Albion College

www.albion.edu/physics | Fall 2016

Physics

Message from the Chair

This year the department of Physics is excited to welcome a new colleague. Dr. Philip Voss joins the department as Assistant Professor of Physics. Phil joins Albion from Concordia College in Moorehead, Minnesota where he taught a variety of physics courses over the past two years.

Phil earned a PhD in nuclear physics from Michigan State University and the National Superconducting Cyclotron Laboratory, and subsequently worked at TRIUMF, a world-leading laboratory for sub-atomic physics located in Vancouver, Canada. Phil is an avid biker and enjoys a number of outdoor activities.

The coming academic year has more exciting changes in store for the department. Thanks in part to a generous grant from the Vitek family, we are undertaking a major renovation of teaching infrastructure in our introductory laboratory spaces. Upon completion, each of the two laboratories will feature dual, high-definition projectors driven by sophisticated lecture presentation and capture software. The rooms, which are separated by a glass partition wall, will also be capable of full inter-operability with content in one room being displayed in the other. Video can be projected from a variety of sources including video cameras, oscilloscopes, and other scientific equipment allowing for fully integrated demonstration of data acquisition and analysis techniques. The department thanks the Vitek family for such a forward-looking gift that will have an immediate positive impact on student learning for years to come.

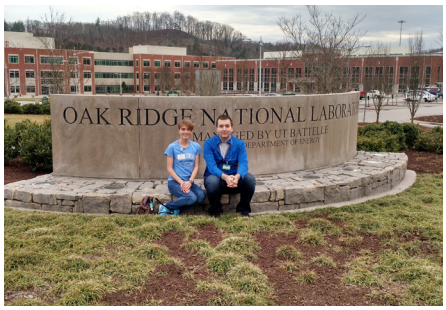
Finally, over the next year the department will be undertaking an extensive review of its programs. It will be both a challenging and exciting time of reflection on past success and planning for the future with the stated goal of taking strong programs in physics, astronomy, and engineering into the next decade. The department encourages and welcomes communication from alumni and friends of the department as we undertake this process. We would love to hear from as many of you as possible, and your feedback on your Albion College education and your career experiences will be invaluable. — **Charles Moreau, cmoreau@albion.edu**

Faculty News

David Seely
dseely@albion.edu

I continue to work with colleagues at Oak Ridge National Laboratory studying charge exchange processes in collisions between highly charged ions and hydrogen. This past summer I took junior students Leanne Wegley, ’18 and Antoniu Fodor, ’18 to Oak Ridge to attempt to make measurements of charge exchange in O8+ + H collisions. As is often the case with experimental research, modifications and repairs were needed for various parts of the apparatus, and most of our time was spent making changes. They

Faculty News continued...



Leanne Wegley, '18 and Antoniu Fodor, '18 at ORNL.

learned a lot about turbomolecular pumps, cryogenic pumps, ion gauges, apparatus alignment, laser pump flash lamp repair, apparatus bake out, and the like. They were able to deliver a well collimated beam of O8+ ions of sufficient flux across the room to the interaction region and a well collimated beam of H- ions to the interaction region, but only got the laser repaired on the last day of their visit. The apparatus is in much better shape for a subsequent visit, however, which they hope to make during the winter break.

Nicolle Zellner
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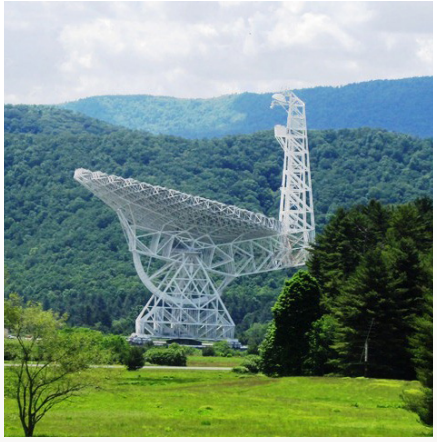
It's an exciting time to be on Albion's campus, with lots of good things related to astronomy and space science happening and planned. Two fantastic Phys 105 (Introductory Astronomy) classes kept me energized in the classroom during both semesters, and three outstanding summer students kept me thinking about mentoring and encouraging the next generation of astronomy professionals. Jayden Butler (x2017) worked on characterizing the glycolaldehyde (two-carbon sugar) abundance and survivability in four recently discovered Oort Cloud comets, in support of a NASA-funded project with collaborator Dr. Vanessa McCaffrey (Chemistry) where we look at impact shock effects on the chemistry of sugars, while Pham Nguyen (x2017) built on the work of other Albion students by looking for trends in compositions, sizes, ages, and shapes of lunar impact glasses from the Apollo 14, 15, 16, and 17 data sets. Victoria Della Pia (x2017) developed several K-12 lesson plans that incorporate various topics in Astrobiology and also satisfy requirements of the Common Core and Next Generation Science Standards.

In June, I traveled to the National Radio Astronomy Observatory in Greenbank, WV to take part in a professional development workshop focused on radio astronomy. The highlight, however, was climbing to the top of the 100-m Green Bank Telescope, which (among other things) searches for hints of alien communication (sponsored by the "Breakthrough Listen" campaign of Russian millionaire Yuri Milner). In July I traveled to San Francisco, CA to



100m radio telescope at Greenbank Observatory.

present a talk about my Phys 105 video project at the National Astronomy Teaching Summit. Check out some of the best videos at www.campus.albion.edu/nzellner/teaching.

Now, in between teaching Phys 105 and a First-year Seminar focused on 100 years of space exploration, I'm writing up results of the lunar glass studies, the comet/sugar studies, and pedagogy curricula and assessments for publications, AND planning my trip to see the Great American Solar Eclipse (www.greatamericaneclipse.com/) on August 21, 2017! For more information on our local viewing event, hosted by the Albion College Astronomy Club, visit our observing page (www.albion.edu/academics/departments/physics/public-observing). Don't miss it!

Phil Voss
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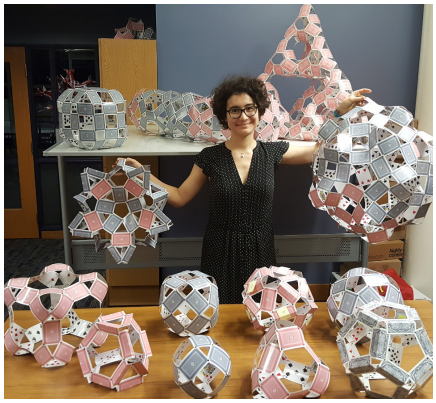
I am a new faculty member in the department. I moved to the area in mid-August and am enjoying the beautiful Albion College campus as well as the surrounding countryside!

I am originally from Michigan and received my Ph.D. from Michigan State University conducting research at the National Superconducting Cyclotron Lab. After that, I spent three years as a Postdoctoral Research Fellow in Vancouver, British Columbia working at TRIUMF, Canada's national lab. For particle and nuclear physics. Most recently, I was a two-year Visiting Assistant Professor of Physics at Concordia College in Moorhead, MN where I taught introduction physics for life-science majors, modern physics and a physics capstone course.

My research is focused on the structure of short-lived radioactive nuclei and I have a burgeoning interest in applying gamma-ray spectroscopy techniques for both environmental and medical science. I am excited to use our in-house shielded spectrometer as well as continue my research collaborations at both MSU (where FRIB, a next-generation nuclear physics lab is under construction) and TRIUMF. I look forward to my teaching and research at Albion College and working alongside the great students and faculty here!

Student Research



Liliya Chernysheva, '19
This past summer (2016), I spent the first part of my project on math, learning about different types of polyhedra. For example, a soccer ball, made by stitching together a bunch of flat pentagons and hexagons, is a polyhedron called a truncated icosahedron. It is one of thirteen special polyhedra collectively called the Archimedean solids.

Next I made physical constructions of polyhedra which in theory have perfectly flat faces, perfectly straight and infinitely thin edges, and precise angles. In reality, we can only approach perfection. To construct a polyhedral form, I substituted rectangular plates for the polyhedral edges. Each individual plate was connected to other plates at their corners using small fasteners. This results in a lattice structure where the edges are transformed into open spaces. Flexible plates produced a new form that had similar properties to the starting polyhedron.

With support from FURSCA funding, I settled on playing cards - material that was rigid enough to hold shape, flexible enough to conform, and low cost. We drilled a hole in each corner and assembled the polyhedral forms with split-pin fasteners.

Since Dr. Reimann has previously worked on polyhedral shapes, it was interesting for us to explore tessellations and their ability to form cylinders of various diameters. Surprisingly, only four out of eleven one-uniform tessellations remained flat. The reason why we are interested in flatness rather than bumpiness is because we believe that bent cards tend to slowly collapse under weight, whereas flat structures are more rigid.

Our future plan is to present our work at the Joint Mathematics Meetings (JMM) in Atlanta in January, 2017, one of the largest annual mathematics conferences in the world.

Justin Kraft, '18
This past summer (2016), I had an internship at Caster Concepts in Albion, MI. I was working in the engineering department designing and testing different material-handling equipment for Conceptual Innovations. Conceptual Innovations is a company inside the Caster Concepts facility who specializes in finding material-handling solutions for manufacturing companies. I had multiple projects throughout the summer such as researching supercapacitor usage as an alternative power source and designing an ergonomic-testing, (ergo) cart.

Although the implementation of supercapacitors ended up being too expensive for an alternative to batteries, I needed to understand how it could be used and the energy savings that would occur with its use. Supercapactiors are separated plates with a charge across them. This charge is built up and released in quick cycles without any chemical reactions. Since batteries use a chemical reaction to provide their power, supercapactiors have a much greater lifespan, resulting in major savings over time. Unfortunately, at this time, we couldn't test this method of energy with the initial price being so expensive.

I used a program called SolidWorks to design, fix, and draw products that are sold to clients. The ergo cart was just one of the many designs that I worked on during my internship this summer. I worked with one other intern from Michigan Tech to co-design this cart. We had to come up with a way to test the torque, force needed, and speed of many different material-handling carts made by Conceptual Innovations. The way to test this before the ergo cart was by using a spring and determining the force by Hooke's Law. This method was not very accurate and thus another solution was needed. The ergo cart design has force sensors in the front that connect to the cart that is being tested. It uses a drive caster underneath to regulate exact speed to push and a computer monitor on the back to display the readings from the sensors.

This internship provided a hands-on opportunity to learn and implement mechanical and electrical engineering skills. I can take this knowledge to my future engineering school and career.

Jack Lhamon, '18
This past summer (2016) I worked for my second consecutive year at a small manufacturing company in Traverse City, Michigan called Skilled Manufacturing. Skilled works for General Motors, assembling parts for the 2016 Camaro, 2016 Corvette and a variety of other vehicles. The parts they assemble range from oil pans and filters to cam covers and oil filter adapters. Skilled also builds all of their own machines to assemble these parts. My duties at Skilled mainly revolved around finding design solutions for

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How have you used your Physics/Engineering degree since graduating from Albion College?

Leslie Simanton, '09
A Physics degree has been crucial to the career I've built since graduating Albion. I went to graduate school at the University of Toledo, completing my PhD in Physics with an Astrophysics concentration in August 2015. My research was on the unusual star cluster populations of the spiral galaxy M101.

For the summer of 2016, I taught introductory physics courses at Owens Community College (Toledo, OH) and Washtenaw Community College (Ann Arbor, MI).

In August 2016, I started a position as the Planetarium Director and Lecturer in the Department of Physics at the University of North Georgia (Dahlonega, GA). I show the physics of the universe to the general public and college students through the UNG Coleman Planetarium!

Olivia Eggenberger, '13
After graduating with my physics degree I worked in a research lab for a year before entering the Biomedical Engineering PhD program at the University of Michigan, continuing work in that lab. My advisor got a new job opportunity in Switzerland so after earning my Masters in BME at Umich, I moved over here and am doing my thesis work at the Adolphe Merkle Institute in Fribourg, Switzerland as a doctoral student at the University of Fribourg.

Erich Owens, '08
I am currently working as a software engineer at Oculus, a virtual reality company owned by Facebook. Working on the computer vision team, I build computer simulations for predicting how well future devices will track and perform, using principles of analysis and linear algebra I learned at Albion (Jacobians!). In fact, many of my simulations are full-blown virtual reality apps (because much of the 3D physics comes with the game engine environment), so we're using VR to build VR.

Katie Brewer, '05
My physics degree, while not directly applicable to my work, provided a solid foundation for my career. As a Performance Improvement Director working with Community Health Centers, my role is to help facilitate teams in solving complex problems in their work processes. I may not need the formulas and theories anymore, but I use the problem-solving skills pretty much every day!

2015-16 Award Winners

Rood: Antoniu Fodor
Tabor: Claudia Crake
Ricker: Oana Vesa
Alumni/Faculty Physics: Erik Davis
Pettersen: Oana Vesa, Alessio Gardi, Antoniu Fodor
Kammer: Oana Vesa

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issues on assembly machines. I would look at the issue, design a solution in Solidworks and then send the design changes to the tool room to be made. For example, one of my larger projects was designing a safety switch. The switch I designed used a pneumatic cylinder to push a rod into a rotating table to prevent it from turning. With some programming, the cylinder would only retract when the technician was finished assembling one side of the part. I had to design several parts, find purchase components and assemble them all in Solidworks. The safety switch prevented unfinished parts from being shipped and helped increased quality control at Skilled. Over the summer I completed several large projects that followed the same process as the safety switch. Skilled has allowed me to see the inner workings of an automotive engineering company and it has let me see the process of identifying a problem, finding a solution, designing said solution and implementing the part.

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