

# Physics Newsletter

2022 - 2023

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## Senior Student Showcase

### Kaylee Berdoll

**HOMETOWN: UTLEY, TX**

Kaylee Berdoll, working with Dr. Renfro, completed her honors project and wrote an honors thesis on the subject of “Designing a speaker attachment for a drone to be used in controlling crow populations in pecan orchards”. This project aimed to create a mobile device that will effectively deter crows with sounds from a speaker mounted on a drone. An affordable drone was selected that is capable of lifting a speaker. A speaker mount was designed, and 3D printed to attach it to the drone. The perceived sound levels from the speaker at different distances were measured and analyzed in comparison to the sound of the drone propellers. Additionally, the effect of sensor direction on the measured sound levels was tested, as well as the accuracy of the height that is displayed on the remote for the drone. The results can be used in many areas outside of pecan farming, such as airports, theme parks, and law enforcement.

Kaylee presented the findings from her project at the Abilene Christian University (ACU) Undergraduate Research Festival in April and during the McMurry University Student Research Symposium (formally known as McMurry University Academic Conference) in May. We are grateful to the Science and Math Advisory Board for supporting this project with the Charles and Lisa Bloomer Student Research Stipend. For this and many other achievements, we recognized Kaylee as an Outstanding Physics Senior and a recipient of one of the Piper–Bottom Awards for Excellence in Physics this year. During the spring commencement, she was also recognized with the Ginny Carlson Memorial Student Award. Her name is now engraved on a plaque outside of the Physics Department. After graduating from McMurry University, Kaylee will continue her education at the Texas A&M University, College Station, working on her MS degree in Mechanical Engineering.



# Senior Student Showcase



## Taryn Fambrough

**HOMETOWN: ALEDO, TX**

Taryn Fambrough, working with Dr. Keith, completed her project on “Building a Dobsonian Telescope”. This is a reflecting telescope that has a concave mirror as the main mirror and then a secondary mirror that will show the image when looking through the eyepiece. With an 8-inch primary mirror, many astronomical objects can be seen ranging from the moon to bright galaxies. Dobsonian telescopes are mounted on an alt-azimuth base so they can turn on a vertical and horizontal axis. She also made a presentation about that telescope during the McMurry University Student Research Symposium. We are grateful to the Science and Math Advisory Board for supporting this project with the Charles and Lisa Bloomer Student Research Stipend. The telescope will now become available for use in the Introduction to Astronomy course.

Last summer Taryn participated in the NSF funded Research Experience for Undergrads program at the Homer L. Dodge Department of Physics and Astronomy at the University of Oklahoma. She worked on reduction and analysis of quasar spectra obtained from the Gemini North Telescope. The data being collected that was then analyzed by Taryn was for the spectra of the iron low ionization broad absorption line quasars. Taryn presented the results of her summer work and talked about the importance of summer research experiences during one of the Society of Physics Students meetings in September.

For many achievements, we recognized Taryn as an Outstanding Physics Senior and a recipient of one of the Piper-Bottom Awards for Excellence in Physics. Her name is now engraved on a plaque outside of the Physics Department. After graduating from McMurry University, she will start working on computational modelling of physics phenomena at the Lockheed Martin aerospace company in Fort Worth, TX.

## Luis Lopez

**HOMETOWN: EL PASO, TX**

Luis Alberto Lopez, working with Dr. Keith, completed his senior research project on the subject of “3D Printed Robotic Pool Claw”. Luis said that the objective of his project was to take a nontechnical element, such as a pool claw and incorporate 3D printing to create a robotic pool claw that uses a Me-Bluetooth receiver and Me-Baseboard to open and close when indicated. Using the MBlock software, the robotic arm is programmed with a cellphone to signal via Bluetooth. This project is designed to secure cue sticks in place to prevent them from falling and becoming damaged, assisting pool players with their game. Luis graduated in May, and wants 3D printing to become a part of his future engineering or technical career.



# Junior Research Proposals



## Chloe Gatch

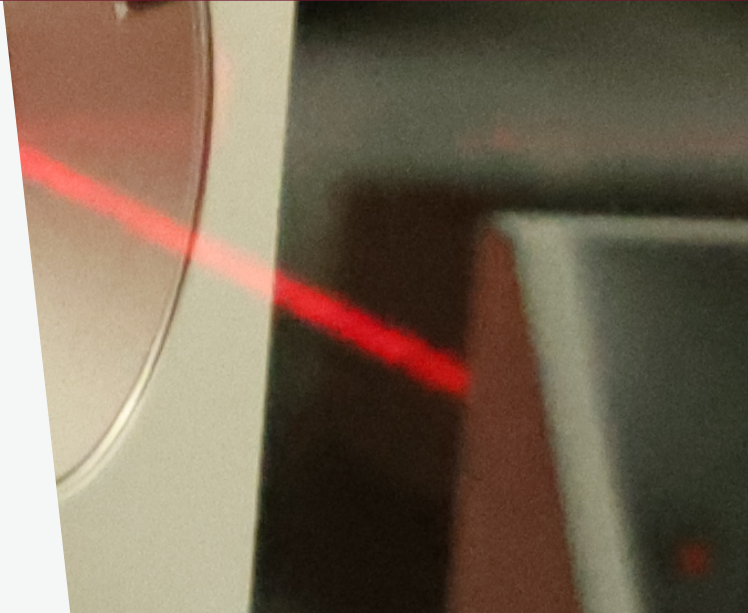
**HOMETOWN: ALEDO, TX**

Chloe Gatch, working with Dr. Keith, presented her senior research proposal to design an “Autonomous Car Prototype”. She stated that the objective of her proposal is to build an autonomous car prototype to investigate how RADAR and ultrasonic sensor systems contribute to an external sensor system’s ability to perform obstacle and collision avoidance (AVs). The external sensor system within an autonomous vehicle is responsible for generating information from environmental feedback. A RADAR sensor is responsible for motion detection by collecting backscattered microwave signals. An ultrasonic sensor is responsible for generating information related to proxemics of the vehicle. We are grateful to the Science and Math Advisory Board for supporting Chloe’s project with one of the 2023-2024 Charles and Lisa Bloomer’s Student Research Stipends.

## Isaiah Narvaez

**HOMETOWN: ABILENE, TX**

Isaiah Narvaez, also working with Dr. Keith, presented his senior research proposal on “Shredding for Sustainability: The Designing and Implementation of a Plastic Shredder”. Isaiah’s goal for this project is to create a different process of plastic bottle shredding. The main task of this shredder is to recycle polypropylene terephthalate or #1 type plastic. The shredder will incorporate three stages with three actions that are compression, shredding, and dumping. The goal for the final product is for the machine to dump 1.5”- 2” plastic strips to then be sold to different recycling companies. We are grateful to the Science and Math Advisory Board for awarding Isaiah’s project with the second of the 2023-2024 Charles and Lisa Bloomer’s Student Research Stipends.



## Jake Woodward

**HOMETOWN: NORTHLAKE, TX**

Jake Woodward, working with Dr. Keith, completed his senior research proposal to build an “Anti-Wild Hog Deer Feeder”. Texas is home to more than 3 million feral hogs causing a nuisance to farmers, hunters, and property owners across Texas. There are multiple options to deter hogs from deer feeders, but there is no perfect option that is successful in deterring only the hogs while keeping the deer. The goal of this project is to design and build a feeder that deters hogs but not deer. This feeder will be able to detect when hogs are near using a microphone and then send a signal to close the lid of the trough. The lid will stay closed until the hogs move away. When the project is finished one can study what effect this feeder has on the hogs’ migration patterns.

## Other Student Research

As part of the “Electricity and Magnetism II” course offered by Dr. Bykov in the spring of 2023, Taryn Fambrough worked on a project to find an “Efficient Numerical Approach to Solve a 2D Laplace Equation for Electric Potential and Determine the Capacitance of a Microstripline”.

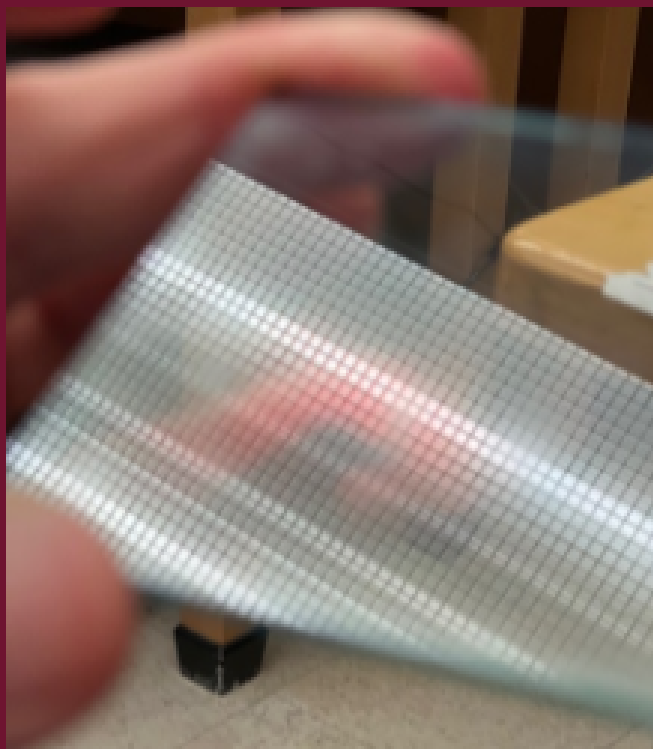
The objective of the project was to use three different numerical methods: Jacobi method, Gauss-Seidel method, and over-relaxation method, to solve a 2D Laplace equation for electrostatic potential. The problem considered this time was for a microstripline, which is a cross section of a cable carrying a signal that is an electromagnetic wave. The cable is half filled with a dielectric, which makes this problem realistic, but the solution becomes more complicated.

The capacitance of the system could also be found numerically. That capacitance is an important parameter affecting propagation of signal in the cable. As a result, the most efficient numerical approach to solving this problem is found. The parameters of that approach are optimized to obtain a reliable value for the capacitance. Taryn presented the results of this project as a poster at the McMurry University Student Research

Symposium in May. The poster is now displayed on the first floor of the Science Building.

Another student project was completed as part of the Automated Experimental Measurements course offered by Dr. Tim Renfro in the fall. For this project students designed and 3D printed a device that could be used to detect an electrostatic field. Made of a surface coated in a conducting material, the item is spun on an electric motor. Stationary points are attached to opposite sides of the spinner on the platform and connected to a potentiometer read by a computer. For practical applications, this device can be used to detect clouds of charge and sudden discharges as found in thunderstorms. Students working on this project were Chloe Gatch, Elijah Gregory, and Kane Strohman.

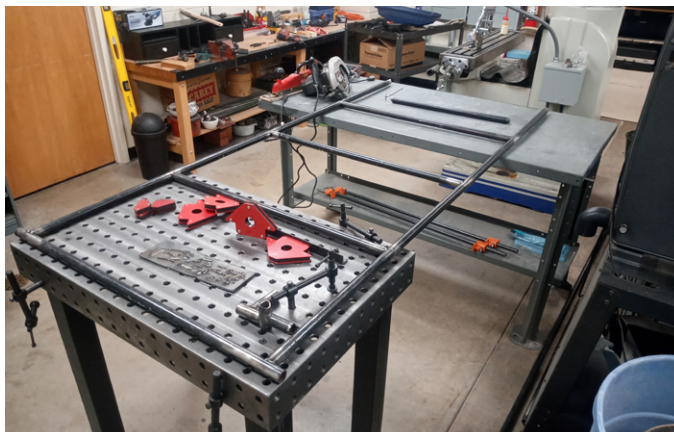
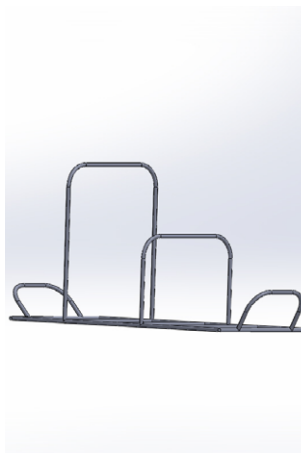
In the Advanced Physics Lab, a group of three students including Chloe Gatch, Elijah Gregory and Kane Strohman was able to utilize our new optics table to design an experimental setup to create a hologram using reflected and diffracted interference. Students were successful in creating 2 slides with some holographic qualities.



# SPS Chapter Research

Our Society of Physics Students (SPS) chapter was very busy this year. As you know, every year we attempt some major project that strengthens our local physics community and serves as a visible outreach effort outside of the university. Last year we announced that the chapter will be working on building an all-terrain sporting vehicle to participate in the Baja SAE student competition. Our chapter was awarded 2022–2023 “SPS Chapter Research Award” by the SPS National Office and another award by McMurry Student Government to build this vehicle. Even though we have later decided that we might not be able to complete our car on time to participate in this year’s competition, we have made some good progress in building the frame for the future vehicle. The original frame design went through several stages and was substantially improved and simplified to make it feasible for manufacturing.

In the first picture, one can see the latest frame design proposed for completion at the first stage of the project. In the next picture, Elijah Gregory and Dr. Renfro are cutting metal that was purchased with the help of the SPS National Office. In the last picture, the base of the frame is placed on the new welding table in the Physics Machine Shop.



## New Courses On Campus

As we started the new Engineering Physics major this year, Introduction to Engineering, Engineering Ethics, and newly redesigned Computer Aided Drafting (CAD) courses were offered as regular courses for the first time. The CAD design project this year was to reverse engineer a product of student’s choice and print a rapid prototype.

In collaboration with Dr. Mark Waters from the Religion Department, Dr. Keith offered a new “Faith and Science” course this spring, looking at the various ways that the two fields of study interact with each other. Many people assume that the two are only in conflict, however, Windependence, dialog, and integration beg to differ. It was a great opportunity for interdisciplinary collaboration for both faculty and students since it does not happen very often that science and religion students take their classes together. The students not only had an opportunity to learn more about other disciplines, but they even worked together as a team to present at the McMurry Student Research Symposium in May. Their talk, explaining the four interaction models mentioned above (as first described by Ian Barbour), was split among four students, and gave a basic overview and examples of each.

## Alumni Presentations

On November 11, we welcomed back our recent graduate, Jonathan Samudio, who is currently a physics PhD student at Baylor University. In his presentation, Jonathan shared his experiences as a graduate student at Baylor and talked about how particle physicists collect experimental data at the Large Hadron Collider and how this is used in searches for new physics. He gave a brief example of a physics analysis using effective field theory to illustrate this process.

We had a large group of our recent graduates including Taylor Freehauf, Kent Grimes, Joseph Watson and Aaron Herring who visited with our current students during Homecoming and talked about their careers and their experiences after graduating from McMurry. We are deeply grateful to all of our graduates who were able to make it to Homecoming last year and we are looking forward to seeing even more of you next fall. This year’s Homecoming will mark 100th anniversary of McMurry University. It will take place during the weekend of October 27–29. The Science and Math Homecoming Reunion will take place on Friday October 27 from 4 pm to 5 pm in the Science Building, Room S105.

# The Passing of Dr. A.C Sharp



A very sad news item that we have this year is of the passing of Dr. A.C. Sharp in December of 2022 and the passing of his widow Mary Beth Sharp in May of 2023. Dr. Sharp was the longest serving physics professor at McMurry University from 1965 to 1999. He was an outstanding teacher, mentor, and leader. He led the Physics Program in its most difficult times, when he was the only physics professor on staff. He was instrumental in bringing the new Physics Program back in the mid-1990s. He served as an inspiration to many of the physics faculty. Even after his retirement, both he and Mary Beth were still actively involved with the University and the Physics Program. But first and foremost, Dr. Sharp will always be remembered by his students as someone who changed their lives forever.

To honor Dr. Sharp's memory, the Dr. A.C. Sharp Endowed Scholarship was awarded for the first time this spring. This year's Society of Physics Students chapter president, Elijah Gregory, has been chosen as the first recipient of that scholarship.

## Lift Off Summer Bridge

As we started offering the new degree in Engineering Physics, not only we were able to introduce new engineering courses into our curriculum, but also started offering the "Lift Off", Summer Bridge Program. Last August, ten incoming freshman students were able to receive college credit by taking a Pre-Calculus course taught by our professional tutor, Ms. Tammy Werner, and a Freshman Seminar course taught by Mr. David Upshaw. Mr. Upshaw, Dr. Bykov and the Center for Student Success staff have developed an engaging content for this summer program.

In the picture taken during last summer's Lift Off, students are shooting toy rockets to gain practical knowledge of the concepts that they have learned in Pre-Calculus course. Two of these students have successfully completed their first year in Engineering Physics program.

The program is taking on its second year now. We are looking forward to welcoming a new group of incoming freshmen for the Lift Off that will start in mid-July this

year. This coming academic year, Mr. Upshaw will be able to offer junior and senior level engineering courses for the first time. These will include "Mechanics of Materials" and "Fluid Mechanics" in the fall and "Heat Transfer" and "Manufacturing Engineering" in the spring. As our program continues to redevelop and grow, if you know of any prospective students who might be interested in both physics and engineering aspect of our offerings, please direct those students' attention towards the McMurry Physics Program.





# SPS Chapter Events Recap 2022-2023

Once again, the SPS National Office recognized McMurry University Chapter of the Society of Physics Students as an Outstanding Chapter for the 2021-2022 academic year. This is the fourth time in a row that the SPS National Office has recognized our students. We are honored to be recipients of these awards.

Our Science Christmas Tree went up as usual just before the Thanksgiving break. In the picture SPS students are Kaylee Berdoll, Chloe Gatch, Taryn Fambrough, Marie Uwituze and Elijah Gregory right after they have finished decorating the tree.



The induction ceremony for the Sigma Pi Sigma, Physics Honor Society took place on April 14. This year's inductees were our SPS students: Chloe Gatch and Elijah Gregory. The induction ceremony speaker was our last year's outstanding graduate, Mr. Austin Bridwell. Austin is currently working as a mechanical engineer with Rentech Inc. in Abilene. He shared some of the experiences in his current position with Rentech and talked about the importance of service as one of the main pillars of Sigma Pi Sigma.

During one of our SPS meetings in the fall, the chapter was able to host students from Cisco Junior College, a local community college. These students came on a tour of our facilities and met with our current students as they were considering transferring to McMurry University after receiving their Associate's degrees.



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 in either virtual or face-to-face during one of our SPS meetings.

## Update From Dr. Keith

In October, Dr. Keith presented his E.E. Hall Memorial Scholar lecture. The title of his presentation was "Earth's Magnetosphere", based on the book of the same title that Dr. Keith published in early 2021.

## Update From Dr. Bykov

At the end of the academic year, Dr. Bykov was recognized for his work with McMurry University SPS Chapter as McMurry University "Outstanding Advisor of the Year". Dr. Bykov is deeply grateful to the SPS students who nominated him for this award.

## Cardboard Boat Races

On December 8, a large group of local middle school and high school students used physics department facilities to complete their engineering competition on building cardboard boats and studying buoyancy. The boats were then tested in the University swimming pool. We are grateful to Mr. Upshaw for assisting in organizing and judging that competition. He also now serves on the advisory board for the local engineering high school. Photo courtesy of AbileneSD.

# Off Campus Event Recap 2022–2023



## October 13–15, 2022

Kaylee Berdoll, Chloe Gatch, Taryn Fambrough, Elijah Gregory, Bryce Borak, and Matthew Pyle, accompanied by Dr. Wayne Keith, traveled to Rice University in Houston to participate in the Texas Section of the American Physical Society fall meeting. While at Rice, Dr. Keith was able to give our students a special inside tour of his Alma Mater. Kaylee Berdoll said, "Attending the APS Texas Section Conference was once again a great experience! I always look forward to hearing about the leading innovations in Physics across various disciplines, and I was not disappointed this year."



## March 23–35, 2023

Elijah Gregory, Matthew Pyle, and Marie Uwituze, accompanied by Dr. Tikhon Bykov and Dr. Tim Renfro participated in the Texas Section of the American Physical Society spring meeting at Texas A&M University, Commerce. Matthew said, "If anything, the conference, while small, was a fantastic experience. There were many people from around the country that gathered to celebrate the field that advanced society for the past few thousand years. I personally made a bunch of connections to people I would not have gotten the chance to meet otherwise!"



## May 2023

Dr. Wayne Keith and a group of Physics students including Kaylee Berdoll, Taryn Fambrough, Chole Gatch, Elijah Gregory, Matthew Pyle, and Kane Strohmán traveled to Flagstaff, Arizona to do astronomical observations on the 42-inch telescope as part of the National Undergraduate Research Observatory (NURO) consortium. In addition to doing their work on the telescope, students participated in several side trips including Meteor Crater, Grand Canyon, Painted Desert, and Petrified Forest national parks.

## Spring Break 2023

Elijah Gregory and Matthew Pyle together with Mr. David Upshaw went to the joint SAE International Aero Tech and ASM Aero Mat conference in Fort Worth. Students had a unique opportunity to talk directly with the leading scientists from major aerospace companies and from NASA. They have learned about some groundbreaking innovations and recent developments in aerospace technology. Elijah Gregory said, "This was an extremely inspiring event for me. This event allowed me to make some decisive decisions about goals for my career. The scale of this conference combined with the educational topics, elite professionalism and sense of major industrial importance blew me away."

## April 11, 2023

Three faculty and eleven students attended a tour of the facilities of Hartmann's Inc. in Abilene. The tour was led by Michael Hartmann, Quality Manager for Hartmann's Inc. Alan Hartmann, the owner and CEO of the company gave us a welcome speech in the spacious and shiny lobby to kick-off the tour. The tour was distributed across all departments at Hartmann's, including machining, inspection, supply chain, and engineering. Hartmann's has CNC mills and lathes, with as many as 5 axes. This allows the shop to fabricate any level of complexity of parts, from a bracket to parts with highly-complex geometry and exotic materials. Additionally, the shop houses an electrical-discharge machining system, capable of fabricating parts with nearly zero tolerance. There were several engineering technicians working on SolidWorks CAD software in the engineering department. They were able to witness first-hand how what they are doing in their CAD course is directly applicable to the real world.

# Academic Symposium

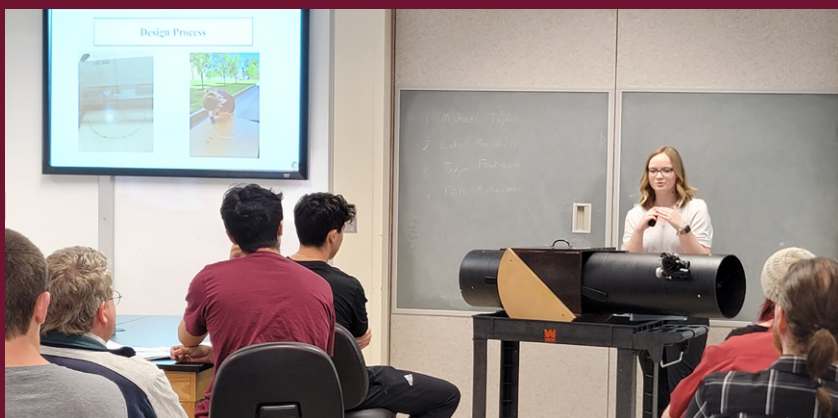
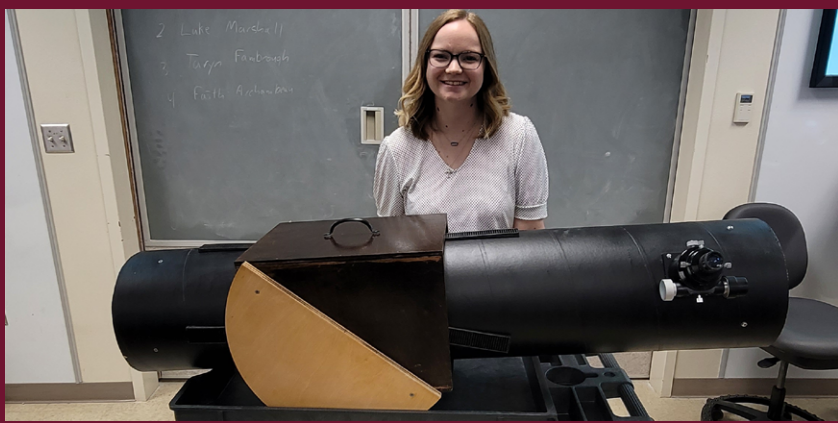
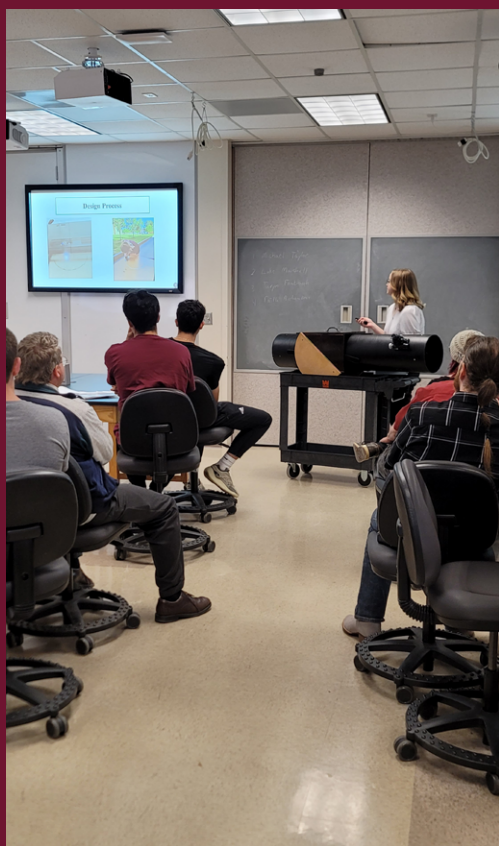
For the first time in University history, McMurry suspended classes Friday, April 28th, 2023, so that the entire campus could join together and celebrate the research, scholarship, and creative works of our students. Their work was featured in oral presentations, honor thesis presentations, poster presentations, business pitches, 3-minute thesis presentations, music performances, art exhibits, and theatre events.

Students were strongly encouraged to participate either by presenting or by attending and engaging with those who are presenting. The Academic Symposium was a wonderful way to learn what our students are working on under the direction of their faculty mentors.

The Symposium kicked off on Friday morning with the Keynote Address in Radford Auditorium at 9:00 a.m. from Sterling Hawkins on the #NoMatterWhat movement. Following the Keynote, student oral presentations and the business pitch competition presentations took place between 10:30 a.m. and 12:00 p.m. in several rooms in Old Main, Cooke, and the Finch-Gray Science Building. Student poster presentations took place between 1:00

p.m. and 2:45 p.m. in the Ryan Fine Arts Building and the Science Building. There were also honors thesis presentations between 12:30 p.m. and 2:00 p.m. and a 3-minute Thesis Competition between 2:00 p.m. and 2:30 p.m. There were theatre productions, music recitals, and art exhibits occurring all day as well. To cap off the day, the Plenary Session which began at 3:00 p.m. in Radford Auditorium was given by McMurry alumni Lenworth "Joonbug" McIntosh.

As mentioned previously, Taryn Fambrough was at the forefront of the event giving an oral presentation on the design process, build, and functionality of her Dobsonian Telescope and by creating a poster presentation on "Efficient Numerical Approach to Solve a 2D Laplace Equation for Electric Potential and Determine the Capacitance of a Microstripline". While most students only gave one poster presentation, Taryn gave two different presentations for The Academic Symposium. Taryn was a testament to the success of the Physics Department at this event.





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, please do not hesitate to contact me at the address above or by email at [tbykov@mcm.edu](mailto:tbykov@mcm.edu).

Thank you for your support,

The McMurry Physics Department

## Our Thanks

All of the above trips and student experiences would not have been possible without the support from the Ward-Bottom Science Fund. We are deeply grateful to Dr. Ward for making this fund available for our use. In addition, we were able to use the same fund to purchase the new ultrasonic testing equipment for the Advanced Physics Lab. This equipment would allow students to learn about many applications of ultrasound, including medical diagnostics and nondestructive material testing. The frequency of ultrasound is set by an electronic oscillator which drives piezoelectric transducers that, in turn, create an ultrasonic compression wave. The same transducers also serve as ultrasonic receivers, converting ultrasonic energy back into electrical signals. We hope to be able to use this equipment for the first-time next year.

Due to the generous support of the US Department of Education Title V grant "Building STEM Success", during the winter break, we were able to upgrade the multimedia projection system in rooms S104, S105 and S106. New high-resolution laser projectors now allow high-quality sharp images to be projected to the room screens. Computer stations with powerful graphics cards create multiple image outputs that can be projected to any of the screens. Video cameras with tracking features follow instructors and allow for high quality lecture video capture. Any class taught in these rooms can now be video recorded. All of the University Physics and some of the upper division physics courses were video recorded this year.

Department of Physics  
1 McMurry University #38  
Abilene, TX 79697

