Holding Back the Floodwaters

Physics and Engineering majors at UWRF get told many times that each course they take will give them some specific knowledge that may be useful in their careers after graduation, but the most important thing that they are learning is how to come up with a solution to a problem that they may never have encountered before. Of course, their instructors aren’t talking about textbook problems when they make that statement. In Kevin Kubiak’s case, the ‘problem’ he encountered after graduation was how to keep water from a hurricane from inundating a town.

Originally from Rhinelander, WI, Kevin was a Dual Degree Engineering student [Ed. - see the sidebar story.] at UWRF and the University of Minnesota, receiving degrees in Applied Physics and Civil Engineering in May of 2012.

As an undergraduate, Kevin interned with the Wisconsin Department of Transportation and also worked on a biomass reactor based on natural materials that was designed to filter agricultural and chemical run-off before the water re-enters the water system.

After graduation, Kevin accepted a position with HESCO Bastion Environmental (www.hesco-usa.com). HESCO specializes in ‘concertainer’ wall units. These are basically wire-mesh, open top boxes that are lined with a durable fabric that is impervious to water. The boxes are connected together, forming a cellular structure, and can be compacted for shipment. When installed, the structure is expanded out (like a concertina, continued on page 2....

UWRF’s Dual Degree Engineering Program Growing Rapidly

Studies by the American Institute of Physics have shown that one of the features of successful physics departments is that they provide their students with many degree options - giving students more flexibility for choosing the career path they desire. One way that UWRF achieves this goal is through the ‘dual degree’ engineering program.

The UWRF dual degree program was initiated by Prof. John Shepherd in the mid-1990s. This type of program is sometimes called a “3-2 program” because students spend approximately three years at UWRF and two years at an engineering school. At UWRF, they take science, math, and general education courses in addition to their first engineering courses. Students then complete their junior and senior engineering courses at the University of Minnesota or the University of Wisconsin-Madison. At the end, they earn two bachelor’s degrees in about five years: applied physics from UWRF and engineering from the engineering school they attended.

Beginning in 2005, Prof. Rellen Hardtke became the coordinator of the dual continued on page 2....
...Flood Walls

continued from page 1

hence the name) very quickly, and can easily be filled with sand or rock to increase the strength of the wall. In locations where flooding is possible, these units can be deployed and filled with sand much more quickly than a traditional sandbag levee can be created.

Upon starting his job, Kevin moved to Charleston, South Carolina just a short time before the Atlantic hurricane season began. In August, he was sent to Plaquemines Parish outside of New Orleans, LA, in anticipation of Hurricane Isaac. There they inspected existing flood walls and oversaw the installation of additional retaining walls along Highway 23, a crucial transportation route. In addition, Kevin assisted the U.S. Army Corps of Engineers with installing their product to fill a gap in an incomplete flood wall nearby. They finished the construction just before Hurricane Isaac hit but stayed outside in Plaquemines Parish as long as they could to make sure the walls were operating properly - saving an eight mile length of the road from being flooded.

The ‘problems’ that UWRF alumni face after graduation come in many different forms, but Kevin has shown just how well those problems can be solved.

...Dual Degree Engineering

continued from page 1

degree program at UWRF and has built the program into a popular option for our students. Over half of our 100+ majors are interested in pursuing careers in engineering.

Looking at those students who have completed the dual degree program since 2008, 100% of them are employed in technical fields and many have moved into project management/leadership roles. Over 30% of our dual degree alums are women, far higher than the national averages for women in engineering and physics. The variety of the engineering degrees earned by the dual degree students (Mechanical, Civil, Electrical, Biomedical, Aerospace, and Astronautics) shows the flexibility of this degree option - allowing students to achieve their career goals, rather than being pigeonholed into a particular engineering path. Starting salaries for these students average more than $55,000, with rapid increases as they gain more experience.

Our physics/engineering dual degree alumni since 2008 and their current positions are:

Casey Murray: Ph.D. student, Electrical Engineering, Univ. of Minnesota
Sydney Hall Wittmier: Business Development Engineer, M.A. Mortenson
Megan Mealman: Engineer, Progress Rail
Tyler Cramer: Quality Assurance Analyst, QBE Insurance
Dustin Mariette: Design Engineer, Northland Tool and Equipment
Adam Lewis: Engineering Supervisor, Progress Rail
David Fairchild: Engineering Lab Supervisor, Donaldson Company (and a current MBA student)
Sean Gamlin: Mechanical Engineer, Mammoth Inc.
Grant Squires: Test & Evaluation Mechanical Engineer, Alliant TechSystems
Daniel Carbone: Consultant, Lancelt Software Development
Crystal Sparkman: Mechanical Engineer, Aspect Automation
Ashley Hammerbeck: Ph.D. student, Environmental Engineering, Univ. of Michigan
Sean Grainger: Design Engineer, Andersen Windows
Michael Koester: M.S. student, Mechanical Engineering, Univ. of Minnesota
Jason Malisheski: Test Engineer, Seagate Technologies
Tracy Crane: Civil Engineer, Ramaker & Associates
Denise Nelson: Biomedical Development Engineer, Sunshine Heart
Jason Zander: Project Engineer, ITW
Kevin Kubiak: Technical Rep, HESCO Bastion USA
Andy Beebe: Mechanical Engineer, SVT Associates

Of course, the flexibility offered at UWRF does not stop with the dual degree program, as there are three other physics major options for students to choose from - all of which lead students into careers as scientists, engineers, and other technical fields.

Please direct any questions regarding the Dual Degree program, or interested students, to Prof. Rellen Hardtke, 715-425-3560, rellen.hardtke@uwrf.edu.
Finding Physics Everywhere

By Matthew Vonk

It can be daunting to be a physicist today. A few centuries ago all it took to be a great physicist was a serendipitous rest under an apple tree and voila! the fundamental laws of nature came pouring forth with a bonus portion of Calculus on the side.

Nowadays you can’t even find a new sub-atomic particle for less than a few billion dollars. It’s not that there aren’t still great discoveries to be made, (I’m personally excited by the prospect of habitable exo-planets in our neighborhood and the steady progress toward a practical quantum computer) but finding the next Shor’s algorithm isn’t something that I’m likely to come up with on my own between classes.

But all science doesn’t need to be monumental science just as there is much more to art than Mount Rushmore. And in the same way that artists are able to see the world in a heightened way that has the ability to transform the ordinary into the extraordinary, I think that physicists also need to be able to see the laws of physics bubbling and oozing out in unexpected places.

That’s why I’m so thrilled to come across situations that cry out for a physics explanation. A few months ago someone sent me the link to a video about a new kind of recreational watercraft that allows the user to fly up to 10 m above the water’s surface by redirecting the water from a 4” diameter fire-hose that has been connected to the output port of a JetSki. The resulting motion is fluid and natural and surprisingly similar to the 1950’s vision of the future of transportation. (See: tinyurl.com/FlyBoardVideo)

I was immediately intrigued by the vehicle, but it wasn’t until Flyboard ® came to the upper Midwest that I called up my friend and video-collaborator Peter Bohacek (a UWRF alum and a physics teacher from Henry Sibley high school in Mendota Heights MN) to record some high-speed footage of the water-propelled jetpack in action. The high-speed video allowed us to explore the physics behind the Flyboard and that lead to an article which was published in the January 2013 issue of Physics Today as their Quick Study feature (tinyurl.com/PTVonkFlyboard).

Our high-speed video, along with a regular-speed video can be found in our video library:
serc.carleton.edu/sp/library/direct_measurement_video/video_library.html

I’m always on the lookout for other ideas, so please let me know (matthew.vonk@uwrf.edu) what surprising, unusual, or unexplained patterns you’ve noticed. After all, if the only thing you’re looking for is the Higgs boson, you’re likely to miss something that’s right under your nose.
Meet Our Newest Faculty Member: Suruj Seunarine

As of this Fall, the title “Best Salsa Dancer in the UWRF Physics Department” has been taken away from Matt Vönk, and bestowed upon the newest member of the department, Dr. Suruj Seunarine. It was a dance-less coup, as Matt - a fine amateur dancer - knew that Suruj, a native of Trinidad and Tobago, grew up dancing on those southern Caribbean islands from which calypso music and the steel drum originate.

Of course, his smooth moves on the dance floor were not the reason he was hired as an assistant professor here at UWRF. Like all the Physics faculty, Suruj is a devoted teacher, who is eager to work with the undergraduate students here. Suruj’s research background has multiple layers: quantum field theory, high energy physics, and most recently, neutrino astrophysics with the RICE (Radio Ice Cerenkov Experiment) and IceCube experiments.

He is ‘replacing’ Jim Madsen in the classroom as Jim takes on greater duties with IceCube in Madison, while remaining the department chair here at UWRF. Part of Suruj’s initial appointment is to involve undergraduate students in IceCube research throughout the year, including over the summer months, which will help lead to an on-going group of student researchers here.

Inspired by Carl Sagan’s “Cosmos” TV show, Suruj studied physics at the University of the West Indies, Trinidad campus, as an undergraduate. From there, he earned a Diploma in High Energy Theoretical Physics in Trieste, Italy, at the International Center for Theoretical Physics. At that time, the center’s director was Nobel Laureate Abdus Salam, who Suruj says was highly inspiring. It was in Italy where Suruj first learned the Latin American dances, as he could find Latin dance clubs, but none for the dances of the West Indies.

From Italy, Suruj returned to the western hemisphere, where he did his graduate work at the University of Kansas, with his dissertation focused on the theory of metastable quantum fields. At the same time, however, he also worked with the experimental high energy physics group on RICE. During that time, he made two trips to the South Pole to do field work.

Continuing his westward journey around the globe, Suruj next went to the University of Canterbury, in Christchurch, New Zealand. Although he was planning on spending only two years there in a post-doctoral appointment, he became a lecturer at Canterbury and ended up spending nine years in New Zealand.

While there, he met his wife, Carla. It was during this time that Suruj became a member of the IceCube research collaboration.

In order to do some dancing, Suruj went to some dance classes while in New Zealand, but was quickly asked to be a dance instructor. This led him to co-found a dance company called ‘del Caribe’ which eventually dissolved when he left New Zealand.

Suruj’s next stop brought him to Barbados, within a few hundred miles of Trinidad and Tobago. There he worked for three years as a lecturer in Physics at the Cave Hill campus of the University of the West Indies. And now, he’s here at UWRF, the furthest north he has ever lived. He’s joined by Carla and their young son, Liam, who has been able to enjoy snow at a much younger age than Suruj did.

In their short time here, they’ve already “been to a state fair, rodeo, and had more than enough deep fried cheese curds.” Since they enjoy traveling, they plan to get out and see as much of America as they can in the coming years.
Alumnus Profile: Carl Nelson

After graduation from River Falls in 1987, I received my M.S. in Physics while attending Michigan State University. My research there focused on low temperature superconducting thin films. During my stay at MSU, I was part of the founding group of graduate students that formed a science outreach group known as Science Theater. This was the beginning of what would become my focus in the coming years: communicating the “wonder of science” to the general public.

As part of this outreach group we built props, such as a bed-of-nails, wrote show scripts and took science out on the road to local schools as well as the local mall for “Science Day at the Mall.” The group was awarded the AAAS award for public understanding of science in 1993. The group has since expanded beyond the Physics department and is still in operation today.

Around 1994 I left MSU and moved to Ann Arbor, Michigan and began volunteering at the Ann Arbor Hands-on Museum. Eventually I became the Outreach Coordinator responsible for managing and delivering outreach programs throughout southeast Michigan. This was a great gig; I was the guy that brought liquid nitrogen, the bed of nails and slime to schools.

In 1997, a new science center was opening in Toledo, Ohio. COSI Toledo (Center of Science and Industry) was an amazing 100,000 square foot facility with over 300 interactive exhibits. I joined the opening team as an Electronic Exhibit Technician. It was amazing to be part of the opening of such a huge project. The iconic exhibit was (and still is) the High Wire Cycle. The first of its kind bicycle that visitors can ride suspended on a one inch diameter cable (twenty feet off the ground) stretched 60 feet across an open atrium! Currently I am the Exhibits Director and Chief Scientist.

As Chief Scientist, I am responsible for development of science content and training for large-scale demonstrations and small group inquiry activities as well as presenting and training team members for weekly live television segments.

For the past 6 years I’ve had a lot of fun appearing on local TV showing off our newest exhibits and demonstrating all sorts of cool science. For the past two years I’ve presented a weekly live science segment, “Imagine It,” on Saturday mornings on the local ABC affiliate WTVG.

Over the past 17 years I’ve seen the science center open, close for two years due to financial difficulties, and then worked to reopen it under its current name, Imagination Station. During that time as Exhibits Director I’ve been responsible for new exhibit development and day-to-day exhibits operations. During the past three years I have overseen nearly 2 million dollars of new exhibit and facilities renovations at the science center.

At this point I don’t think I could have found a job that is as much fun, as challenging and new every day. If you’re in Toledo, stop by the Imagination Station, check it out and say hello.

[Ed. - To see past episodes of Carl’s on-air, LIVE presentations, go to: carldnelson.com/content/science-videos/]

This page top left: Carl Nelson poses with a flaming test tube of solid methane. The methane is solidified by submerging the tube into liquid nitrogen. As the solid warms, the evolved vapor can be ignited. The size of the flame is controlled by heating or cooling the tube. Top right: Carl demonstrates the “self-carving pumpkin” at a meeting of the Toledo Rotary. For this demo, a pumpkin face is carved, and the carved pieces are placed back into the holes. A beaker of water with calcium carbide is placed inside the pumpkin to generate acetylene gas which can be ignited with a lighter inserted in the back of the pumpkin. The resulting explosion forces the ‘face’ pieces out of the pumpkin. Left: Carl in the classic bed of nails demonstration, with a Halloween twist.
Making Games can be Educational, Too

In Matt Vonk’s introductory Electronics course, students learn all about a variety of important and useful topics: filters, operational amplifiers, Thévenin equivalent circuits, circuit simulators, and LabView programming, for example. The last three weeks of the semester are devoted to having students complete a project that demonstrates their knowledge and mastery of the material they’ve been learning.

Common projects are guitar amplifiers, light sensors, and audio filters. This past semester, Peter Gagliardi and Joe Germain built a Pokemon Game in a Box.

The object of the game is to move the Pikachu (a Japanese anime character) back and forth to avoid obstacles moving past on a conveyor belt. Beneath each obstacle is a magnet, and the Pikachu sits above a small magnetic field sensor. If one of the obstacles passes beneath the Pikachu, the sensor detects it and the game stops. The score is determined by how long the player can avoid the obstacles.

The conveyor belt starts slowly, but quickly ramps up to an impossibly frenetic pace. When the game is over, the lid of the box closes automatically. In addition to having cool graphics, two stepper motors, and a LabView controlled data acquisition board (DAQ), the device plays the Pokemon theme song and keeps track of players’ high scores. The students’ video describing the project is available at: www.youtube.com/watch?v=XVLV2LuocUQ

Spring Banquet

The annual spring physics banquet will be held in the evening of Friday, March 15, 2013 in the University Center Ballroom. In addition to inducting the new members of the Sigma Pi Sigma physics honor society, there will be student posters for perusing and opportunities to catch up with alumni, old and new faculty, students, and staff.

After dinner, we will have a talk by University of Minnesota Electrical Engineering Professor Rhonda Franklin. Her research involves radio frequency microelectronics for communications and the interface between biology and electronics. She has also served as undergraduate and graduate advisor for UWRF dual degree student Casey Murray. Watch your mail for a postcard in February with more information.

Physics Puzzler Result

Last issue’s Puzzler was to identify the apparatus shown in the picture. The winner of the puzzler prize was Lilian Hoines (an alum from 1990) who correctly identified the device as a galvanometer.

The mirror in the center is attached to a thin vertical wire which allows the mirror to rotate around a vertical axis. The mirror is also attached to a coil of wire (underneath the mirror in the base of the instrument) which sits between the poles of a permanent magnet. The galvanometer is attached to an electrical circuit via the two terminals in front. Current flowing into the device flows through the coil. Because the coil sits in a magnetic field, the electrons experience the Lorentz force - causing the mirror to twist. By monitoring the angle of a beam of light reflected off the mirror, the galvanometer can be used to determine the amount of current flowing through the device.

[Ed.: The editor is always looking for good Puzzler ideas, if you have one - please send it in!]
2012 ΣΠΣ Quadrennial Physics Congress

Editor’s note: In early November, a contingent of UWRF physics students and faculty attended the Sigma Pi Sigma Physics Congress, which is held every four years. The following are excerpts from their report of the trip to the Society of Physics Students.

The SPS delegation from the University of Wisconsin-River Falls recently participated in PhysCon 2012 in Orlando, Florida. The experience was incredible. You see, during the drudgery of a typical Physics undergrad’s semester, one often becomes overwhelmed and delirious with the exhaustion brought on by the many long hours spent pouring over the incredulous minutiae contained in the perplexing equations of the universe. PhysCon provided the inspiration to continue. The unique experiences at NASA, listening to all of the amazing presentations given by some of the heaviest hitters in Physics today, then actually sharing a meal and rubbing elbows in personal conversation with such incredible people reminded us of why we were going through the rigorous journey that is learning Physics. The conference came at the perfect time in the semester: that time around the 10th week when typically “the wheels come off” for many students.

Eight students, accompanied by Earl Blodgett, traveled approximately 1,500 miles to attend the Sigma Pi Sigma Congress 2012 in Orlando, FL. We were generously funded by UWRF Falcon Grants and UWRF Physics Alumni. We’ve been working to raise funds for nearly four years, after sending a group to the 2008 Congress.

The NASA tours were a major highlight of the conference for us. Two students, Theodore McDonough and Katrina Hanson, engaged in the SPS Reporter tour and the other six students enjoyed the regular tour. The students who were serving as SPS reporters got to tour NASA labs and meet NASA researchers, get photos next to the countdown clock, and stand by the launchpad. The other students toured the Visitor Center and also went to the launchpad. Going to a facility so highly-recognized for its contributions to science and technology was inspiring.

There were several other parts of the conference that were memorable. We enjoyed listening to plenary talks by prominent scientists such as Prof. Freeman Dyson. The workshops were informative, enjoyable, and thought-provoking. Students from our group were represented in all of the different workshops, so we got to discuss our various experiences with one another and learn even more.

Breakfast with the Scientists was also memorable. Several students in our group used the exhibits to explore grad school opportunities and network with representatives from various physics associations. Two students, Charlotte Evans and Tyler Capek, presented their research at the poster session. Eating liquid nitrogen ice cream at the party was fun as well!

While we were in Orlando, many of us took the opportunity to venture around a bit. We enjoyed meals together at the Mexican and Chinese restaurants across the street. Seeing all the wildlife was an added bonus; in total, we saw several alligators, a dolphin (in the ocean!), an armadillo, lizards, pelicans, and vultures! The weather was also wonderful, especially when compared to our usual frigid Midwest environment.

We thoroughly enjoyed our trip to PhysCon 2012 and we are very thankful that we had the opportunity to attend. The experiences we had there were enlightening as well as enriching. We were able to bond as a group as well as network with other students and professionals who share our love of physics. This was a very memorable event for all of the UWRF students who attended, and our advisor got to cross touring the Kennedy Space Center off his bucket list.
Upcoming Observing Schedule

The UWRF Physics Department’s public observing schedule for the 2013 spring semester has been set. Each evening begins with a public presentation by our own Eileen Korenic, followed by the public observing session in the observatory, weather permitting.

Objects to be seen in the night sky this spring include Jupiter, the moon, and globular clusters.

Tuesday Feb. 12
  8:00 pm Talk: “The Comets Are Coming!”
  8:30 pm Telescopes

Wednesday Mar. 13
  8:00 pm Talk: “Fastest, Coldest, Biggest: Cosmic Extremes”
  8:30 pm Telescopes

Tuesday Apr. 16
  8:00 pm Talk: “Gas Giant 5: The Solar System’s Lost Planet”
  8:30 pm Telescopes

A Request from the Newsletter Editor

Dear Readers:

You may have noticed that over the past few issues of the Physics Newsletter, I have been trying to incorporate more stories about you and your fellow alumni. These profiles are not only interesting to read in their own right, but they also provide wonderful examples for us to point to when we are talking to high school and transfer students who are thinking about coming to UWRF.

I’d like to continue including stories about the many fascinating things that UWRF Physics majors end up doing, but I need your help identifying people to profile. Please contact me to suggest someone (or yourself!) for a future story. I’m interested in stories about people at every stage of their careers - even those who have retired.

Please contact me (see the bottom of the page) with suggestions or questions. - Lowell McCann

Name: ____________________________ Years attended: ____________________________
Address: ____________________________

Phone: (_____)(____)___
Email: ____________________________

May we share your addresses with your fellow physics alumni? _____ email _____ postal
News: ____________________________

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