



Department of Physics



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

Dear Friend :

With another academic year being over, it is the time to give you the latest update on the Physics Department news.

In addition to two graduates in December, the department had another graduate, Daniel Zipprian, this spring. Under the supervision of Dr. Keith, Daniel has completed his senior research project to build a Micro Hydroelectric Generator and presented his work to the public in late February. For his design Daniel planned to funnel the flow of water into a nozzle which would be aimed towards the turbine. The turbine constructed by Daniel is connected to a shaft that is connected to the rotor. The rotor uses a brake rotor for the surface to hold the magnets. The system is vertical, with the rotor as the highest part on the generator and the turbine at the bottom. The magnets are facing downwards with the magnetic field going in a vertical direction. The stator of the generator consists of the coils sitting on top of a metal ring that can be adjusted to match the height of the brake rotor. The generator was tested and is capable of producing small voltages. Inspired by the work on his project, Daniel has applied to several graduate programs and jobs. He has been accepted to the MS graduate program in Mechanical Engineering at University of North Texas. He has still to make his final decision about his postgraduate plans.

The department also had two students who either started working on their senior research proposals or continued working on their projects this year.

Under the supervision of Dr. Bykov, Jared Land has finished building a table top model rail gun which uses a strong magnetic field to drive a projectile. The objective of this work was to design a functional electromagnetic accelerator (i.e. rail gun), with considerations for size, portability, modularity, and weight. Jared was able to test the gun with projectiles of different shape and find the one which worked the best. You can see the video of the most successful test on YouTube at <http://www.youtube.com/watch?v=B-hKWduKgA>. Jared and the Physics Department would like to thank the Science and Math Advisory Board for awarding the "Charles and Lisa Bloomer student research stipend" to Jared last year and making it possible to fund the parts for this rather expensive project. At this point Jared has completed all of the requirements for his physics degree, but he is going to stay at McMurry for one more semester to pursue additional minors in Psychology and Political Science.

Under the supervision of Dr. Renfro, Arthur T. Ross developed a proposal to modify an obsolete, malfunctioning spectrophotometer owned by the Chemistry Department and convert it into a modern/digital piece of equipment. The final product will be a digital spectrophotometer that can interface with any modern laptop, using student-programmed software. This equipment will be completely serviceable in-house and will function at a level near that of a new spectrophotometer at a fraction of the cost. Arthur has presented the proposal to the public in mid-April. He has already started working on disassembling the old spectrometer and hopes to have most of the work done during the summer. The project will be funded by both the Physics and Chemistry departments. Also, the Science and Math Advisory Board has awarded the "Charles and Lisa Bloomer student research stipend" to Arthur to work on this project. This is the third award since the stipend was established by SMAB three years ago and the third time when the award has been won by a physics student, even though two awards were given this year, one going to Physics and the other one to a student in the Biology Department. We are very grateful to SMAB for their continued support of the Physics program and congratulations to Arthur!

We had a record high nine freshman students in the University Physics course this spring. Six of them will continue on to the sophomore year. We hope that they form the core of the physics student body for the next couple of years. Among them is Brittany Houghton, the new recipient of the Ward-Bottom scholarship. Brittany is a second generation McMurry student from Merkel, TX. She is interested in Astrophysics and after graduation

wants to go to a graduate school majoring in that subject area. Brittany has also been elected as the new president of the McMurry Society of Physics Students Chapter for the upcoming academic year.

As usual, at this time of the year the freshman enrolment is not clear yet. This is why we are always asking you to help us identifying more prospective students. If you know of somebody who might be interested in perusing a degree in physics or pre-engineering, please give that person our contact information. We are always happy to chat with prospective students, their parents and provide more information on our programs.

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

At the end of March, all physics faculty and a group physics students, including Brittany Houghton, Jared Land, Sarah Nason, and Daniel Zipprian, as well as physics alumnus Jeremiah Land traveled to the Texas Section of the American Physical Society (APS), American Association of Physics Teachers (AAPT) and Society of Physics Students (SPS) joint meeting at Angelo State University, San Angelo, TX. All McMurry students participating in this meeting presented posters on various research and class projects they completed during the past year.

One of the audience favorites was the poster presented by physics freshmen Brittany Houghton and Sarah Nason on the project they completed last fall in the University Physics I course. They studied the compression of cake. The class came up with this idea after a Young's modulus experiment with stretching wire was performed. A question was raised of what would happen if we compressed something else? Students created their own Young's modulus experiment, but in a more entertaining way. The experiment involved measuring the height of a cake before and after a weight has been applied to the cake. The compression coefficient was determined then and conclusions were made for what type of cake is more compressible. Based on this experiment, in collaboration with Dr. Renfro, Sarah and Brittany designed a lesson plan which can be used by high school teachers who want to teach the subject of Young's modulus.

Jared Land and Jeremiah Land presented a poster on the project they completed in collaboration with Sheharyar Khan as part of the "Electricity and Magnetism II" course they took with Dr. Bykov last year. In this work they studied a numerical solution of the boundary problem for the 2D Laplace equation for the electrostatic potential in a given geometry. The objective was to numerically model the potential grid and the electric field of 2-dimensional capacitors of various configurations and compare them to the experimental results. The goal was accomplished by the implementation of the finite difference Gauss-Seidel iteration method through the use of the C programming language.

Daniel Zipprian presented a poster on the subject of his senior research project "Construction of Hydroelectric Generator" which he has recently completed under the supervision of Dr. Keith.

Finally, Dr. Renfro presented the poster created by his student Arthur Ross, who was not able to attend the conference. This work was done as part of the "Digital Electronics" course last fall. In that project the students created a Christmas light display that toggles the power of different strands of lights, according to what frequencies are played in a song, as an example of an analog to digital circuit. This was accomplished using a BA3830S IC six-band audio filter and six solid-state relays.

Also during the conference Dr. Bykov presented a talk entitled "Using peer review process for teaching introductory physics laboratory." In this talk Dr. Bykov described how a method very similar to the professional peer review process has been incorporated into the teaching of an introductory physics laboratory at McMurry University. In this process students are asked to review anonymous copies of each other's lab reports and determine whether or not these reports are suitable for publication in a scientific journal. This technique has become an essential part of the Modular Curriculum Approach (MCA) teaching model designed and adopted at McMurry for teaching the introductory physics sequence.

This spring for the first time, Dr. Renfro offered an Engineering Drafting course for students who are interested in future engineering careers. It is based on Solidworks 3D CAD software. We were able to purchase a site license for this software using some money from the Ward-Bottom fund and we are grateful to Roger Ward for creating this fund and, among many other things, making this class possible. In this course students learned how to create a part in a CAD program, produce an orthographic engineering draft, simulation testing, and basic engineering and manufacturing standards. The final project was assigned in the course. For that project students were divided into civil engineers and mechanical engineers. They picked a real world problem and were asked to derive a solution, using the CAD program. The first group made engineering drafts for equipment to be used in the Biology Department. This equipment would include different stands and holders for photo cameras used by Dr. Brant to take pictures of various animals in a wild. The second group created engineering drafts for a bridge in the Abilene area.

Also this spring Dr. Keith in collaboration with Dr. Thornburg of the Math Department offered a “Leadership in Science” course. The course project this year was to perform an energy audit and come up with some ways of saving money on the electric bill for one of the nonprofit organizations in Abilene. The class decided to help the “Boys and Girls Club” that meets at Wylie Christian Church on the south side of Abilene. After multiple site visits to take measurements and some number crunching and online research, the class put together a set of recommendations to improve the energy efficiency of the buildings.

In March we continued our alumni talk series with one of our most devoted alumni, Dr. Charles Curb. This time his talk was entitled “Science and the English Language”. In this talk he discussed the special role of language in the scientific enterprise. One of Dr. Curb’s examples was about forensic linguistics. Apparently one can determine, based on the writing sample, whether or not it was written by a man or a woman. In some cases, such evidence can become a decisive piece of information in a murder trial. The students and faculty enjoyed Dr. Curb’s talk. We always like to welcome our alumni back and would like to see more of you coming here in the future. 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 is during the Homecoming weekend. This year it will take place on October 25th-28th. You will receive a special invitation to the Science Homecoming Reception in the fall.

This spring the department has also continued working on updating the physics equipment. In particular, for the first time in recent years the University has funded a capital fund request from the Physics Department to upgrade the ageing equipment in the physics machine shop. Some of the items in the shop are dating as far back as the 1940s and becoming very dangerous to work with. At the same time the shop has been used more and more actively in recent years, starting from the building of the famous physics trebuchet in 2007 and up to the last student projects of Jared Land and Daniel Zipprian. More and more of our students want to build something for their senior research work. This is why we decided that updating the shop machinery should be one of our top priorities. The process started this spring with the purchase and installation of the new mill. Having this device will improve the safety of the shop as well as improve the quality of manufacturing. Until now all the milling has been done using a drill press. A mill will replace it as well as give a more stable platform for machining which is safer. You can follow the story of moving 2500 lb. mill into the shop on our Facebook page. The mill is now finally installed and ready for operation. We hope to be able to continue the shop renovation process and purchase a new lathe next year to replace the lathe which has been in the shop for the last 50 years.



The last but not least of the big news is that in March Dr. Keith received tenure and was promoted to the rank of Associate Professor. Our congratulations to Dr. Keith for a job well done!

These were just some of the very many news we had during this spring. You can always keep track of our current news by visiting us on Facebook. Look for the McMurry Society of Physics Students group page.

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