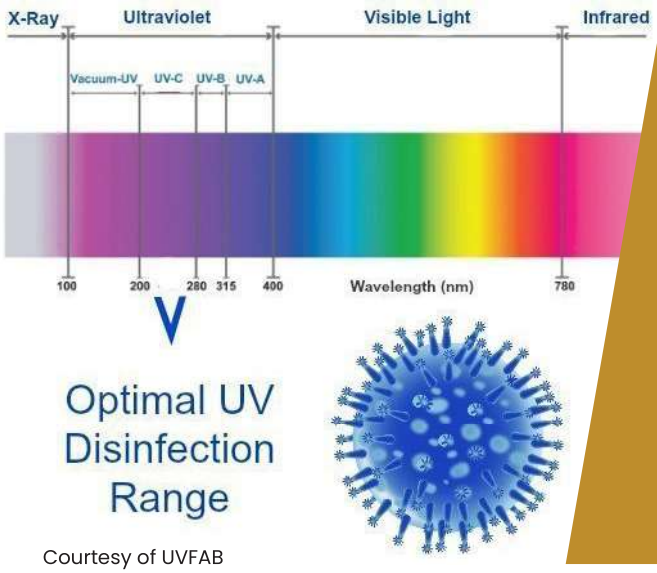
Hailie Brown's senior research proposal, titled "Dark Matter" and supervised by Dr. Wayne Keith, is an investigation based on the literature review into one of the least well known components of the universe. With this project, Hailie will focus her study on the fundamental question that has intrigued physicists for nearly a century: what is dark matter, and how does it operate within the cosmos? Hailie hopes her project will help her to be become better prepared for a future career as an astrophysicist or particle physicist.

Victor Huerta

HOMETOWN: ACUÑA, MEXICO

Victor Huerta, advised by Dr. Timothy Renfro, proposed an engineering project titled "Salsa Dispenser" for his senior research. The goal of the project is to design and construct a semi-automated salsa dispensing machine to enhance efficiency, consistency, and sanitation in fast-casual restaurant environments, such as Rosa's Café. Victor wants to find a cost-effective solution that is rooted in practical engineering and restaurant operations.





Courtesy of UVFAB

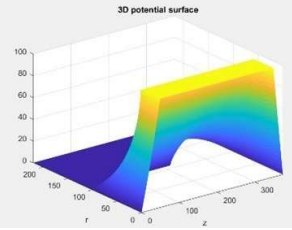
Dustin Volk

HOMETOWN: SPRINGFIELD, OR

Dustin Volk's, advised by Dr. Wayne Keith, senior research proposal aims to address the critical issue of surgical site infections (SSIs), which affect approximately 5% of surgical patients, often due to bacteria introduced by operating room staff. Recognizing the limitations of existing sterilization methods, Dustin proposes a specialized "Decontamination Booth" utilizing rotating, skin-safe 222nm UVC light technology, chosen specifically for its efficacy in rapidly destroying bacteria without harming human skin. Dustin anticipates broader applications for the booth, suggesting potential adoption in manufacturing and biotechnology clean rooms to further minimize contamination risks, ultimately aiming to significantly reduce postoperative infections and enhance patient safety outcomes.

Electricity and Magnetism II

As part of the "Electricity and Magnetism II" course offered by Dr. Bykov, Marie Ange Uwituze and Matthew Pyle worked on a project to find a numerical solution for the 2D Laplace equation in cylindrical coordinates. Their task was complicated by geometric intricacies and the presence of dielectric materials interfaces. Consequently, the students employed three distinct numerical methods, the Jacobi Method, Gauss-Seidel Method, and the Successive Over-Relaxation (SOR) Method—to systematically determine the most efficient technique. The students effectively communicated their methodology, results, and conclusions during their presentation at the McMurry Symposium for Student Research, Scholarship, and Creative Works in late April. Their presentation emphasized both the importance of theoretical understanding and the practical engineering relevance of their study.

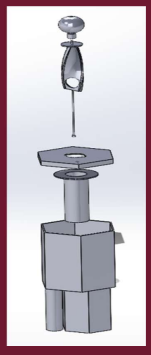


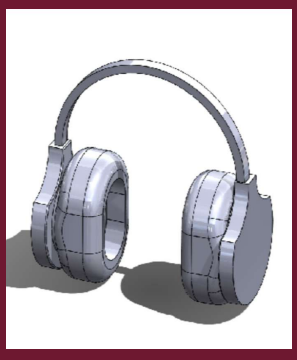
Advanced Physics Lab

In the Advanced Physics Lab, a group of students worked on a project to study airflow dynamics for different shapes placed in a wind tunnel built by Mr. Austin Wegner '11. After many years of sitting on the top shelf in the stockroom, the tunnel has found its second life.

CAD

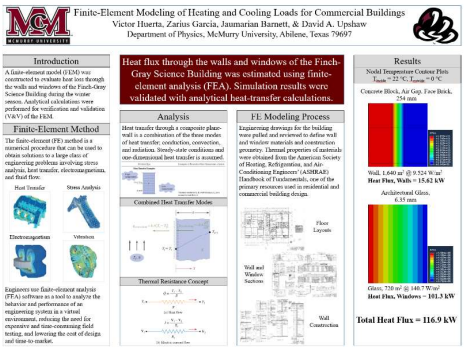
In the CAD course offered by Mr. Upshaw, each student worked on their own small engineering projects, where for each project parts were designed and assembled in the SolidWorks engineering CAD software. The projects ranged from a spring-loaded coffee tamper to a golf ball washer and noise cancelling headphones. Most of these projects were presented as posters at the McMurry Symposium.





Curriculum Updates

Substantial changes were made to our curriculum in the last two years, where using MATLAB programing software package has become a standard practice for numerical solutions and visualizations for many of the homework problems and computational projects in a number of upper division physics courses. We are grateful to the Ward-Bottom Science Fund for supporting MATLAB software purchase and renewals that made these innovations possible. We have also used the support of the Ward-Bottom Science Fund to purchase yet another important software package, "Abaqus."


Finite-Element Modeling of Heating and Cooling Loads for Commercial Buildings
Victor Huerta, Zarius Garcia, Jaumarian Barnett, & David A. Upshaw
Department of Physics, McMurry University, Abilene, Texas 79697
Introduction
Heat flux through the walls and windows of the Finch-Gray Science Building was estimated using finite-element analysis (FEA). Simulation results were validated with analytical heat-transfer calculations.
Results
Analysis
Finite-Element Method
FE Modeling Process
Combined Heat Transfer Modes
Thermal Resistance Concept
Total Heat Flux = 116.9 kW

"Abaqus" is a finite element analysis (FEA) computer aided engineering (CAE) software that was used in the new FEA engineering course that was offered for the first time by Mr. Upshaw this spring. Three students, Jaumarian Barnett, Zarius Garcia, and Victor Huerta, who took this course, used the software to perform heating and cooling load analysis of the McMurry Science Building. We hope this analysis can be used in the future to improve the building's heating and cooling efficiency. The results of this project were presented by the students as a poster at the McMurry Symposium in April. Another student project was completed as part of the Automated Experimental Measurements course offered by Dr. Renfro in the fall. For this project, a group of students bult an automatic dog feeder.

Department Updates

The entire curriculum of the Engineering Physics degree has been pilot tested and placed on a regular course rotation now. The process was finished this spring with the last "Finite Element Analysis" course offered for the first time. The number of students in this program continues to grow and the first two graduates finished the program this year. These two students still came in under the old pre-engineering physics focus. But next year, we expect the first graduates who started the program with the first Engineering Physics class in 2022.

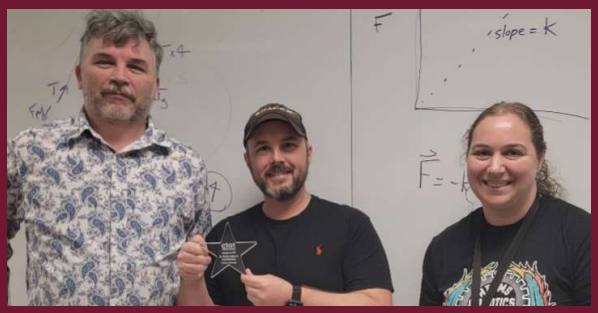
This year, we have also continued with the STEM-Scholars Program, sponsored by the National Science Foundation. Two engineering physics students were selected to participate in the program when it started, and they have now finished their second year at McMurry. Another three physics and engineering physics students were designated as STEM scholars and finished their first year this spring. Four physics students received the Ward-Bottom Science Scholarship this year. Both programs are unique opportunities to make a McMurry University education more affordable and accessible to students in need. We still have open spots to either become a STEM scholar or a Ward-Bottom scholar next year. If you know any prospective students who might be interested in our degree offerings and need additional scholarship support, please direct their attention to the McMurry Physics Program.

This is also the last year of funding that was available to us through the Title V "Building STEM Success" US Department of Education grant. This summer, we will be outfitting our upper-division physics spaces (rooms S119 and S120) with additional screens and video cameras that will be able to track a presenter. We have also been working on upgrades and purchasing new tools for the physics machine shop. We are grateful to the Ward-Bottom Science Fund for being able to support some of these upgrades.

SPS Chapter News 2024-2025

This year, our Society of Physics Students (SPS) chapter stayed busy as always. During the Homecoming Festival, several student clubs participated in activities to promote McMurry science programs to the general public. In the pictures, SPS chapter members are shooting the Physics Trebuchet and launching plastic rockets during the Homecoming festival.

On November 8th, the Physics Department and the SPS hosted the Abilene Independent School District (AISD) "Cardboard Boat Building Competition" building day on the McMurry campus. This is the third year in a row that AISD has chosen to hold their event on our campus. This year, Dr. Tikhon Bykov and Mr. David Upshaw were recognized (see the picture) with the AISD crystal star award for their continuous commitment to supporting this event. The award was presented by science teacher and McMurry graduate, Denae Volk '22. During the



competition, one of the SPS members, Alex Smith, made a presentation (shown in the picture) to middle and high school students focused on physics and engineering of naval ships.

Our Science Christmas Tree went up as usual just before Thanksgiving break. Pictured SPS students are Elijah Gregory, Hailie Brown, Marie Ange Uwituze, Dustin Volk, Alex Smith, Christian Hernandez, and Mr. David Upshaw after finishing putting decorations on the tree.

Once again, the SPS National Office recognized the McMurry SPS Chapter as an Outstanding Chapter for the 2023-2024 academic year. This is the sixth time in a row that the SPS National Office has recognized our students. We are honored to be recipients of these awards. The SPS Chapter has also been recognized by McMurry University with a Wally award as an Outstanding Student Organization for the 2024-2025 Academic Year. The Physics Department is especially grateful to Mr. Dustin Volk, who served as the chapter vice-president this year. Dustin worked hard to organize the AISD boat building event, watched over other students in the chapter, and helped work on the machine shop upgrades. The department has instituted a new student award to recognize an outstanding McMurry SPS Chapter Leader. That award went to Dustin this year.

Summer Internships

Throughout the academic year, our SPS chapter hosted several invited speakers. Last summer, for the second time, Ms. Marie Ange Uwituze participated in the "Nuclear Research Experiences for Minority Students in Texas (NREMST)" program at the University of Texas at Arlington. Once again, she worked in their laboratory for Neutrino and Rare Events Search. She presented her summer internship at a SPS meeting in the fall. This year she worked on instrumentation related to the Deep Underground Neutrino Experiment (DUNE). Her work involved troubleshooting and refining the innovative Q-Pix pixel-based readout system, designed to replace traditional wire-based detection methods by offering significantly enhanced precision, simplified integration, and reduced power consumption. Reflecting on her internship, Marie expressed appreciation for the diverse and dynamic nature of hardware-based research, acknowledged the steep learning curve of handling specialized equipment and software, and highly recommended this internship program to fellow students.

Another senior physics student, Mr. Elijah Gregory, presented his summer internship that he completed at ADIT Electron Tubes company (a subsidiary of Ludlum Instruments) in Sweetwater, TX. Elijah's summer internship involved extensive hands-on experience with photomultiplier tubes (PMTs), which are devices used for precise detection of radiation, widely employed in radiation monitoring, medical imaging, and security systems like TSA scanners. His experience involved substantial problem-solving, data collection, and analytical work, particularly with instruments like oscilloscopes, multimeters, and specialized software, and involved independent learning under the mentorship of several ADIT Tube employees.

We have several students who are doing internships this summer, and we are looking forward to learning what they did when they come back in the fall. Marie Ange Uwituze is participating in the Compact Muon Solenoid (CMS) summer internship program managed by the Cornell Laboratory for Accelerator-based Science and Education. She is working on the team that analyzes the Higgs Boson data from CERN, trying to improve the CMS muon trigger. John Tran is participating in a different summer internship, but also with the CMS experiment. His internship starts in Fermi Lab and will continue at the University of Maryland, College Park. Congratulations to all our students who will be participating in internships this summer!

Homecoming and Alumni Presentations

Our Homecoming Reunion event took place on November 1, 2024. The event was well attended by alumni, current and former faculty, and students. The invited speaker this year was Dr. Morris Baker '63. Dr. Baker received a BA in Biology from McMurry in 1963, an MEd from Harvard University in 1970, and a PhD in Clinical Psychology from Ohio State University in 1976. He was a Psychology professor at McMurry from 1983 to 1994. During the centennial celebration in 2023, Dr. Baker was awarded an Honorary Doctor of Education from McMurry. In his talk, he reflected on his past experiences at the university, as a student when university was less than 40 years old and as a faculty member when it was around its 60th anniversary. This year, Homecoming will take place during the weekend of October 10-12. Please mark your calendars and watch your email for additional details on the Science and Math Homecoming Reunion. If you are interested in becoming a speaker for this event, please let us know as soon as possible.

We had some other alumni who were able to visit us during the year and gave interesting and engaging talks to our students about the career paths they took after graduating from McMurry.

On February 28th, Ms. Jeanette Schofield '11 gave a presentation to science and math students and faculty on the history and current developments of various AI models. This presentation included some interactive workshop elements.

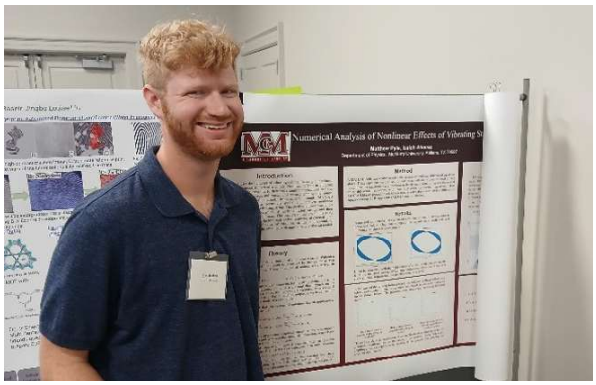
In April, we hosted Ms. Kaylee Berdoll '23. Ms. Berdoll holds a BS degree in Physics with Civil/ Mechanical Engineering focus from McMurry. She is currently working on her MS degree in Mechanical Engineering at Texas A&M University. Kaylee described how her graduate school journey evolved from initially enrolling in a non-thesis program to shifting toward a thesis-based track after she received a research assistant position at the RELLIS Energy Efficiency Laboratory. Beyond the technical side, Kaylee discussed the various graduate program options available. She emphasized the accessibility of graduate school, describing the manageable workload. She also commented on her time at McMurry, appreciating the university's smaller, tight-knit community compared to Texas A&M's large scale. Kaylee's talk was part of this year's induction ceremony for the Sigma Pi Sigma, National Physics and Astronomy Honor Society. We inducted two of our best SPS students: Samantha Ford and John Tran.

Next year, we would like to continue our presentation series, "What I did with my physics degree." If you are interested in giving a talk, please let us know, and we will be happy to schedule your presentation either virtually or face-to-face during one of our SPS meetings.

Physics Year in Review 2024-2025

As in the past, we have actively participated in academic conferences and tours outside of McMurry University.

In mid-October, Dr. Bykov took seven students to attend the Texas Section of the American Physical Society meeting at the Southern Methodist University (SMU) in Dallas, TX. During the conference, the students attended professional talks and learned about educational opportunities in graduate schools in Texas. One of McMurry physics students, Matthew Pyle, presented a poster based on the research project that he completed last spring, titled "Nonlinear effects in vibrating strings observed through numerical analysis."



At the same conference, one of our McMurry Physics alumni, Jonathan Samudio '21, who is currently a graduate student working on his PhD in Physics at Baylor University, was presenting his work that he did over the summer while working on the Large Hadron Collider (LHC) in Switzerland at CERN. The experiment that he worked on was recently awarded the Breakthrough Prize in Fundamental Physics, and his name is listed under the prize laureates. Yet another McMurry physics graduate, Dr. Alexandria Mendoza '19, received her PhD in physics from Baylor University this year.

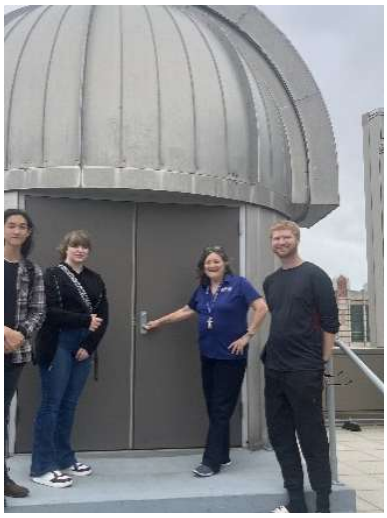
As in years past, in January a group of students traveled to one of the national sites for the Undergraduate Women in Physics conference. This year, the conference took place at the University of Colorado in Boulder. They attended plenary talks presented by astrophysicist and aerospace engineer Dr. Erin Macdonald, who discussed her journey from academia into Hollywood, serving as the science advisor for Star Trek; and Dr. Desire Whitmore, who emphasized the importance of effective science communication and education through her laser physics demonstrations. Workshops provided participants with essential skills ranging from effective science communication to navigating the job market with sessions focused on crafting CVs and resumes tailored for non-academic careers. They also got to experience a real winter with snow in Colorado.

Eight engineering physics students, accompanied by Mr. Upshaw, went to the 3DEXPERIENCE World 2025 Conference in Houston. They were able to attend several presentations from leading engineering companies, and see innovations such as the Boston Dynamics robot "Spot" and AI generative floor plans. During the breakout sessions, they were able to learn about 3D scanners, applications for movie sets, firefighters, worker robots performing machine learning by watching humans and much more. In the picture, McMurry students Victor Huerta, Zarius Garcia, and Jaumarian Barnett are attending one of the presentations.

McMurry physics student, Matthew Pyle, attended the

Global Physics Summit in Anaheim, CA on March 17-21, 2025. This is the main international physics conference that brought thousands of physicists, researchers, and students from all over the world to California. At this conference, Matthew presented an outline of his senior research project. His presentation was titled "How a Single Experiment May Have Tipped the Foundation of Physics" He also presented a similar version of this talk at the McMurry Symposium in April.

Several physics students, accompanied by Dr. Keith, attended a tour of Ludlum Measurements Inc. in Sweetwater on March 21st. This tour was able to take students to the different divisions of the company and show them the inner working for manufacturing photomultiplier tubes, calibration of Geiger counters and many of processes and laboratory facilities available on site.



In April, Dr. Keith and three physics students attended the Texas Section of the American Physical Society meeting at the University of Houston. While there, Dr. Keith took the students to his graduate school alma mater Rice University nearby. The students were able to meet with two Rice faculty members, including Dr. Patricia Reiff, who showed the students their rooftop observatory. Pictured left are Matthew Pyle, Hailie Brown, Dr. Wayne Keith, and John Tran. Pictured right are the students with Dr. Reiff. Two students also went on a discovery trip to visit the NASA Johnson Space Center in Houston in late March.

For the second year in a row, Mr. Upshaw and Dr. Renfro served as judges for the Big Country Manufacturing Challenge (BCMC) 3-D Printing Competition. On March 26, 2025, several high school student teams from all over the Big Country participated in a competition to design and 3D print an engineering tool that would resolve a practical engineering task. For the second consecutive year, Mr. Upshaw also served as the engineering technical reviewer for the BCMC; reviewing all challenge documentation, team CAD models and drawings for technical accuracy and design for manufacturability and assembly.

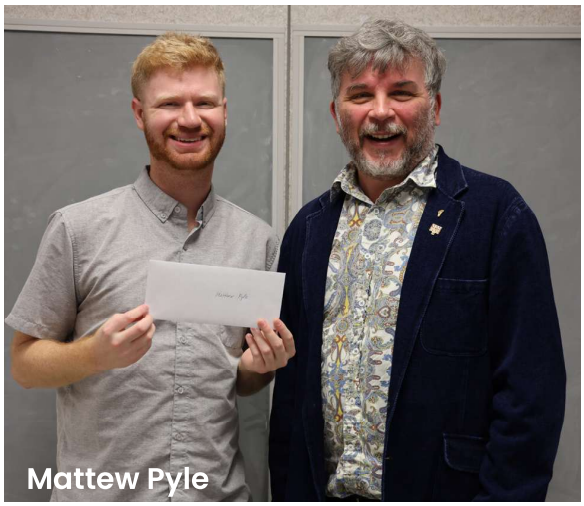
The majority of the above trips and student experiences would not have been possible without the support from the Ward-Bottom Science Fund. Thanks to Roger Ward, we have the resources to pursue excellence and innovation and advance our work in many meaningful ways. The Ward-Bottom Science Fund has been in place for over a quarter of the century. Since this program started, several generations of former Ward-Bottom scholars found their calling and are trying to make our world a better place. Many went on to receive advanced degrees and excel in their careers in various fields anywhere from academic research to applied engineering. This year, Roger's lasting impact was recognized with him receiving the John Wesley award on April 24th. This award is one of the most distinguished philanthropic honors for McMurry University. On behalf of the Physics Department, we extend our sincere congratulations to Dr. Ward on receiving this award.

Physics Recipents of the 2025 Math and Science Student Awards

Kane Strohman

Kane Strohman

Samantha Ford


Mattew Pyle

Dustin Volk

Robert May

SCAN ME

Keep track of our current events by visiting us on Facebook at the McMurry Society of Physics Students or online at ***https://sites.google.com/site/mcmurryphysicsdepartment/home.***

To update your communication preferences, email tbykov@mcm.edu.

Thank you for your support,

The McMurry Physics Department

Our Thanks

After 11 years of service, Dr. Sandra Harper, McMurry University's 10th president retired at the beginning of January. To celebrate Dr. Harper's contributions to the physics program, the McMurry chapter of the SPS presented Dr. Harper with an engraving of a War Hawk made with the physics laser cutter on the top of one of the historic laboratory wooden stool tops. The Physics Department is deeply grateful to Dr. Harper for her support of our program, and we wish her a happy retirement. We would also like to welcome the new university president, Dr. Lynne Murray! We are looking forward to working with Dr. Murray to bring our program to new levels of achievement in the coming years.

Tikhon Bykov - Wayne Keith - Timothy Renfro - David Upshaw

The McMurry Physics Department

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