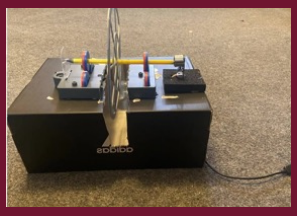
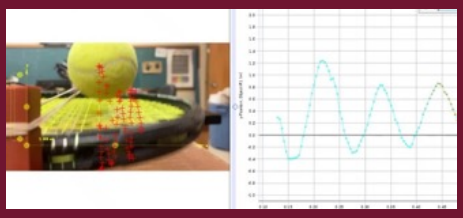
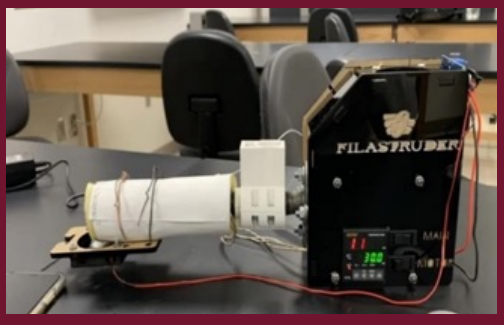
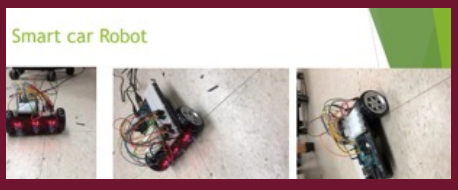







DEPARTMENT OF PHYSICS

McMURRY UNIVERSITY

Dear Friend:

It has certainly been a very unusual and a challenging year for many of us. However, despite these many challenges, we have a number of great and exciting news items in the McMurry Physics Program that we would like to share with you at this time.

As it has become a tradition, we would like to start by telling you about the successes of our graduating seniors. Last year we had a big graduating class, but not everybody was able to finish on time last May as many things were put hold due to COVID-19 pandemic. So, this year we are glad to report the final results of the senior research projects for the students who could not finish last year as well as for those who finished this year. All together, we had eight graduating seniors. Some of them finished last August, some in December and some just graduated a few weeks ago in May.

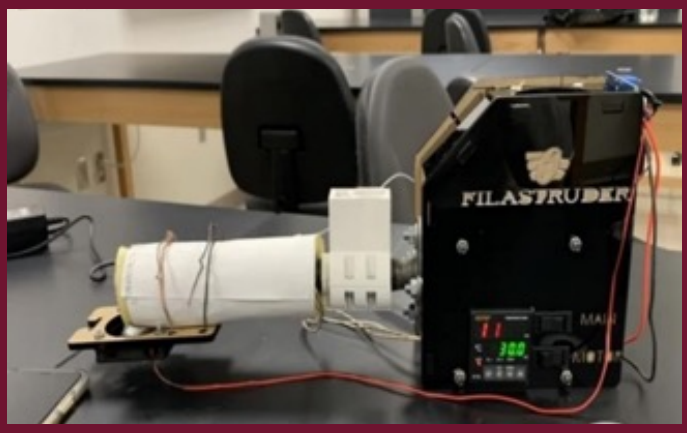
Tikhon Bykov - Wayne Keith - Timothy Renfro - David Upshaw

The McMurry Physics Department

Senior Research Projects

Colton Hunt

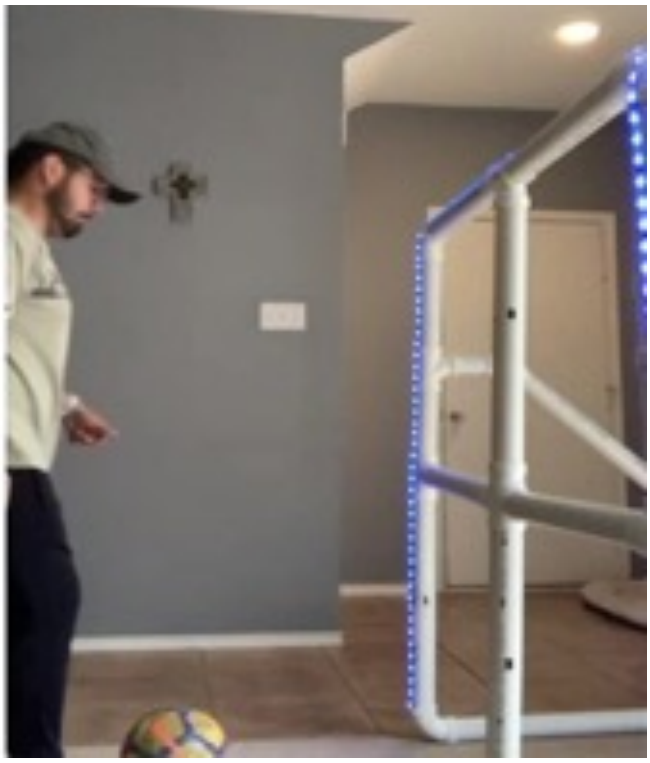
(HOMETOWN: SAN ANGELO, TX)



Colton Hunt (Hometown: San Angelo, TX), working with Dr. Renfro, has completed his project for developing conducting graphite infused plastic fiber capable of conducting electricity to be used in 3D printing. The first step was building a filament extruder (see the picture) that can be used to make 3D printing fibers from different plastics. Once the extruder was finished, it was used to produce a conductive filament. This was achieved by adding graphite powder to ABS pellets. They were melted together in the extruder to form fiber. The filament's conductivity and resistivity was tested by applying continuously increasing voltage to samples starting at 5 cm and increasing the length by 5 cm up to 20 cm. Having the ability to 3D print conductive fibers opens the door to very specially made circuits and easy replacements for custom parts. After graduating in August of 2020, Colton started working for Skyline Power LCC, the same company where he did his internship during the previous summer. Since then he has participated in several electric construction projects conducted by the company in different locations in US.

Jose Mireles

(HOMETOWN: HUTTO, TX)



Jose Mireles (Hometown: Hutto, TX), working with Dr. Bykov, has completed his project to build a "Training Machine That Increases Soccer Player's Passing Accuracy". The objective was to incorporate technology for training purposes in the sport of soccer. The training machine that simulates a soccer gate was built from PVC pipes. This training machine uses IR break-beam sensors to detect if the ball goes through a gate or not. A code was designed to randomly illuminate the LED strips on one of the four gates along with that particular gates IR sensor. From the moment a gate's LED strip changes color the player has 8 seconds to pass the ball to that target gate. This project was designed to improve players' passing accuracy and to test and evaluate their technical skills. In the picture, Jose is testing his device. Jose has finished his project and graduated in August 2020.

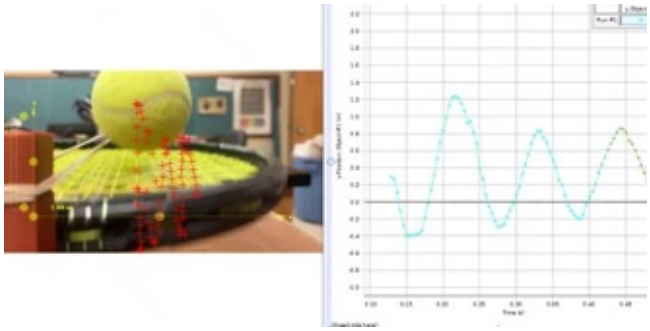
Francis Narvaez

(HOMETOWN: STAFFORD, TX)

Francis Narvaez (Hometown: Stafford, TX), working with Dr. Renfro, finished her project on making plastic as a possible building material. Plastic materials being used for 3D printing are ABS and PLA filaments. The project used ABS pellets and a specific additive to create a stronger, more durable plastic alloy. It is known that cellulose fibers found in the cell walls of plant and bacterial cells can be broken down into individual composite strands called "fibrils" and used to produce strong, steel-like fibers. Therefore, the purpose of this experiment was also to test whether an additive along with cellulose fibrils will create a stronger material than regular ABS printing material alone. Several tests to measure mechanical properties of the new material were performed. The picture shows material samples prepared for compression test. We are grateful to the Ward-Bottom Science Fund for making it possible to purchase the equipment for this project. Frances finished her project and graduated in August of 2020.

Carlos Martinez

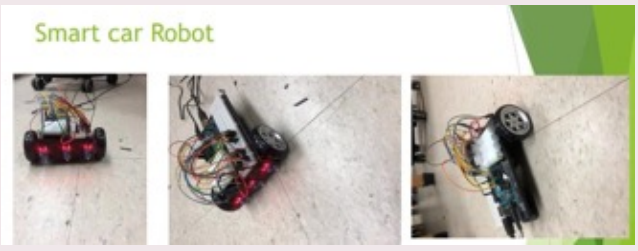
(HOMETOWN: TORREON, COAHUILA, MEXICO)



Carlos Martinez Hamdan (Hometown: Torreon, Coahuila, Mexico), working with Dr. Bykov completed his project on "Vibration damping on a tennis racquet". The main objective was to find vibration frequencies for the different spots of a tennis racquet depending on where it is hit with the ball. Deferent spots would result in different outcomes for the motion of the racquet. The player will be able to achieve different results by adjusting the spot where the ball will come in contact with the racquet. Carlos has used slow motion video analysis to study his own tennis racquet. One of his tests is presented in the picture above. The project was finished and presented in May 2021. After his graduation, Carlos wants to continue his education either in MBA or in an engineering Master's program.

Gabriela Martell

(HOMETOWN: KATY, TX)



Gabriela Martell (Hometown: Katy, TX), working with Dr. Keith, completed her project to build a "Smart Car". The project addressed a basic idea of a smart car that could help reduce the number of car accidents. The goal was to create a smart car robot that will sense when the driver goes off the road and re-directs it back into the road. This was achieved through light sensors and an Arduino based program. You can see the pictures of that robot car being tested. Gabriela finished her project and graduated in December of 2020.

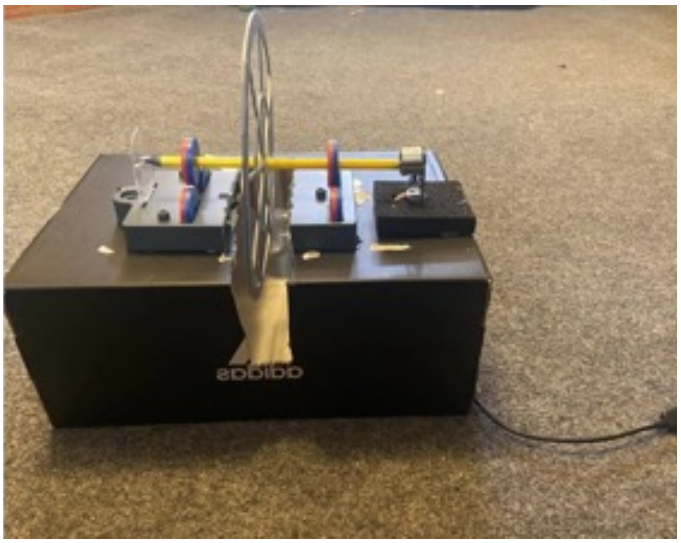
Jonathan Samudio

(HOMETOWN: FORT WORTH, TX)

Jonathan Samudio (Hometown: Fort Worth, TX), working with Dr. Keith, defended his honors thesis "Low-Cost Gamma Ray Spectrometry". Typical gamma ray spectrometry is performed using professional grade equipment with expensive scintillation detectors. This project aimed to construct a much lower cost detector which would provide a gamma spectrum that generally matches the accepted spectrum energies for a specific radionuclide. The detector was assembled and wired to the Theremino software analyzer and a gamma spectrum was obtained and calibrated for Cs-137. This was then compared to control data and literature references, and it was determined the low-cost apparatus does produce a recognizable and usable spectrum. However, the output signal, which is generally small, was affected by background noise, which prevented additional optimization. In the future, controls will be put in place to mitigate background noise, allowing for further development and refinement of this technology. The picture shows experimental setup for Jonathan's project. In addition to the formal defense of his thesis, Jonathan has also presented his project at the Texas Section of American Physical Society spring meeting. The meeting that took place at Texas A&M University, Corpus Christi TX was held in a virtual format due to COVID-19 pandemic, which made it much easier for students to present there. Jonathan has also presented his work at the McMurry University Academic Conference/Undergraduate Research Festival in early May. He has graduated with honors in May and he will start working on his Ph.D. in Physics at Baylor University this fall.

Jacob Williams

(HOMETOWN: GOLDTHWAITE, TX)



Jacob Williams (Hometown: Goldthwaite, TX), working with Dr. Bykov, presented his senior research project "Modification of a Tangible Axle with the use of Magnetic Levitation to Minimize the Coefficient of Friction" The goal of this study was to develop a model that could minimize the friction by using magnetic suspension. For this project, Jacob used magnetic levitation by permanent magnets and electromagnets, placing a tangible axle with a fixed wheel in magnetic equilibrium. He also used regular bearings to create controlled model for comparison to levitated axle. The magnetically levitated model did prove to reduce the amount of friction in comparison to non-levitated model. The picture shows Jacob's design of the levitated axle. Jacob has graduated in May. In the fall, he will start working on his PhD in Physics at Texas Tech University.

Joseph Watson

(HOMETOWN: PANHANDLE, TX)

Joseph Watson (Hometown: Panhandle, TX), working with Dr. Keith, defended his honors thesis on "Compound Bow Efficiency". The goal of this work was to determine what affects the efficiency of a compound bow. Some general factors could have been draw weight, draw length, cam shape, let-off percentage, arrow weight, arrow spine, and string silencers. The efficiency of a compound bow was measured using several sets of variables and constants to determine relationships for these efficiency factors. It was discovered that draw length and arrow spine do not affect efficiency. Efficiency increases with increased arrow weight and as a bow approaches its peak draw weight. Efficiency decreases as string silencers, or generally speaking weight, is added to a bow's string. In the picture Joseph is testing his bow. We are grateful to the Science and Math Advisory Board for supporting this project through the 2020-2021 Bloomer's Student Research Stipend. In addition to the formal defense of his thesis, Joseph presented his work to the Science and Math Advisory Board and at the Texas Section of American Physical Society spring meeting. He has also made a poster for the McMurry University Academic Conference/ Undergraduate Research Festival. Joseph has graduated with honors in May. In June he will start working as Society of Physics Student (SPS) intern with the NASA Goddard Space Flight Center. His profile is featured at national SPS webpage (https://www.spsnational.org/programs/internships/2021/joseph-watson). You can follow Joseph's work at NASA through his blog that will be published at the national SPS website. Both Jonathan and Joseph were recognized as outstanding physics graduates of 2021. They have been awarded with Certificates of STEM Research for not only being able to finish their research projects, but to present these outside of McMurry University.

Other Student Projects & Events

Our sincere congratulations to all of our graduating seniors. In the picture taken right before graduation in May, all of us are standing around the McMurry Cassini Memorial in front of the Science Building.

Also in May, our juniors presented senior research proposals for the projects that they will be working on during the next academic year.

Austin Bridwell, who will be working with Drs. Keith and Renfro, presented his proposal on **"Plastic Grinder and Filament Extruder"**. This project will be operated as a McMurry Research Team, with the possibility of bring in additional students to help with the work. The objective of this project is to develop a grinder capable of grinding plastics efficiently and without constant supervision. This grinder will take plastic debris and pieces and grind them into fine pellets or strips, from which they can then be recycled into 3D-printing filament. The next phase of the project is to construct a 3D-filament extruder to heat and extrude the finely ground plastic into 3D-printing filament. We are grateful to the Science and Math Advisory Board for supporting Austin's project with the 2021-2022 Bloomer's Student Research Stipend.

Derek Hostas, working with Dr. Keith, proposed to study **"The Effect Pitching has on the Drag of a Baseball"**. The objective is to determine the different aspects that can affect the drag of a baseball after being pitched. These different aspects include; left or right-handed thrower, different pitches, body type, and velocity. An additional factor involved with the trajectory of a baseball is the Magnus effect related to the spin rate of the ball. A pitcher's performance will be observed over a period of time, and compared from the beginning of the fall season to end of the fall season. To assist in the calculations of velocity, spin rate, spin direction, and release point, the technology from "Rapsodo", curtesy of McMurry Baseball, will be used.

Megan Martinez, working with Dr. Keith, will design **"Volleyball Blocking Mechanism"**. Her objective is to develop a mechanism to be used during practices to help preventing future injuries of volleyball players. The mechanism will also incorporate an Arduino sensor that determines force on and acceleration of the ball that is being hit. This will give athletes the ability to visualize how much force is being applied when coming in contact with the ball. The project can help the trainer/doctor get a better understanding of how hard the ball comes in contact with the face or head of the athlete to determine the level of potential injury.

Jessy Villagomez, who is also working with Dr. Keith, will build a **"Two Way Communication Device"**. That two way communication device, using Bluetooth technology, will be integrated it into a "Storm trooper" helmet; Jessy is a big fan of the Star Wars franchise. The practical aspect of the project could help communication in the cases where people have to wear protective helmets (for instance when working at a construction site) and do not have their hands free. The plan for the helmet is to 3D print is from several parts. The Bluetooth unit inside of the helmet will allow to connect to various devices, such as a phone, a computer, a tablet, or other helmet types. The main goal for Jessy is to be able to understand the electronics behind the Bluetooth communication technology and gain more experience with 3D printing.

There are several other student projects that were performed as part of regular courses that we would like to mention here.

In **"Electronics"**, students worked on a number of projects individually or in small groups. Among those

projects were a "critter bot" Arduino controlled, 3D printed robot, an FM radio, and projects to diagnose and repair various electronic devices.

As you may recall, last year in Dr. Bykov's **"Thermodynamics II"** course, the project was to perform numerical simulation of a critical droplet in 2D Lattice Fluid. Through the summer, Joseph Watson continued working on his project to prepare a submission for publication. His first article in a peer-reviewed journal entitled **"Numerical Study of Critical Liquid Droplets Using Density Functional Theory for 2D Lattice Gas with Short-Range Interactions"** has been published in the 2020 issue of the Journal of Undergraduate Reports in Physics. **(https://www.spsnational.org/jurp/2020/numerical-study-critical-liquid-droplets-using-density-functional-theory-2d-lattice-gas)**. His work was also featured on the issue's back cover. We are glad to recognize Joseph for his first professional publication.

Another programming project was incorporated into the **"Electricity and Magnetism II"** course offered by Dr. Bykov in the spring. "**Numerical Solutions of the Laplace Equation for Electrostatic Potential in Cylindrical Symmetry"** were studied by Jonathan Samudio and Jessy Villagomez. Several iterative numerical methods (Jacobi, Gauss-Seidel, and successive over relaxation) were compared as they were applied to various electrostatic problems in cylindrical symmetry. The Gauss-Seidel method was determined to be the most efficient and was used to investigate field emission configurations in the form of a Spindt-tip and extended needle. It was found that optimization of the field emission for the Spindt-tip configuration depends only on the gate voltage past 100 V. However, field emission may be increased by raising the emission tip away from the gate plate. The field depends on the geometry of the tip and is optimized based on a linear relationship for height, and a rational function of tip width. To maximize output, the tip should be as sharp as possible, with a reasonable extension towards the anode plate. Jonathan presented that work at the McMurry University Academic Conference/ Undergraduate Research Festival in early May.

As mentioned above, several physics students participated in that conference. You can learn more about that event by going to **https://blogs.mcm.edu/STEMsuccess/partnering-for-stem-success-2/spring-2021-title-v-research-festival/.**

Another major undertaking that was completed by our SPS student group this year, is the work funded through the NASA's Minority University Research and Education Project **(https://www.nasa.gov/stem/murep/projects/nasa-minds.html)**. Our student team, **"Moon Hawks"**, under Dr. Keith's supervision and with Dr. Renfro's help, completed the project on **"Electrostatic Charge Mitigation in Shadowed Regions of the Moon"**. The project studied various methods of charge dissipation for possible use on spacesuits during the Artemis mission. The two methods examined were the use of flexible conducting spikes and vaporization of polar molecules from a charged surface. Each solution was tested in atmosphere and under medium vacuum between 100 and 500 mTorr, with Van de Graaff generators used to deposit charge. Funding from the NASA MINDS program was used to purchase materials for testing and to refurbish the McMurry University bell-jar vacuum chamber which was originally built by Dr. Bottom. Both the active and passive methods of charge dissipation were found to be effective under vacuum, with a copper weave triangle producing the best results for the passive case. In the active case, vaporizing polar molecules is highly effective, however further considerations would need to be made in regards to functionality in the lunar environment due to ice formation from evaporative cooling. The picture shows the new design for the vacuum chamber. Please also see this video **(https://www.youtube.com/watch?v=GPOo2xGiHiI)** with our students talking

about the project. The results were also presented as a poster at the McMurry University Academic Conference/Undergraduate Research Festival in May.

As you can see we have had a lot of exciting news this year, however, the major news that should have an everlasting impact on our program occurred in October, when we have learned that US Department of Education has decided to fund McMurry University's proposal for the **"Building STEM Success"** Title V grant. This 5-year, 3 million dollar grant will allow for major improvements to our STEM programs and will introduce new educational opportunities for our students. One of the focus areas for the project is to expend and redesign McMurry University physics offerings. As you know, during the last decade, the McM Physics Program has experienced substantial growth in several areas, including the number of students, the number of physics graduates, and an increasingly diverse student population. Many of the recent graduates are pursuing careers in engineering or closely related fields. To capitalize on this success and to provide students with a liberal arts path to engineering, we will start a new major in Engineering Physics. Because of this external grant we were able to hire a new faculty member with extensive expertise in several fields including physics and mechanical engineering. After successfully completing the search earlier this spring we are glad to welcome Assistant Professor of Engineering, Mr. David Upshaw '08 as the newest member of the McMurry Physics Department. Many of you know David from the time when he was a student in our physics program. Since then, he has completed his Master's Degree in Mechanical Engineering at Texas Tech University and held several positions with different engineering companies. His latest appointment was as Research and Development Engineer with the Los Alamos National Laboratory. We are very glad to welcome David back home and looking forward to working with him for years to come. David will become responsible for delivery of the engineering part of the physics offerings and he will direct undergraduate engineering physics student research projects.

To support upper division experiment-based instruction and undergraduate student research, the upper division physics laboratory space will be renovated in the course of this summer. The demolition was finished last week and we are looking forward for construction to start shortly. In the course of this project, the new laboratory space will be built in the place of the old chemical storage room, dark room and secured storage closet. The new seminar room, next to the lab in the space previously occupied by the room S120, will serve as a student lounge, SPS meeting room and the classroom for small upper division courses. A new optics table will be purchased and installed in the lab. Several modern equipment setups have already been purchased earlier this year. These include a set of **"Modern Interferometry"** experiments, **"Diode Laser Spectroscopy"** experiment, and a mechanical test frame to study mechanical properties of various materials. Later this month, Dr. Renfro will be traveling to Scranton, PA to attend a workshop to learn about **"Diode Laser Spectroscopy"** techniques. We are grateful to the Ward-Bottom Science Fund for making it possible for Dr. Renfro to attend that workshop. We hope that construction will be finished during the summer and those of you who will visit us for Homecoming in the fall will be able to see our new instructional spaces.

In addition to starting the new Engineering Physics degree, another major component of the **"Building STEM Success"** project is to provide students with effective career pathways on the journey to their future profession. To achieve this goal, McMurry University will create a STEM Student Success Center (S3C) that would identify underprepared students in need of assistance and provide ongoing support for undergraduate course of study, career building training, assistance for graduate school and internship application processes, and will prepare students for post college life. The center will also support a peer-assisted learning program for physics and math courses. McMurry University will also institute a Summer Bridge Program that would boost the mathematics proficiency of incoming freshman students. This strategic learning program will prepare students to be calculus ready, so they can take Calculus I and University Physics I courses during their first fall semester at McMurry.

We are looking forward to these new and exciting opportunities for our students and our physics program. In the meantime, we still need your help if you know of any prospective students who might be interested in a physics or engineering degree, please direct those students' attention towards the McMurry Physics Program.

There were many other notable events during this academic year.

In the fall of 2020, the National SPS Office recognized the McMurry University Chapter of the Society of Physics Students as a Distinguished Chapter for the 2019-2020 academic year. This is the second time in a row that the National Office has recognized our students; we are honored to again be recipients of this award. The picture of our Chapter has also appeared in the Spring 2021 issue of the SPS Observer and the short segment on page 5 was devoted to our tour of Lockheed Martin plant last year. **(https://www.spsnational.org/sites/default/files/files/publications/observer/2021/SPS_Observer_Spring_2021-web.pdf)**.
Unfortunately, last summer the majority of research experience programs and internships were cancelled due to COVID-19, so our students were unable to present their summer work in the fall. For the same reasons, our SPS section had scarce opportunity for academic travel, tours and conferences through this year. However, we were able to take the advantage of communication technology opportunities that have become so accessible during the time of pandemic. Several students and faculty were able to attend virtual conferences of the Texas section of the American Physical Society (APS). The Fall meeting took place at the University of Texas, Arlington, the Spring meeting occurred at Texas A&M University, Corpus Christi. Two students presented at the Spring APS section meeting. Dr. Bykov and physics senior student, Joseph Watson, have also virtually attended the national APS meeting in March.

Throughout the academic year, we hosted several virtual presentations by the physics alumni in the series of talks **"What I did with my physics degree"**. In September, our speaker was **Mr. Todd Neer '10**. After graduating from McMurry, Mr. Neer held a number of positions with Whataburger®, first as a project coordinator, then as a business manager and as a digital product manager in San Antonio Whataburger office. The title of his talk was **"Digitally transformed teams - how business and technical teams lead digital transformation"**. Mr. Neer talked about how digital transformations have accelerated across various industries over the last 10 years. The success is less about the technology and more about the shift to focus on building digital products and services for the customer by truly understanding the customer's needs. He has shared his experience at a Whataburger, where he led digital product management team through the launch of their loyalty program and ordering products on both the website and mobile app channels. He described how data driven decisions are made to scale the digital products and respond to COVID. Mr. Neer also discussed what aspects of his physics degree were relevant to his transition to the world of business. His talk has attracted not just science, but also many business students.

In October, we welcomed **Mr. Dustin Brown '08**. After graduating from McMurry, Mr. Brown held a number of engineering positions with CoServ, an electric and gas distribution company serving North Texas. In 2017 he began working for Concho Valley Electric Cooperative, Inc. in San Angelo, TX. Mr. Brown is licensed as a Professional Engineer and currently holds the position of the Director of Engineering & Operations at Concho Valley Electric Cooperative. His talk was entitled **"Working as an Electrical Engineer with a Physics Degree"**. During his talk, Dustin discussed how his strong background in physics and a broad spectrum of experiences in electrical engineering led to his current career choice. His path to become a professional engineer was demanding and yet rewarding. From the tedious calculations of an arc flash study on a distribution system to designing and building an electrical arcing demo, from creating settings for numerous electronic distribution system controls and metering to developing standards and designs of distribution systems, from managing solar installations to developing and running demand response programs, from designing training facilities to investigating power quality issues, from mapping to system modeling, from designing and controlling SCADA systems to managing UAV inspection programs, his journey has been long, but the reward was worth the ride. We are grateful for this interesting talk and we are hoping that we will be able to take a tour of the Concho Valley Electric Cooperative next fall if travel restrictions are lifted.

Later the same month, we had another interesting speaker, who is not a McMurry alumnus, but had a very interesting career path from physics research to Wall Street to entrepreneurship and back to physics teaching. **Dr. Tigran Kalaydzhyan** earned combined BS/MS degrees in theoretical physics from Lomonosov Moscow State University, Russia in 2010. He then completed

his Ph.D. in theoretical physics at the University of Hamburg, Hamburg, Germany in 2013. He did his first postdoctoral appointment at Stony Brook University, NY from 2013 to 2015. His second postdoctoral appointment was at the University of Illinois, Chicago from 2015 to 2016. His third postdoctoral appointment was at the NASA Jet Propulsion Laboratory (JPL) in Pasadena, CA from 2016 to 2018. From 2019 to 2020, Dr. Kalaydzhyan worked as a Quantitative Analyst for A.R.T. Advisors, LLC in New York City, NY. Currently Dr. Kalaydzhyan resides in Abilene, TX where he invests in local real estate and teaches physics in a local college. His talk was entitled **"A personal statement in support of physics"**. In his talk he discussed a number of cases where the traditional physics and math education turned out to be invaluable for his career and the life path in general - from theoretical physicist, a NASA scientist, a Wall Street trader and a real estate business owner. He also talked about some lesser-known applications of physics and math skills to business and finance. This presentation caused a lot of interest among our students.

In November, we were joined by our recent graduate, **Ms. Alexandria Mendoza '19**. She is currently pursuing a Ph.D. in physics at Baylor University. She was talking about her current research project **"Determining Electrostatic Field of Microcavities in Lunar Dust Grains"**. The lunar regolith covering the surface of the moon has a component of very fine, jagged dust particles. The dust is difficult to remove from spacesuit material, and dust in the lunar habitat poses a hazard to astronauts' health. Thus an understanding of the transport of lunar dust is important for future lunar missions. Dust grains in the regolith become charged through exposure to the solar wind, photoemission and secondary electron emission. Ms. Mendoza is working on the implementation of a numerical model to resolve the charging of grains on the lunar surface and determine local variations in the electrostatic field. At the end of her presentation, Alexandria also discussed her experience in graduate school and in transitioning from the undergraduate to graduate level academics. This was especially useful for those of our students who are planning to continue their education at a graduate level. Some aspects of the Alexandria's project served as an inspiration for the SPS NASA project described above.

In January, many of our students were able to participate in a search process for an Engineering Physics faculty member and engage in a conversation with **Mr. David Upshaw '08** when he was interviewed as a candidate for that position. We sincerely appreciate all of our students for the valuable feedback they have provided in the search process.

In February, **Dr. Bradley Blackwell**, Assistant Professor of Sustainability and Renewable Resources at McMurry, talked to our students about non-traditional career routes in engineering. His own field of expertise is water resources and water pollution, but he has moved into that field after completing his Ph.D. in civil engineering at Syracuse University. Dr. Blackwell was able to answer many questions about interdisciplinary nature of science and various career paths in technical fields.

In April, we finished the semester with a talk from our recent graduate, **Mr. Richard Garcia'15**. When he was a student at McMurry, he completed a summer REU program with the Department of Mechanical Engineering at Texas A&M University, College Station. That experience has determined the next steps in his academic career. He received a ME in Mechanical Engineering from Texas A&M University in 2017. While in graduate school, Richard worked as an engineering intern with PM&AM Research. From 2017 to 2018, Mr. Garcia worked as a Science & Engineering Associate with the SLAC National Accelerator Laboratory at Stanford University. Currently, he is a Junior Mechanical Engineer with Century Design Inc. in San Diego, California. His talk was entitled **"Pivot: The Importance of Remaining Agile in Your Career"**. As a former McMurry student-athlete, he often found that it was essential to connect life lessons to the lessons learned on the field. In most sports it is crucial to master the skill of pivoting; planting your feet and changing direction in the quickest, most efficient way on demand. He discovered that this skill is also crucial for his career. Richard talked about the lessons he has learned and about using his physics degree to reach the next step in his career.

This was the last event of the spring semester that also coincided with the Sigma Pi Sigma, National Physics Honor Society, induction ceremony. We have recognized five of our best students: Austin Bridwell, Derek Hostas, Taryn Fambrough, Ernesto Valle, and

Jacob Williams as the newest members of our Sigma Pi Sigma chapter.

We would like to continue the **"What I did with my physics degree"** talk series next academic year and hope that many of you will be able to participate. Now that we can use communication technology to our advantage and bring remote speakers from faraway places, it should be especially easy for you to present in that series. If you are interested, please let us know, and we will be happy to schedule your presentation online during one of our SPS meetings. However, we would also love to see you in person as life goes back to normal. Hopefully, it will be possible to visit during the Homecoming weekend of October 15th-17th 2021. Please stay tuned for additional information.

As you may recall, last year our SPS chapter started a new project to promote the union of science and art. They have studied the drawings created by Leonardo da Vinci and built a prototype of a helicopter based on his designs. We are glad to report that the project was brought to its final stage and unveiled to the Science Building community during the end of the semester event in April of this year. The picture below shows our students working on the project earlier in the semester and standing around the model after Sigma Pi Sigma induction ceremony on the day of unveiling. We hope that **"da Vinci helicopter"** will find its permanent place in the lobby of the Science Building. Hopefully, we can invite a larger Abilene community to see the helicopter there.

There several more events of this academic year, we would like to mention.

As you hopefully remember, at the end of the last academic year Dr. Keith was finishing his work on the second edition of the book **"Earth's Magnetosphere"** by Dr. Wayne Keith and Dr. Walter Heikkila. The book is finally published and available for purchase. If you are interested, Dr. Keith, still has a few copies left at a discounted price and will be able to sign a copy of the book for you. The book is also available in the McMurry University Library and in the Physics Department. Dr. Keith's efforts working on the book were recognized with the McMurry University's E.E. Hall Memorial Scholar Award. Next spring, Dr. Keith will present the E.E. Hall memorial lecture on a subject from his book.

After the start of the Title V **"Building STEM Success"** project in October, Dr. Bykov has taken on an additional responsibility of the Activity Coordinator for this project. He will be closely working with David Upshaw and the rest of the Physics Department the on creation of the new Engineering Physics degree. After academic restructuring in April, Dr. Bykov was also appointed the chair of the new Division of Science and Mathematics. As division chair, Dr. Bykov will try to enhance collaboration between all science departments to better serve our students.

In March, the announcements were made about inaugural appointments of the two endowed professors in the sciences. Dr. Malaney O'Connell is going to be the first Norton Jones Endowed Professor of Chemistry and Dr. Tikhon Bykov has been selected as the first Virgil E. Bottom Endowed Professor of Physics. We are deeply grateful to all of you who have contributed to these two endowment campaigns. In his role as the Virgil E. Bottom Endowed Professor of Physics, Dr. Bykov will continue his research in the field of Density Functional Theory (DFT) that has been widely used in computational physics for solving problems related to interfacial phenomena. Even though, it is very challenging for an undergraduate student to master the numerical approaches behind typical DFT models, a

simplified 2D lattice gas version of DFT has been used by Dr. Bykov to introduce student research projects into the Thermodynamics II course. As we have reported in our newsletters in the past, the results of these projects have been presented at several undergraduate student research conferences. The last project led to McMurry physics student, Joseph Watson publishing in the Journal of Undergraduate Reports in Physics. This summer Dr. Bykov will be working on the refinement of the teaching materials for the DFT module of the Thermodynamics II course. At the same time, he will design the new DFT-based student research project(s) that could be used in future offerings of this course. In future, Dr. Bykov would like to be able to offer a summer student DFT workshop in a format similar to Research Experience for Undergrads (REU). Students will learn and master DFT methods and will complete a research project that will culminate in a poster that could be presented at a conference during the following academic year.

These are just some of the many events of the past academic year. You can always keep track of our current events by visiting us on Facebook (look for McMurry Society of Physics Students) or online at **(https://sites.google.com/site/mcmurryphysicsdepartment/home)**.

If you have been recently added to our database and/or never received this letter before and/or by some reason want to be removed from the list and/or prefer to update your contact information and/or prefer to receive an electronic instead of a paper copy of this letter, please do not hesitate to contact me at the address above or by email at **tbykov@mcm.edu**.

Tikhon Bykov - Wayne Keith - Timothy Renfro - David Upshaw, The McMurry Physics Department