

Tikhon Bykov
Physics Department, Box 38
McMurry University
Abilene, TX 79697
(325) 793-4875
tbykov@mcm.edu

Dear Friend :

With the end of the academic year it is now time to give our traditional review of the department news. Since the previous issue of this letter was all devoted to the Science Building renovation we have a lot of news to share with you going back to the beginning of this academic year.

We had five graduating seniors this year, all of which were working very hard to complete their senior research projects on time. It took them both the fall and the spring semesters to complete their work.

Tylar Murray has finished building and testing of the hydrogen fuel cell. Under supervision of Dr. Renfro he has completed the honors thesis in which he has reviewed the research findings, and experiential knowledge that would be of use for anybody looking to create or work with a fuel cell system. In this overview he has made a special emphasis on the functions of the individual parts of Proton Exchange Membrane (PEM) fuel cell. He has also described his own experimental findings specific to the testing platform constructed. You can find the picture of Tylar and his project on the McMurry SPS Facebook page. Tylar has graduated with honors and has been accepted to the graduate programs in electrical engineering at University of South Florida and at University of California in Santa Barbara. He has not made his final decision about post graduate plans yet. At the moment Tylar and Dr. Keith are working on astronomical observations in Lowell observatory in Arizona.

Aaron Ward has completed building and testing of the UAV aircraft under supervision of Dr. Renfro. This project included design and construction of the airfoil, fuselage, and tail section. The airfoil was designed based on the NACA 2415 airfoil, and data was provided through a program called Winfoil 3.0. This data was used to predict the flight characteristics of the aircraft itself. The fuselage was designed to house a battery, small camera, receiver, and all of the servos needed. Final testing included hand launches and in-flight testing, and belly landings. Control surface testing included ailerons and elevator. You can find picture of Aaron testing his aircraft on the McMurry SPS Facebook page. Aaron's postgraduate plans include moving to Dallas and looking for a technical job or internship there. He is planning on applying to graduate school next year.

Under supervision of Dr. Renfro Austin Wegner has completed his project on design and construction of a small-scale wind tunnel on the order of eight feet in length. The wind tunnel is suitable for use in educational demonstrations as well as low speed wind research. As a matter of fact, it has already been used during summer workshop with McMurry 5th grade magnet class. During his presentation Austin discussed design and the difficulty of construction as well as future modifications for improvement. You can find the picture of Austin and his wind tunnel at the McMurry SPS Facebook page. The tunnel is now permanently housed in the room S120 where it takes most of the back wall space. After graduation Austin has stayed at McMurry for the summer post back teaching certification program. Once he will receive his teaching certificate, he his planning on becoming high school physics teacher.

Also under supervision of Dr. Renfro, Michael Herriage has finished assembling of the main parts of the table top size cyclotron. The objective of this project was to investigate the theories and concepts behind the cyclotron particle accelerator, make predictions on a cyclotron that accelerates alpha-particles around 100 keV, construct cyclotron using predictions, and test the constructed cyclotron to see if it acts by the theoretical calculations. The construction of the cyclotron took more time than expected. The vacuum chamber and electron magnet were completed. However, the RF circuit which drives the electrode was not completed. We hope that Michael may have some time during the summer to finish his cyclotron or it will be finished by the next generation of physics students. You can find the picture of Michael next to his cyclotron at the McMurry SPS Facebook page. After graduation Michael is staying at McMurry through the summer to get his teaching certificate. Currently he is applying to various physics-related and teaching positions. Michael is also planning on applying to graduate school next year.

Jeanette Schofield has graduated with double degree in physics and mathematics. As part of the requirements for her math degree, under supervision of Dr. Cindy Martin, she has completed the honors thesis entitled "Quaternions and 3d Rotations". In this thesis she has considered historic background, definition and properties of quaternions as well as their applications to various problems in mathematics and physics. Jeanette's physics project, which she completed under supervision of Dr. Keith, was closely related to her math thesis. The final version of the project was entitled "Comparison of methods for rotating between two distinct coordinate frames". In this work Jeanette compared traditional in physics Euler's angles rotation method to the method based on using quaternions. After graduation Jeanette's long term plan is to go to the graduate school in Computer Science. However, she first wants to get some real world experience working in the programming industry. She is currently applying to various positions which will provide her with relevant experience before going into programming industry.

The department also has several juniors and seniors who either started working on their senior research proposals or continued working on their projects this year.

Under supervision of Dr. Bykov, Alistair Adams has made significant progress on his project of "Backyard Conversion of Waste Biomass to Ethanol". He has finished building his gasifier to produce a syngas from biomass. Most of the components used in the building of the gasifier were acquired from the local scrap yards. The body of the gasifier is made from an old water tank and some scrap metal. Alistair has also used an old electric motor from the physics department storage to run the gasifier's ventilation system. At the moment, the gasifier is under testing to be able to obtain sufficient amount of the syngas. It still remains to be seen if purification of the syngas and its conversion to ethanol will become possible.

Several students have also completed their proposals to perform projects during next academic year. Under supervision of Dr. Renfro, Sheharyar Khan is proposing to develop engineering design to cover McM football stadium or an available footprint. This design will be constructed and tested in Solidworks software. The department has purchased one copy of that software not only to be used for Sheharyar's project but also planning on introducing an engineering drafting course.

Under supervision of Dr. Bykov Jared Land has proposed to build a table top model rail gun, which uses strong magnetic field to drive a projectile. The objective of this research proposal is to design a functional Electromagnetic accelerator (i.e. railgun), with considerations for size, portability, modularity, and weight. The effects of various rail geometries/bore profiles, field augmentation, and projectile designs will also be studied. This project has been awarded "Charles and Lisa Bloomer student research stipend". This is the second award since the stipend was established by the McMurry Science and Math Advisory Board two years ago and the second time when the award is won by a physics student. You may remember that Tylar Murray was a recipient of the first award last year. Jared is the second winner this year. Congratulations to Jared!

Also under supervision of Dr. Bykov, Jeremiah Land in planning on designing and building of a small coaxial UAV helicopter that will fit in a backpack and be capable of streaming video from an onboard camera. Once completed, the applications of such a UAV will be explored.

Under supervision of Dr. Keith, Daniel Zipprian is planning to design and build a micro-hydroelectric power generator, including building the electric generator from scratch.

Also under supervision of Dr. Keith, Benjamin Sherwood would like to build a working model of a maglev train.

Some other student news worth of mentioning is that the second year in the row the McMurry physics major and honors student Ashley Simone Kelsey has received the prestigious American Physical Society (APS) Minority Scholarship. Each year, the APS Committee on Minorities in Physics acts as the selection committee for this scholarship which attracts many excellent applicants. Ashley has been chosen to be one of only 40 physics students in the Nation to receive this award.

There were only 3 students in our freshman class this spring, but we hope to gain more freshmen next year. We have met several promising perspective students during previews this year and count on them coming to McMurry. We have received several inquires and two applications for the Ward-Bottom scholarship from the incoming freshmen and one application from a sophomore, which has rarely happened in the past. We have awarded the scholarship to Stephen J. Terry a very promising student from a small town of Stratford in Texas panhandle. Stephen will be coming to McMurry in the fall with the intention of getting of his BS degree in physics here and later continuing his education to the doctorate level. We hope that Stephen will not disappoint our expectations.

We should also mention some other events which took place in the department during this year.

In the course of the year the McM chapter of the Society of Physics Students was working on an aerial photography project designed to include participation by the McMagnets, 5th grade students who attend the science and math magnet school program on the McMurry campus. The SPS members planned to set up a tethered balloon with a small camera in order to take photos from approximately 1,000 feet. Physics students taught one of the 5th grade class sessions to tell 5th graders about physics of buoyancy and how to build the container housing the camera. The actual balloon launch took place on April 12th. You can see the numerous pictures of this event on the McMurry SPS Facebook page.

In October Drs. Wayne Keith and Timothy Renfro and students Michael Herriage, Austin Wegner, and Tylar Murray attended the Region 13 American Physical Society (APS), SPS, and American Association of Physics Teachers (AAPT) joint conference at UT San Antonio. Students who participated were able to attend presentations given by undergraduates, graduates, and post-graduates over a wide range of research topics. Austin Wegner comments, "I feel like I gained valuable insight on how to give a presentation." Students were also able to tour the Southwest Research Institute where they learned about the institute's role in several NASA missions and explored some of the facilities where space instrumentation is designed and tested.

Also in October a group of physics students, including Michael Herriage, Sheharyar Khan, Tylar Murray, Aaron Ward, Austin Wegner, and Daniel Zipprian and all physics faculty visited the campus of Texas Tech University at Lubbock. The purpose of the trip was to learn more about Graduate School opportunities at Texas Tech. We received a warm welcome from Dr. Ravi Dani, the graduate school recruiter for College of Arts and Sciences, Dr. Mahdi Sanati, the graduate school recruiter for the Department of Physics, and David Upshaw, McMurry Physics class of 2008, and a graduate student at the Mechanical Engineering Department of Texas Tech. The group first visited the Physics Department and met with the Physics Chair, Dr. Roger L. Lichti, who gave us a brief overview of the department research focus areas and talked about expectations placed on the incoming graduate students. We then took a tour of the Texas Tech University Nano Tech Center, which is an interdisciplinary structure built between the Physics, Chemistry and Engineering departments. The Center's areas of interest include fundamental science and growth of advanced semiconductor materials for optoelectronic and CMOS applications, and the design, fabrication, characterization and implementation of MEMS. The tour was given by the center's director Dr. Mark Holtz. The group also took a tour of Biophysics and Teaching labs in the Physics Department and the Mechanical Engineering laboratories, organized by our good friend, David Upshaw. On this tour we saw failure analysis, robotics, high pressure, combustion processes and some other labs. We also observed the \$1.5 million electron microscope at work. The day was completed by visiting the Texas Tech University Museum.

In February the Physics department purchased a single license of Solidworks CAD and Simulation software for senior projects and later development of a drafting and computer simulation class to be completed before senior projects are started. It is believed that this will enhance the students' ability to complete a model and simulation before projects begin construction. This will be added as a component of project research for those looking to build experiments and devices.

In November Dr. Tikhon Bykov attended the national meeting of the "New Physics Faculty Reunion" at the University of Maryland. During the meeting Dr. Bykov presented a poster entitled "Using MS-OneNote Software as Interactive Teaching Tool in Physics Courses" In this poster he described how collaborative writing features of MS-One Note software can be used for effective interactions between a student and the instructor. He also showed how MS OneNote can be used for various in-class group activities and work on group projects. As an illustration, some examples from calculus-based University Physics course and algebra-based General Physics course taught at McMurry University were considered.

In March Dr. Bykov and two physics students, Aaron Ward and Michael Herriage attended National American Physical Society (APS) meeting in Dallas. It is not that often when our students have a chance to attend a meeting of the professional society at the national level. Even though both Aaron and Michael have been regularly coming to the Texas section APS meeting, it is the first time for them to attend the national event. The meeting brought about 7500 physicists from the United States and around the world to Texas. The meeting program has extended thought entire week with talks, posters and exhibits being given in almost every sub area of physics and related scientific fields. With such a huge scope of activities, it was somewhat difficult for us to choose what presentations we should attend. Perhaps, one of the most memorable events was David Hanson's (of Hanson Robotics) presentation on advances in construction of modern human-like robots. A present day robot is capable of supporting rather long conversations with people and even though these conversations may not necessarily be at the top level human intellectual abilities, it is rather high achievement for a "talking machine".

Another challenge is how to make robots more lifelike, so that not only they can talk but also mimic human facial expressions and be more actively involved in conversation. David Hanson brought his “friend”, a robot called Philip K Dick, with him and placed him in the audience, so we have found ourselves rather surprised seeing Philip seating almost right behind us during David’s talk. In the afternoon Michael Herriage had a chance to attend some of the exhibits and talk to the representatives from the company manufacturing vacuum chambers to get some assistance on his senior research project. Also in the afternoon Dr. Bykov presented a talk “Modular Curriculum Approach (MCA) for teaching of introductory physics: Tablet PCs and flexible instructional space to stimulate active learning” during the session devoted to the physics education research. In his talk Dr. Bykov discussed recent introductory physics curriculum reform and renovation of the physics spaces in McMurry Science Building.

In April four physics students including Tylar Murray, Doyle Dacus, Aaron Ward and Jeremiah Land and all physics faculty visited the campus of Baylor University to take a tour of the new Baylor Science building and physics laboratories there. On the Baylor side the tour was organized by Dr. Walter Wilcox and former McMurry Physics student Tim Renner. We were happy to learn that Tim will be graduating from Baylor this spring with PhD in string theory physics. Congratulations to Tim! Tim has given us an excellent presentation highlighting the main aspects of his PhD research work as well as overview of Baylor’s graduate program in string theory physics. On the same day our group took a tour of the testing site for Space X Corporation in McGregor. This test facility is responsible for testing of rocket engine hardware from development stages through acceptance for flight, and from component level to complete stage testing.

In May we have welcomed back our old friend David Upshaw. David has graduated from Texas Tech University Department of Mechanical Engineering with his Masters degree last month. Congratulations! He has visited us to give a presentation on the subject of his Master’s thesis work. His talk was entitled “Influence of Drilling Parameters on the Accuracy of Hole-drilling Residual Stress Measurements“. According to David, the objective of this research was to define drill speeds that produce acceptable results when using the hole-drilling technique for measuring residual stress. This was achieved by performing ESPI/hole-drilling stress measurement of a known applied stress in discrete rpm intervals. The talk took place in front of the full audience of physics students and faculty and received a very warm welcome.

These were just some of the very many news we had this year, but you can always keep track of our current news by visiting us on Facebook. Look for McMurry SPS group page.

Since the picture with the enrollment of the new physics majors is not quite clear, as usual we would like to ask your help in telling prospective students interested in physics about our physics program and your experience at McMurry. Please feel free to give these prospective students our contact information and invite them to visit our web site at <http://www.mcm.edu/newsite/web/academics/ncs/physics/index.htm> or visit us on Facebook under “McMurry Society of Physics Students”.

We only had one of our former students, David Upshaw, to come and meet with our students this year, but we hope to continue the tradition of alumni talks. Even if you are coming here not with a special purpose of giving a talk but for some other occasion, please do let us know about your visit and we will be happy to chat with you and hopefully get some of our students to meet with you. One of the best occasions to visit us is during the Homecoming weekend. This year it will take place during the weekend of October 7th-9th. As in the past, we will have a special reception for science alumni and we are looking forward to see you there.

If you have been recently added to our database and 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, The McMurry Physics Department