HPUPHYSICS

Annual Report

FALL 2014

HPU physics students and faculty launch a helium balloon and payload from the lawn in front of Roberts Hall.

Greetings from the Chair of the Department of Physics at HPU!

By Dr. Aaron Titus

To alumni, current physics majors, family, and friends, thank you for being a part of establishing the physics program at High Point University. In this inaugural annual report for the Department of Physics at High Point University, we want to highlight the accomplishments of our students, our alumni, and our faculty. These achievements are a celebration of how far we've come and a foreshadowing of many success stories ahead.

The HPU faculty approved the B.S. and B.A. degrees in physics in 2010. We celebrated our first graduating class in 2012, and we launched the Department of Physics in 2013. During the past three years, we've had 9 graduates, we grew to four full-time physics faculty, and we started an endowed physics scholarship.

We always say that the physics program is like a big family. So I guess that makes the faculty like parents and this annual report like one of those family Christmas letters that reports on the annual activities of the family. In that spirit, I wish to tell everyone how proud I am of my colleagues, our students, our alumni, and our supporters. Each of you have influenced me and made me a better person. Thank you for your entrepreneurial spirit, unbridled enthusiasm, and unending grace and trust that helped found the physics program.

Godspeed,

Dr. Aaron Titus
Chair, Department of Physics

HPU physics

RESEARCHHIGHLIGHTS

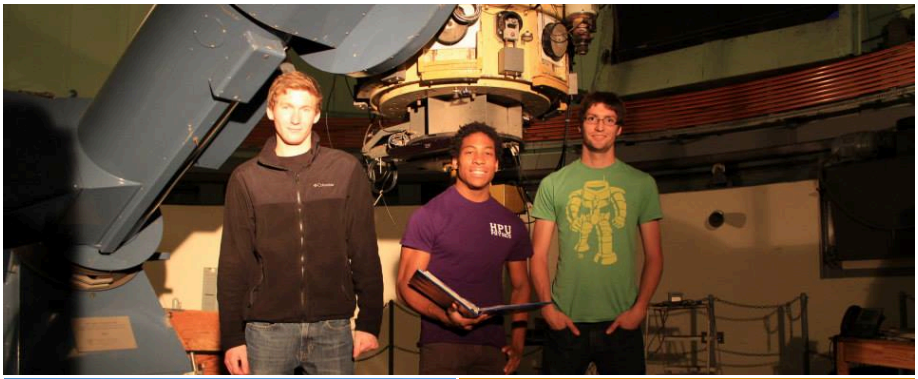
Students travel to Chile and observe with professional telescope

By Dr. Brad Barlow

In May 2014, Aaron Marlowe, Eugene Filik, and Tyler Hockett travelled to Chile with me (Dr. Barlow) to use the CTIO 0.9-m telescope. During their 5-night run at the observatory, they used the facility to observe pulsating hot subdwarf stars, white dwarfs, and eclipsing binary stars.

I am so glad these students accompanied me on this trip. For one, it was nice having extra hands around the telescope. More importantly, however, these students gained experiences that are relatively hard to come by as undergraduates: they operated a professional, research-grade telescope on their own; they interacted with various astronomers at an international observatory throughout the week; and they learned how to interpret astronomical data on the fly. As the proverbial icing on the cake, they will have a peer-reviewed publication with their names on it by the end of the year because of their hard work.

When they weren't observing at the telescope, the students went hiking in the Andes, explored the local flora and fauna, played frisbee (at an elevation of 9,000 ft!), interacted with several professional astronomers, and even battled one very large Chilean Rose Tarantula. We plan to continue bringing students to the site every other year.



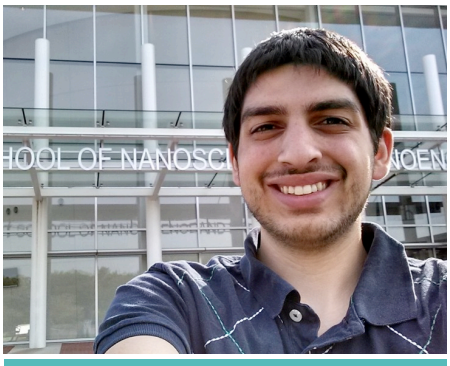
"This experience broadened my horizons to the field of astronomy [...] and will help establish me as a productive member in the world of physics."

Eugene Filik '16

Dr. Fiser Awarded Life-Saving Patent

February 2014

Congratulations to Dr. Briana Fiser for being granted a U.S. patent for a medical device that could help save lives! Along with researchers at UNC, Dr. Fiser worked on a portable device capable of immediately assessing a patient's blood clotting abilities. When trauma occurs, the shock undergone by a person's tissues affects his/her clotting abilities, possibly causing a decreased ability to clot. Assessing these effects immediately is an important step in patient treatment. Dr. Fiser's main contribution was the development of micron-sized rods similar in size to cilia, which are tiny hairs that work to remove particles from our lungs. The rods are initially free to move, but when blood is added to the rods and begins to clot, rod motion decreases. This change in rod movement helps detect how well a patient's blood is clotting. The benefit of this device is its portability, as the rods fit on a chip smaller than the palm of one's hand, making it easy for paramedics to carry it with them to determine what life-saving measures should be used on their patients.



Simeon Simeonides at JSNN

S. Simeonides Studies Heart Monitors at JSNN

Summer 2014

Rising sophomore Simeon Simeonides spent the past summer working at the Joint School of Nanoscience and Nanoengineering (JSNN) in Greensboro, NC, where he was part of a research team working to develop personal heart monitors that can help determine heart health and potentially predict heart attacks. A typical day for him entailed suiting up and going to work in a cleanroom to fabricate samples. He also used *Matlab* to try and understand the theoretical side of his work. Under the wing of a graduate student, he learned about the numerous fabrication methods commonplace at JSNN, along with how to use various lab instruments like a PVD machine and a spin-coating machine. "Two important things that I learned about research: it's really hard to continue someone else's work when they aren't there to help you out, and nothing ever goes completely right on the first try," says Simeonides.

HPU and Department Now Members of Two Important Research Consortia

SMARTS Telescope Consortium

July 2014

The Small and Medium Aperture Telescope System (SMARTS) Consortium is a research collaboration of U.S. universities that operate several professional telescopes at Cerro Tololo International Observatory (CTIO) in Chile, including the 0.9-meter, 1.3-meter, and 1.5-meter telescopes. Primary members of the consortium include Yale University, Georgia State University, Ohio State University, and now High Point University. Our membership in SMARTS will give HPU students and faculty access to their facilities for 5 years.

We are very excited about our involvement with SMARTS! Students will be able to participate with faculty at HPU and other universities in studies of binaries. One of the major projects to be undertaken with SMARTS is a follow-up of UNC's Evryscope survey. With any luck, we'll be confirming the existence of new exoplanets (planets around other stars) within a year or two!

The SMARTS Telescopes
Sitting atop picturesque Cerro Tololo in the Chilean Andes Mountains are the 0.9-meter, 1.3-meter, and 1.5-meter telescopes.

JSNN Facility
The Joint School of Nanoscience and Nanoengineering is housed in this $60 million facility in Greensboro, NC.

Nanomanufacturing Consortium at JSNN

February 2014

HPU now holds a spot in the Nanomanufacturing consortium at the Joint School of Nanoscience and Nano-engineering (JSNN) in Greensboro, NC. The consortium, which is a collaboration between several different universities and industries in the Triad region, will focus on preparing students to conduct basic research in the sciences. Their $60 million research facility is located approximately 20 minutes North of HPU's campus and accessible to students and faculty after they have completed various training exercises. Dr. Fiser, along with chemistry professor Dr. Brian Augustine, plan to use the facility to carry out research projects with students. "This new collaboration is an ideal way to increase the number of undergraduate research opportunities available to our students here in North Carolina," says Fiser. One of our physics majors, Simeon Simeonides, has already benefitted from JSNN's facilities (see previous article).

S. Pettit Completes REU in Dept. of Electrical Engineering at PSU

Summer 2014

Stephanie Pettit, a junior in the department, spent the summer working in Penn State Univesity's Department of Electrical Engineering as part of an REU program. The goal of the REU program is to "provide interested undergraduate students selected from across the nation the opportunity to be involved in cutting edge research and thus develop students' interests in graduate studies and in future research in electrical engineering areas."

Stephanie's project focused on finding variations in the index of refraction of a material through different treatments. By using the concept of gradient refractive index optics and by finding a way to change the index of refraction, lenses can be corrected as well as flattened. Her research involved thermally annealing samples and using ellipsometry to find indices of refraction and detect any changes in their values. "I successfully found a change due to the formation of nanocrystals as shown through TEM images," Pettit says. "This research has given me many skills and helped me learn more about optics than I had ever known."

S. Pettit in her cleanroom attire at PSU.

IN THEIR OWN WORDS...
→ Three Students Share their Summer Research Experiences

My Summer at CISCO Systems

By Mr. Stephen Vultaggio

My name is Stephen Vultaggio, and I'm a senior Physics student here at High Point University. For the past two summers I've been working as an intern here at Cisco Systems in Boxborough, MA. I've done a wide range of jobs over these two summers: coding, manual testing, automating processes, and network administration and configuration. The major project I've been working on these past two summers is called ISE, Identity Service Engine, which is essentially an all-in-one security solution for big business.

My first summer at Cisco I worked with the profiler team, which is a small development team for a feature of ISE. Basically the job of this feature is to identity everyone who joins the network and figure out what type of device you are using. The job I was given on the profiler team was all coding, mostly in java. With my mentor at the time, we were tasked to make a proof of concept code that would help monitor and display data to the admin of major corporations. At the end of that summer we completed the code and presented it in front of 400 people, including some senior directors. Our code, modified, is now being used in other products throughout Cisco and will soon be released to the customer as a support feature.

This summer at Cisco I've been working on the MDM QA team. MDM, mobile device management, is our solution in ISE to manage large amounts of corporate phones when connected to the corporate network or at home. QA stands for Quality Assurance, which is basically manual testing for the code our development teams create. Our job is to assure that the code is working and find any bugs or problems in the code. At first, my tasks involved setting up a load server into our network architecture and rewiring our QA server rack. I then was asked to test a feature currently being used by the customer, and it was associated with the profiler team. I've spent a lot of time scripting, automating our setup tasks, and manually testing the feature over virtual devices.

After I graduate from High Point University, I hope to be employed by Cisco, working in coding or manual testing. After I start working full time I want to get a masters degree in either 802.1x, switching/routing, network security, or maybe business. Both Cisco and High Point University have given me incredible opportunities that are paving the way for my future career.

S. Vultaggio at CISCO

Designing Accelerators at Duke University

By Mr. Andrei Makhanov

This summer, I had a unique opportunity to intern through Duke University at the Triangle Universities Nuclear Laboratory (TUNL) under the supervision of Prof. Albert Young. I learned about Nuclear Physics and spent a lot of time in the TANDEM laboratory where I cleaned accelerator parts with alcohol, took data, and helped replace mirrors inside of the tandem accelerator. I was also given the task of designing a model for 1 MeV electron accelerator in Autodesk Inventor (CAD software) and assembling it in the laboratory.

During my first week, I set up in my apartment, met my colleagues, and explored the surroundings. From my colleagues, I was able to learn a lot about physics, philosophy, and their experiences. Many of my colleagues felt they were doing this internship because they set very ambitious goals in Physics. After meeting my adviser, he promptly showed me around the labs and all the existing accelerators.

In electronics class at High Point University, I had learned how to use oscilloscopes. This skill came in handy when I was looking at the waves produced by emitted electrons. I was a bit scared at first because I was working near a 1000V line, and I was in a proton lab. I was also a bit worried about radiation until I learned all about dosages and that when the device is not running there is no radiation whatsoever. Also, to be able to work in the labs, I had to pass a radiation test and a laser safety test. Initially, I had to learn Autodesk Inventor 2014 which took a few days. I had to sit down with a Mechanical Engineer, Mark Emamian, and I had to design certain parts. I also watched a lot of YouTube videos in order to properly learn everything I needed to know before designing the model of the accelerator.

When I met with my advisor to discuss the project, at first I had little knowledge of what I was supposed to design. All I knew was that I was designing a particle accelerator. As I continued with the project, I started to understand it better. I found out the work that I did in Autodesk Inventor was very important to the project because once I finished the model, its measurements could be taken using a built-in ruler. With that it was easy to determine the size of each part. From the articles I read during my summer work, I learned that I was building an accelerator for electron energy calibration for the experiment of UCNA – Ultra Cold Neutron A-correlation high precision measurement in a process of a neutron beta decay.

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IN THEIR OWN WORDS...
→ Three Students Share their Summer Research Experiences

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When I finished my internship, the accelerator was not assembled yet. I believe that many of the goals for my part of the project were met. Although I did not have time to fully assemble the final product, I did design a final model in Autodesk Inventor. If I had more time, I would have been able to fully assemble the final product and test the accelerator.

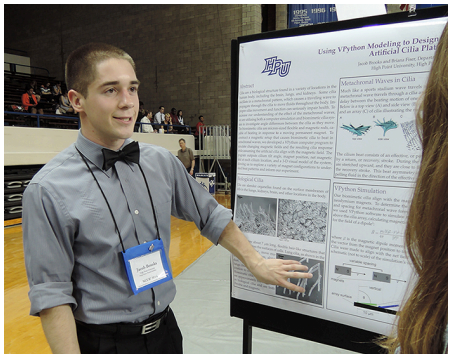
In this internship, I learned a lot about nuclear physics. Though I have never taken a course in nuclear physics, I believe that physics courses I did take at High Point University, especially Modern Physics and Electronics, helped me to easily adjust to the work environment. During this internship, I did a lot of Computer work, and I would like to thank the Computer Science Department of High Point University for helping me to become a proficient programmer. I would like to extend my gratitude to Dr. Martin DeWitt for being my advisor at HPU for this project. I would also like to thank my advisor at TUNL, Dr. Albert Young, for giving me the opportunity to work on this great project.

A. Makhanov (front row, second from left) with all the DUKE/TUNL REU students.

Biotech Internship at Becton-Dickinson

By Mr. Jacob Brooks

This summer I had the opportunity to intern at Becton-Dickinson, a leading medical technology company, developing and manufacturing products such as syringes, sample collection tubes, advanced lab robotic instrumentation and assays for diagnosis of various infectious microorganisms. The R&D team I was assigned to is working on the detection of the human papilloma virus (HPV). HPV is one of the most prevalent sexually transmitted infections (STI) in the world and has received increased interest in recent decades for its thoroughly researched connection with cervical cancer. The HPV assay involves real-time polymerase chain reaction (PCR) for HPV DNA detection and is designed to detect the presence of the fourteen high-risk HPV genotypes associated with the development of cancer. The HPV Assay is performed by a robotic instrument that performs sample extraction and all subsequent steps associated with real-time PCR. The PCR assay contains primers and probes to detect fourteen high-risk HPV genotypes, as well as an internal control target (human beta globin) derived from each individual sample processed on the instrument. The instrument provides a patient results report that indicates the absence or presence of high-risk HPV DNA. That information will be used by the physician to manage patient care.



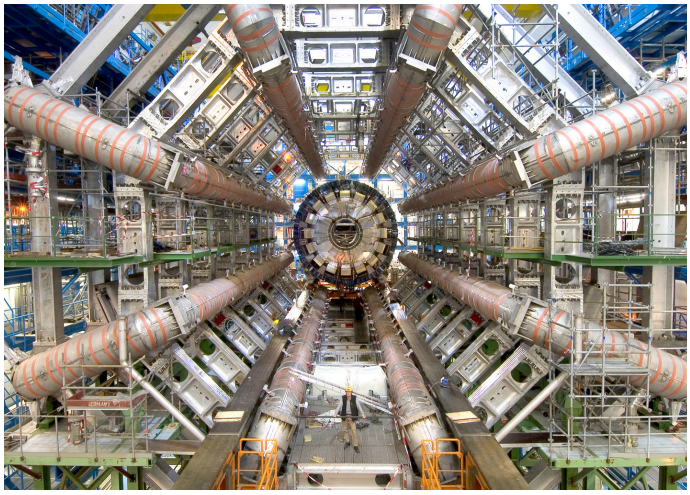
J. Brooks

During my time with BD, I performed multiple tasks in support of both the launch of the assay outside of the Unites States and with preparation for future validation studies. This involved everything from logging numerous types of clinical specimens into a tracking database to assist with ongoing development efforts. One specific example was my assistance in investigating the potential cause for non-released lots of PCR tubes not meeting performance requirements. I worked with BD colleagues and interns to troubleshoot impeded amplification performance of certain reagent lots. This was accomplished by designing and performing experiments to identify which factors or components were responsible for the unwanted results. We performed multiple types of experiments that eventually led to two factors being identified which could result in reduced amplification. We determined that modulating the concentration of one component could negate the effect of the other, and thus the reaction would proceed normally. My assistance with the BD team provided a root cause for what had occurred so that options for preventive actions could be developed.

Additionally, I contributed to the BD R&D team by learning and performing cell culture. The cells used are infected with HPV genotypes so they can be used as mock clinical samples for use in experimental testing or validations. I was able to learn and practice techniques for growing these human cell lines (HeLa) which, as eukaryotic cells, require much more care and attention (sterilization of equipment, changing of media, and ratio of media to cell growth) than prokaryotes like bacteria. After the cells are grown to a specific concentration, they are isolated and frozen for future use.

"Even within [my] studies, there was substantial freedom: countless projects I chose myself, numerous opportunities to work with professors and bountiful occasions to give my own personal feedback."

Kevin Sanders ('14)



Student Profile: Kevin Sanders
Taking HPU Physics to CERN in Switzerland

Kevin Sanders 14'

Meet Kevin Sanders, a 2014 HPU graduate who majored in physics and computer science (with a minor in mathematics). Upon his graduation this past May, he had gained more research experience than many graduate students!

Over the past few years, Kevin has worked as a software developer at EconApps, a supplemental instructor for a Web Development class at HPU, a tutor in physics and computer science, and a summer intern in Maryland who helped with the installation and replacement of 10,000 computers in the Montgomery County Public School System. His past research has involved work at HPU (computation modeling of a kicked football), the Colorado School of Mines REMRSEC REU (watershed modeling), and multiple REUs at the University of Michigan (computational modeling, data visualization, particle collision, etc.). Kevin has presented research at several venues, including Big South Undergraduate Research Symposiums and American Association of Physics Teachers meetings.

Even though he was officially a student at HPU in Spring 2014, you wouldn't have found him walking around campus: Kevin spent the semester at CERN, a research organization in Geneva, Switzerland that operates several particle accelerators, including the world's largest physics laboratory! Kevin has been working with scientists at CERN on various projects since the summer of 2013, through a University of Michigan REU program. He spent the summer of 2013 working on-site at CERN, returned to HPU for classes in the Fall, and then went back to CERN in the Spring. His research focused on the Compact Muon Solenoid (CMS) experiment. Specifically, he worked on upgrade/longevity studies for the Electronic Calorimeter (ECAL), a crystal calorimeter with about 80,000 scintillating crystals (meaning they will light up when struck by particles, particularly electrons and photons). This work had him cooking/testing electronics and analyzing simulation data to determine efficiency of reconstruction in the future.

Outside of classes and research, Kevin enjoys playing ultimate frisbee, traveling and hiking. He was captain of High Point's ultimate team before relocating to Switzerland. Lucky for him, Swiss country provided plenty of hiking and traveling opportunities, which he took advantage of.

We are excited to announce that Kevin is now pursuing his doctorate in physics from Boston University. We know he will accomplish great things!

Poster and Oral Research Presentations by HPU Physics Students

Aug 2013 - Jul 2014

2014 Winter Meeting of the American Association of Physics Teachers (AAPT)

4-5 January 2014; Orlando, FL

"Measuring and Modeling a Boleadora"

Jacob Brooks

Mentor: Dr. Aaron Titus, Physics

Poster presentation

The effects of the throwing technique on the motion of a boleadora in flight were investigated. The boleadora is an ancient hunting weapon made of three individual masses connected by rope to a common knot. The dynamics of the boleadora depend on whether it is thrown by the knot or by one of the masses. A computational model was developed for each throwing technique. Predictions of the models were compared to results from 3D video analysis. The models and results from video analysis for the two throwing techniques will be presented.

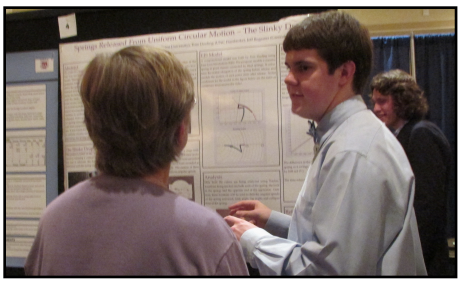
"Springs Released From Uniform Circular Motion – The Slinky Drop Extended"

Matthew Carnaghi

Mentor: Dr. Aaron Titus, Physics

Poster presentation

The path of a spring released from uniform circular motion was investigated and compared to a computational model. This study is an extension of the "Slinky drop" experiment, which consists of holding the top of a SlinkyTM above the ground, allowing it to stretch due to the gravitational force, and releasing it from rest. For the falling slinky the bottom portion of the slinky remains stationary until the slinky collapses. Similarly, for a spring in uniform circular motion, the spring is not uniformly stretched but is most stretched near the center of the circle. When released, it is expected that the furthest end of the spring will continue in uniform circular motion until the spring has collapsed. Video analysis was used to measure the motion of a spring released from uniform circular motion, and results were compared to a computational model of the system. It was found that the free end of the spring continues in uniform circular motion after the fixed end is released and before the spring fully collapses.



"Incorporating Data Visualization into ZENODO"

Kevin Sanders

Oral presentation

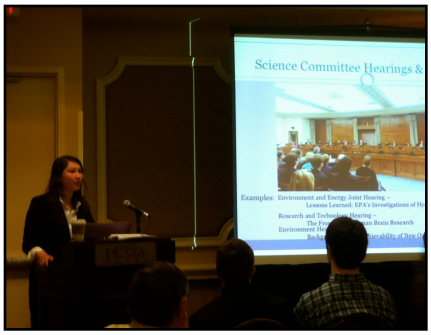
ZENODO is a research hosting website made for all disciplines. It is built on the idea of all research shared, no matter the subject, no matter the status of the researcher. ZENODO was developed alongside and on top of INVENIO, a digital library software suite, produced by the Digital Library Technology group at CERN. This talk will cover some of the technologies that came into play, as well as my role of beginning to incorporate data visualization into the website during my time spent at CERN through the University of Michigan REU.

"SPS Mather Internship: US House of Representatives Committee on Science, Space, and Technology"

Nikki Sandford

Oral presentation (invited)

As a Society of Physics Student Mather Intern, I worked in the US House of Representatives' Committee on Science Space and Technology. Nobel Laureate Physicist, Dr. John Mather, created this program to promote awareness of science policy among young physicists. In the Science Committee, I was directly involved in the legislative process through research projects, working with staff, and attending committee hearings and markups. I will discuss my experiences on Capitol Hill and interactions with Congressmen, staff, and experts in the scientific community. A physics/scientific background, along with opportunities from this SPS Internship with Congress has been extremely applicable and beneficial to my future career path and current studies at William and Mary Law School.



223rd Meeting of the American Astronomical Society (AAS)

5-6 January 2014; Washington, D.C.

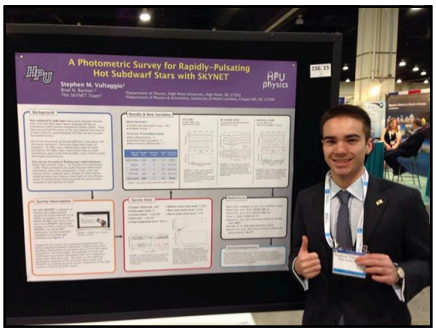
"A Photometric Survey for Rapidly-Pulsating Hot Subdwarf Stars with SKYNET"

Stephen Vultaggio

Mentor: Dr. Brad Barlow, Physics

Poster presentation

Hot subdwarf B stars (sdBs) are evolved stellar objects with high effective temperatures and large surface gravities. Theory shows that these stars were once red giants that were stripped of their outer H envelopes. How this stripping occurs is uncertain, although observations show binary interactions probably play a major role in this process. A small fraction of sdB stars exhibit rapid photometric oscillations; such pulsations are excellent tools for unraveling the structure and future evolution of these stars. We are currently surveying known sdB stars with the SKYNET telescope network to discover new pulsators. Here we discuss the details of our survey and present a handful of new variables that we have found.



National Conference on Undergraduate Research

3-5 April 2014; Lexington, KY

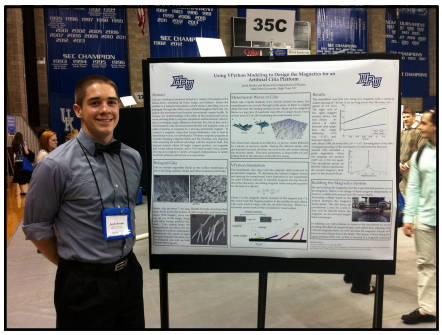
"Using VPython Modeling to Design the Magnetics for an Artificial Cilia Platform"

Jacob Brooks

Mentor: Dr. Briana Fiser, Physics

Poster presentation

Cilia are a biological structure found in a variety of locations in the human body, including the brain, lungs, and kidneys. These cilia oscillate in a metachronal pattern, which causes a traveling wave to propagate through the cilia, moving fluids throughout the body. Improper cilia movement and function can cause seriously impair health and contribute to a variety of ciliopathies, including primary ciliary dyskinesia (PCD) and nephronophthisis (which causes kidney failure). Additionally, cilia malfunction can affect embryonic development and left-right asymmetry determination in humans. As cilia drive fluids to one side continuously, they initiate asymmetrical development. Metachronal wave patterns in cilia result in fluid flow, and to increase our understanding of the effect of the metachronal wave patterns, we are utilizing both a computer simulation and biomimetic cilia system. We hope to investigate cilia beat amplitude and frequency with an array of artificial cilia, where each cilium is a polymer rod with its upper portion surrounded by a magnetic tube. These cilia respond to the magnetic field from a permanent magnet moving above them. To construct a magnetic setup in our biomimetic system that results in metachronal waves arising in the cilia array, we developed a VPython computer program that simulates changing magnetic fields and the resulting cilia response. The program assumes artificial cilia align with the magnetic field, allowing us to explore a variety of magnet configurations to understand beat patterns before exploring the artificial system experimentally. The program outputs the tilt angle for each cilium, magnet position, and net magnetic field at each cilium location, as well as a 3-D visual model of the system. This output is used to inform our experiment, and results of the simulation and progress in the experimental investigation will both be discussed.



North Carolina Section of the American Association of Physics Teachers Meeting (NCS-AAPT)

11-12 April 2014; Boone, NC

"Computational Model of a Weak Spring in Uniform Circular Motion"

Matthew Carnaghi

Mentor: Dr. Aaron Titus, Physics

Poster presentation

A computational model of a weak spring spinning in a circle has been written using Easy Java Simulations (EJS). The model calculates the spring extension in its quasi-static state. The model takes into account the spring mass, spring constant, rate of rotation, air resistance, and gravity. The model demonstrates the "Principle of Locality". When the center of the spring is released, the outer end of the spring continues to move on its original circular path. This continues until a wave from the released end makes its way to the outer end. This phenomenon has been seen in real physical systems and was the motivation for making the computer model. The basic math behind the model will be covered and the model itself will be demonstrated under different initial conditions.

"Physics in Non-Inertial Reference Frames"

Junjie Liao and Simeon Simeonides

Mentor: Dr. Aaron Titus, Physics

Poster presentation

This project focused on creating classroom-friendly videos of motion in non-inertial reference frames where fictitious forces are required in order to apply Newton's laws. To explore motion in a linearly accelerating frame, we attached a camera to a fancart which accelerated down a track, and we recorded video of a neighboring fan cart accelerating down a parallel track at a lower rate. To explore motion in a rotating frame, we attached a camera to a rotating turntable and rolled a steel ball across the turntable. We collected data on the ball's motion from one video camera in the rotating reference frame and from a second camera in the lab frame. We analyzed the videos from each experiment using the video analysis software Tracker to determine mathematical models for each force. We created simulations of the motion in each frame in VPython. Results from both the video analysis and the corresponding computational models will be compared and discussed.

Research & Creative Works Symposium ("High-PURCS")

24 April 2014; High Point, NC

"Using vPython Modeling to Design the Magnetics for an Artificial Cilia Platform"

Jacob Brooks

Mentor: Dr. Briana Fiser, Physics

Poster presentation

We developed a vPython computational model of a biomimetic cilia array in which magnetic cilia respond dynamically to the changing magnetic field generated by a moving magnet. This model was used to inform experimental setup for data collection using biomimetic cilia arrays and permanent magnets.

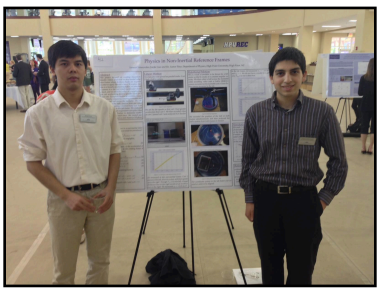
"Framed: Physics in Non-Inertial Reference Frames"

Junjie Liao & Simeon Simeonides

Mentor: Dr. Aaron Titus, Physics

Poster presentation

This project demonstrates the concept of fictitious forces, which are apparent forces observed from an accelerating reference frame. We captured video from non-inertial reference frames and analyzed it to determine mathematical models for each fictitious force. We then used these models to write simulations of each force in VPython.



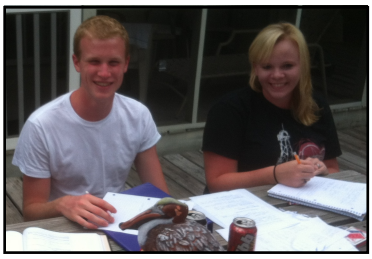
"Emmy Noether: Contributions as a Mathematician and Physicist"

Ben May & Stephanie Pettit

Mentor: Dr. Karen O'Hara, Mathematics

Poster presentation

Emmy Noether has made considerable contributions to mathematics and physics through her research and theorems. By analyzing her life and work, we provide an in-depth look at developing theorems and making mathematical discoveries as well as look into the expansions that have been made beyond her work and describe how they affect mathematics today.



"A Survey for Pulsating Hot Subdwarf Stars with SKYNET"

Stephen Vultaggio

Mentor: Dr. Brad Barlow, Physics

Oral presentation

Hot subdwarf stars are one of the least understood stages of stellar evolution. Some show pulsations that help reveal their structure and future evolution. We are currently monitoring several subdwarfs with robotic telescopes in Chile to discover new variable stars. Here we present the new variables that we have found.

OUR GOAL is to involve all students in the research process because the experience and skills they obtain will make them more competitive for graduate school and industry. But more than experience and skills, students will gain confidence as a scientist.

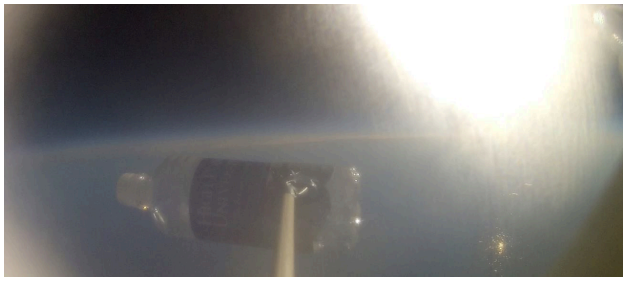
EDUCATIONAL OUTREACH

Balloon Payload Launched to Near Space from HPU Campus!

Oct 2013

Surrounded by a crowd on the lawn in front of Roberts Hall, several HPU physics majors helped launch a helium-filled balloon to the upper atmosphere. A styrofoam "payload" was attached that carried two Go-Pro cameras, some hand warmers (to keep everything from freezing at high altitudes!), a GPS tracker, and a water bottle with the HPU logo attached (to get a shot of "HPU" from space!).

Immediately after the successful (but windy) launch, the team started tracking the balloon online and took off down I-85 to catch up with it. Once the balloon burst at 100,000 ft, the payload fell to Earth and landed over 175 miles away, near Bethel, NC! After searching for over an hour at night in a large soybean field, the team found it in one piece and returned to HPU. To celebrate a successful mission the team went out for NC-style BBQ, and each member of the team sipped from the water bottle that had 'been to space' for fun. A video summary of the launch may be found by searching "SP-1 Balloon Launch from High Point University" on youtube.com.



Piedmont Science Fair Hosted by Physics & Chemistry

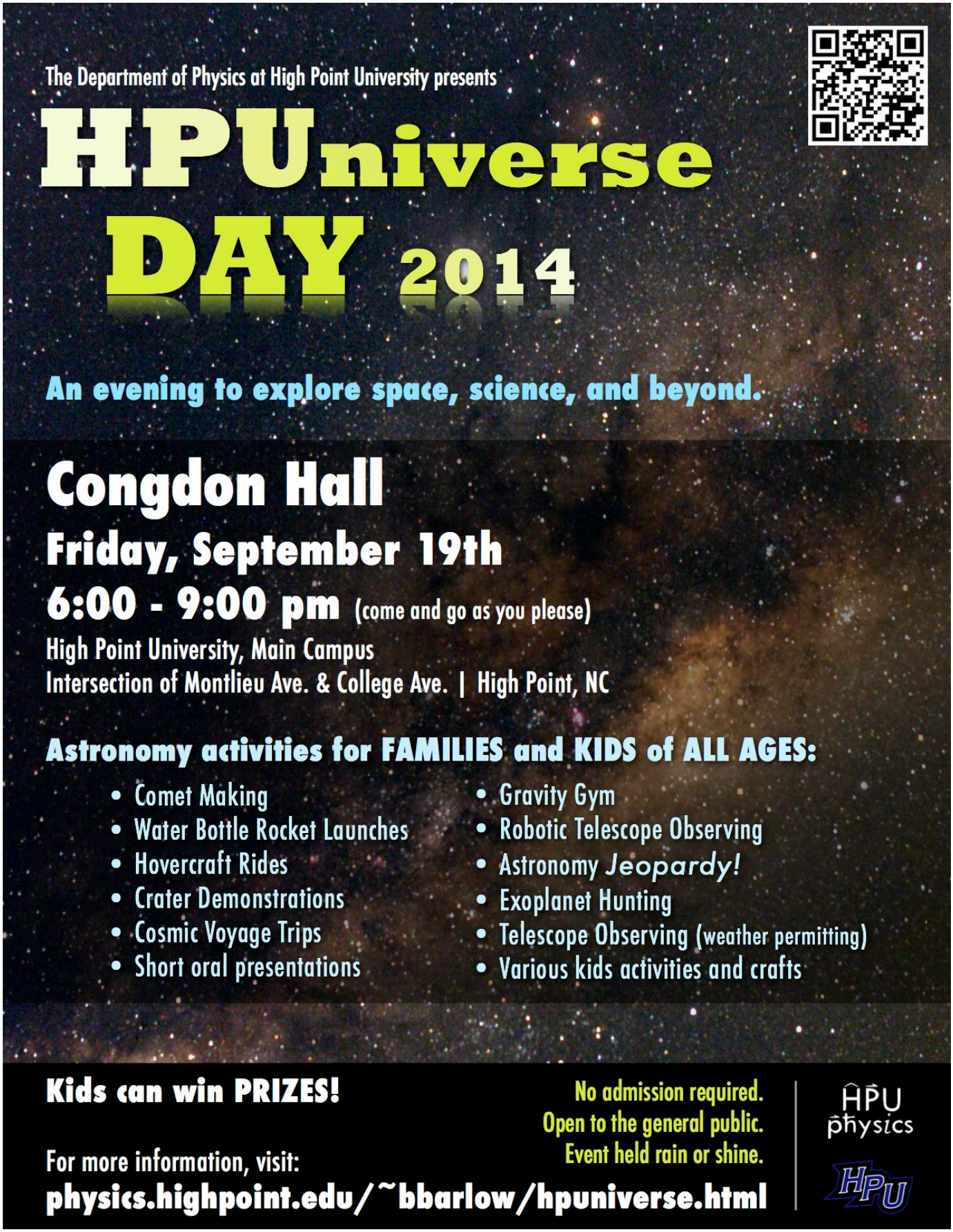
Jan 2014

At the start of the Spring 2014 semester, the HPU Departments of Physics and Chemistry hosted the Piedmont Science Fair for Non-Public Schools inside of Congdon Hall. Our two departments set up rooms with hands-on physics and chemistry experiments for visitors to play with and held a demonstration show in the afternoon. Our physics majors were a great help in hosting this event, and we all had a fun time with the students!

Boys & Girls Club Visit for Hands-On Physics Demos

Feb 2014

This past spring, the Biology, Chemistry, and Physics clubs joined forces to host children from the Boys and Girls Club at an interactive science fair on High Point University's campus. Children ranging in ages from 5 - 16 attended the event. Physics majors Keisha Daughtry, Matthew Carnaghi, and Junjie Liao helped the children carry out a series of hands-on experiments involving light, sound, air pressure, and Bernoulli's principle. Highlights included shooting paper cups off of each other's heads using gentle blasts of air from a homemade air cannon, playing tunes on a xylophone made of water-filled wine glasses, and viewing a demonstration firing of our ping-pong ball cannon which can launch a ball at an astounding 150 miles per hour (yes, it's very loud)!


The Department of Physics at High Point University presents
HPUniverse
DAY 2014
An evening to explore space, science, and beyond.
Congdon Hall
Friday, September 19th
6:00 - 9:00 pm (come and go as you please)
High Point University, Main Campus
Intersection of Montlieu Ave. & College Ave. | High Point, NC
Astronomy activities for FAMILIES and KIDS of ALL AGES:
• Comet Making
• Water Bottle Rocket Launches
• Hovercraft Rides
• Crater Demonstrations
• Cosmic Voyage Trips
• Short oral presentations
• Gravity Gym
• Robotic Telescope Observing
• Astronomy Jeopardy!
• Exoplanet Hunting
• Telescope Observing (weather permitting)
• Various kids activities and crafts
Kids can win PRIZES!
No admission required.
Open to the general public.
Event held rain or shine.
For more information, visit:
physics.highpoint.edu/~bbarlow/hpuniverse.html
HPU physics
HPU

Extra! Extra! Read All About It!

Physics Faculty & Students In the News

Star Struck: HPU Student Study Astronomy in Chile

High Point Enterprise News Article, 5 Aug 2014
http://www.hpe.com/news/x1071193325/Star-struck-HPU-students-study-astronomy-in-Chile
https://www.youtube.com/watch?v=4PXJ1ePdaxQ

Student Joins Team Researching Personal Heart Monitors

Career & Internship Services & *Extraordinary Education News, 9 Jul 2014*
http://www.highpoint.edu/blog/2014/07/student-joins-team-researching-personal-heart-monitors/

HPU Student Discovers Rare Star

Undergraduate Research Video, 11 Jun 2014
http://youtu.be/D1zYBTstnpk
High Point Enterprise News Article, 26 Jan 2014
http://www.hpe.com/news/x1385731733/HPU-student-discovers-rare-star
Extraordinary Education News, 21 Jan 2014
http://www.highpoint.edu/blog/2014/01/physics-major-discovers-new-pulsating-star/

Class of 2014 Profile: Kevin Sanders Works Toward His Physics Doctorate

Extraordinary Education News, 23 May 2014
http://www.highpoint.edu/blog/2014/05/class-of-2014-profile-kevin-sanders-works-toward-his-physics-doctorate/

Student Present Research At National Undergraduate Conference

Extraordinary Education News, 14 Apr 2014
http://www.highpoint.edu/blog/2014/04/students-present-research-at-national-undergraduate-conference/

HPU Astrophysics Professor Explains the Science Behind a 'Blood Moon'

Time Warner Cable News, 14 Apr 2014
http://centralnc.twcnews.com/content/news/706688/-blood-moon--to-grace-skies-early-tuesday-morning/
https://www.youtube.com/watch?v=7yflkV0XR6A

Intern Profile | Nikki Sanford | High Point University

Career & Internship Services Video, 27 Feb 2014
http://www.highpoint.edu/blog/2014/02/intern-profile-nikki-sanford-high-point-university/

Physics Professor Granted Potentially Life-Saving Patent

Extraordinary Education Featured News, 18 Feb 2014
http://www.highpoint.edu/blog/2014/02/physics-professor-granted-potentially-life-saving-patent/

Physics Students Successfully Launch Balloon Into Near-Space

Extraordinary Education Featured News, 18 Dec 2013
http://www.highpoint.edu/blog/2013/12/physics-students-successfully-launch-balloon-into-near-space/
https://www.youtube.com/watch?v=efySUZK5fyk

HPU students studying ISON movement

Time Warner Cable News, 25 Nov 2013
http://charlotte.twcnews.com/content/search/701909/hpu-students-studying-ison-movement/

Congratulations to Our 2014 Graduating Seniors!

Mr. Andrei Makhanov

Andrei Makhanov graduated with a triple major in physics, math, and computer science (again, a *triple* major!!!). Andrei is an excellent programmer who greatly enjoyed doing research and development projects. In our electronics class, Andrei created a laser harp using an Arduino micro-controller and a Python program. He used eight diode lasers to emit laser beams and a circuit to detect when each beam was blocked. His Python program communicated with the Arduino and played a note when each beam was blocked.

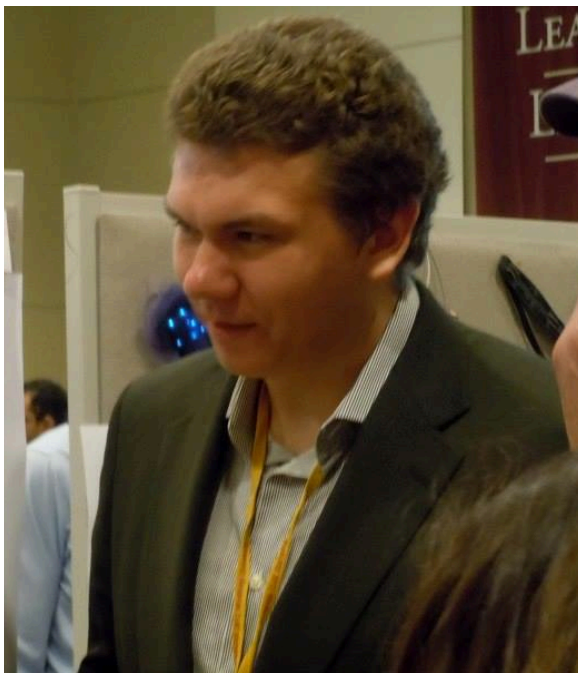
In addition to this project, Andrei did research with Dr. DeWitt where he measured the approximate age of an open star cluster. He presented his work at the Fall 2012 Meeting of NCS-AAPT and the 2012 BigSURS meeting. Finally, he spent the summer of 2013 doing research at the Triangle Universities Nuclear Lab (TUNL) at Duke University. Andrei assisted with the design of a compact 1 MeV electron accelerator. After graduation, Andrei is considering working in industry or going to graduate school in physics or computer science.

Mr. Kevin Sanders

Kevin Sanders graduated with a double major in physics and computer science. He began doing research in his freshman and sophomore years, focusing on the physics of an American football in flight. The summer after his sophomore year, he did funded research at the Colorado School of Mines REMRSEC REU program. Kevin worked in the High Performance Computing department on ParFlow, an integrated, parallel watershed model.

After his junior year, Kevin spent the summer doing funded research through a University of Michigan REU at CERN, the premier particle accelerator in the world. Once again, his programming skills were noticed and he was tasked to work in the IT-CLS-DLT (Digital Library Technology) department on the ZENODO/Invenio project, a research sharing initiative. While he was there, he acquired an additional project analyzing particle collision data from the ATLAS detector. This led to funding to do research at CERN during the Spring Semester of his senior year. While taking three courses online at HPU, he lived in France and worked at CERN. As an undergraduate student, Kevin gave eight presentations at regional and national conferences, including three presentations at national AAPT meetings. Kevin is now in the Ph.D. program in physics at Boston University and will do research in particle physics.

Congratulations! Andrei Makhanaov (left) and Kevin Sanders (right) each graduated with a degree in physics from HPU this past May.



The HPU Department of Physics Faculty
Just what are they up to?

Dr. Aaron Titus
Associate Professor of Physics, Department Chair

Last year I worked with Matt Carnaghi on springs released from uniform circular motion and with Simeon Simeonides and Junjie Liao on measuring motion in non-inertial reference frames using a GoPro camera. I also co-wrote the instructor's solutions manual for the 4th edition of *Matter and Interactions*. This next school year I will co-author the student's solutions manual for *Matter and Interactions.* I will also focus on writing and submitting a few articles on some of the research projects students and I have worked on during the past five years. In the Spring of 2015 I will be on sabbatical and hope to produce an epub on *Physics for Video Games.*

Dr. Titus is the current chair of the Department of Physics at HPU. "Titus" received his B.S. in physics from Penn State University and his Ph.D. in physics from NC State University.

Dr. Martin DeWitt
Assistant Professor of Physics

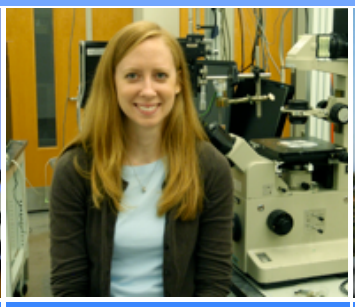
This past year, I worked with Walter Morrisette studying the effect that a spoiler has on a car's performance, and made progress on a project to build a wind tunnel designed by Stephen Vultaggio. The next step in the wind tunnel's development is to build the equipment that will measure the lift and drag forces on a model placed in the test section. This will allow our physics majors to carry out a wide variety of aerodynamic investigations. This summer, I attended a workshop at the California Institute of Technology to learn how to use a diode laser apparatus that will soon be incorporated into the laboratory components of many of our upper-level physics courses.

Dr. DeWitt has a B.S. in aerospace engineering from NC State University and a Ph.D. in physics from NC State University.

THE PHYSICS FOUR!


Aaron Titus


Martin DeWitt


Briana Fiser


Brad Barlow

Dr. Briana Fiser
Assistant Professor of Physics

I worked with Nick Kasle, Jacob Brooks, and Stephanie Pettit this past year. Nick designed and executed an experiment to determine why gloves were introduced in the sport of racquetball and not tennis. Jacob and Stephanie investigated ways to use a magnetic artificial cilia system to replicate the metachronal wave exhibited by biological cilia in the human lung. This next year I will continue to work with Jacob and Stephanie, making progress with them on this topic. In addition, we received a NC Biotechnology Institutional Development Grant to create a Cell Culture Facility on our campus that I will use to begin designing research experiments investigating the physics of biological cilia.

Dr. Fiser has a B.S. in physics and mathematics from the University of Mississippi, a M.S. in physics from UNC-Chapel Hill, and a Ph.D. in physics from UNC-Chapel Hill.

Dr. Brad Barlow
Assistant Professor of Astrophysics

During the 2013-2014 academic year, my first at HPU, I worked with Stephen Vultaggio and Aaron Marlowe on observing pulsating stars and comets with the robotic SKYNET telescopes. One of the highlights of my year was bringing three physics majors to observe in Chile (pg 2). I published two articles in peer-reviewed journals, including one on binary stars and another on active galaxies and started a collaboration with UNCG on a "biomusic" project. This upcoming year, I will invest a significant amount of time in getting research with SMARTS off the ground (pg 3). I hope to start an upper-level astrophysics course soon, which would pave the way for an astronomy minor in the near future.

Dr. Barlow has a B.S. in physics from Mississippi State University, a M.S. in physics from UNC-Chapel Hill, and a Ph.D. in physics from UNC-Chapel Hill. He also worked as a postdoctoral research associate at Penn State University.

AROUNDTHEDEPARTMENT

The Physics Department Turns 1 Year Old!!!

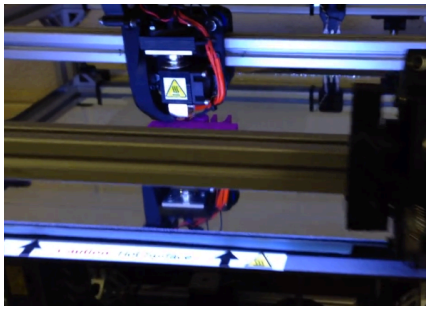
Jun 2014

Happy Birthday to us! Formerly a part of the Department of Chemistry & Physics, the Department of Physics formed its own entity on June 1st, 2013. We currently have four full-time faculty members but hope to add two or three additional professors over the next decade or so. We are now officially one year old, and we're looking forward to going around the Sun many more times!

We now own a 3-D Printer!

May 2014

A few months ago, we bought our first 3D printer from Fusion3 Design, a company based out of Greensboro, NC. In addition to giving students opportunities to work with and understand the technology behind 3D printers directly, our purchase has many practical applications; using simple 3D design software, student and professors can design and then print custom plastic parts specifically for the projects and instrumentation they are working on. This allows us to bypass the often time-consuming and expensive process of outsourcing the manufacturing of custom parts for simple but specific needs. HPU student Hunter Smith spent the summer learning how to use the 3D printer. We hope to integrate the technology into multiple physics courses.



2013 Beach Trip Was a Success!

Oct 2013

Our physics department is like one big family. That's why we like to take "bonding" trips each year. This past fall, our Society of Physics Students club went to Oak Island, NC, where Dr. Gray Bowman graciously hosted us at his beach houses. Students spent time walking in the sand, swimming in the ocean, playing frisbee, flying a stunt kite, throwing a football around, and enjoying a picnic lunch on the beach. After a day of fun in the Sun, everyone retired to the beach houses for a relaxing dinner, homemade peach cobbler and ice cream, and an informal folk/bluegrass concert performed by Dr. Bowman and Dr. DeWitt. Trips like this one bring freshmen, sophomores, juniors, and seniors together and help to build a strong sense of community among our majors.

HPU Physics Alumnus Joins Department

Aug 2014

After graduating HPU in 2009, Damon Smith went on to pursue his Master's Degree in Physics at North Carolina A&T State University. We are happy to announce he is now an Adjunct Professor of Physics at High Point University! This fall, he is teaching one of our General Physics II lecture courses, along with both General Physics I and II labs.

Fiser's Research Class Enters Its Third Year

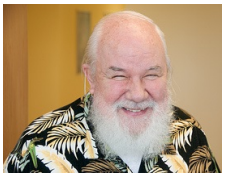
Aug 2014

In 2011, Dr. Fiser developed and served as instructor for a class that teaches students the primary skills needed to conduct scientific research. Throughout the course, students learn how to search the literature for previous publications on a topic, to read and interpret academic articles, to cite references properly, to write and format academic papers, and to communicate and present scientific results to others. Students must also carry out their own research projects over the course of the year. In the past, the topics of these projects have ranged from inertial reference frames to ancient hunting weapons to monitoring a comet as it plunged into the Sun. This type of class has few counterparts at other universities and has become a required class for physics majors at HPU; it's also popular with students. "Dr. Briana Fiser's Physics Research and Writing course really taught me a lot about how research is done every step of the way," says HPU physics major Simeon Simeonides.

Physics Dept. Receives Generous Book Donation

Aug 2014

John and Jola Hubisz are donating thousands of physics, math, and general science books to High Point University and the Department of Physics. In one van-load at a time, books are brought to HPU for cataloging. Thus far, 839 books from the "John L. Hubisz Physics Collection" have been added to our library's holdings. Some of our favorites include the complete set of books from the *MIT Introductory Physics Series*, the complete set of books from the *Berkeley Physics Course*, and *The Collected Papers of Albert Einstein*. To find books from the collection, visit www.highpoint.edu/library/ and search for "John L. Hubisz Physics Collection" in quotes. The department will forever be grateful for this generous donation.

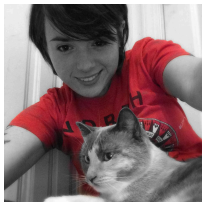


HPU Physics Alumni
What are they up to?

Catherine Hendricks
HPU Class of 2012
B.S. in Physics; B.A. in Religion (HPU)

Catherine obtained a Master's Degree in Medical Physics from East Carolina University in 2014. She now teaches introductory physics at Central Carolina Community College.

Laura Lee
HPU Class of 2012
B.A. in Physics; B.S. in Biochemistry (HPU)

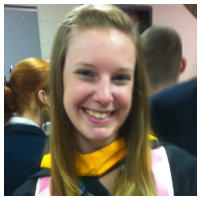


After finishing her studies at HPU, Laura went off to North Carolina State University to pursue a Ph.D. in the Department of Chemical and Biomolecular Engineering. She received a 2014 National Science Foundation Graduate Research Fellowship (NSF GRF) for her studies there, which includes an annual stipend, cost-of-education allowance, and support for professional development opportunities. This fellowship is highly-competitive, and we were very excited to hear that she received one!

Colin McGuire
HPU Class of 2012
B.S. in Chemistry; minor in Physics (HPU)

Colin is now a high school teacher at Lowcountry Preparatory School in South Carolina. He teaches both physics and chemistry.

Linda Poplawski
HPU Class of 2013
B.S. in Physics; minor in math (HPU)



Linda is now a student in the Department of Physics at Duke University pursuing a graduate degree in Medical Physics.

Nikki Sanford
HPU Class of 2013
B.S. in Computer Science & Math; Physics minor (HPU)

In summer 2013, Nikki was one of two AIP Mather Policy Interns. As a result, she worked on Capitol Hill with the US House Committee on Science, Space, and Technology. She's currently a graduate student at William & Mary Law School.

Brielle Tyree (Spencer)
HPU Class of 2012
B.S. in Math; B.S. in Physics (HPU)

One year after earning her Bachelor's degree from HPU, Brielle went on to obtain a Master of Arts in Teaching (M.A.T.) from HPU. She is now teaching full-time in the Department of Math and Computer Science at High Point University.

Randall Williams
HPU Class of 2013
B.S. in Computer Science; minor in Physics (HPU)

Randall is an Informer Implementation Specialist for Entrinsik in Raleigh, NC. Informer is software to generate reports and analyze data.

Bradley Taylor
HPU Class of 2013
B.S. in Chemistry; B.S. in Mathematics; minor in Physics (HPU)

Based on his experience with Resident Life, SGA, and the Odyssey Club at HPU, Bradley decided to pursue a Master's degree in Higher Education and Student Affairs at North Carolina State University. As part of the program, Bradley is a graduate assistant at Duke University

Email Dr. Titus at atitus@highpoint.edu with a brief summary of what you're up to!

HPU Physics Alumni
What are they up to?

Amanda Tindall

HPU Class of 2012

B.S. in Biochemistry; minor in Physics (HPU)

Amanda is a Ph.D. candidate in the Department of Biochemistry and Biophysics at Texas A&M University. Amanda is studying the allosteric regulation of human liver phospofructokinase. In 2013, Amanda received an Honorable Mention for the NSF Graduate Research Fellowship.

Aaron Robinson

HPU Class of 2011

B.S. in Math; B.S. in Computer Science; minor in physics (HPU)

After graduating from HPU, Aaron returned to the Pacific Northwest where he worked for Pacific National Lab. He later worked for Amazon, and now he works for LabKey in Seattle, WA, where he develops open source software for bioinformatics.

Libby Wise (Messina)

HPU Class of 2011

B.S. in Chemistry; minor in Physics (HPU)

Libby received her M.S. in Forensic Science at George Mason University in 2012. She now works as Forensic Laboratory Specialist for the Virginia Department of Forensic Science.

Dr. Dan Short

HPU Class of 2010

B.S. in Math; B.S. in Chemistry; minor in physics (HPU)

Yes, we have to call him "Dr. Short" now. Dan received his Ph.D. in Environmental Engineering from the University of California, Riverside in 2014. Dan is now a Fuels Technologist for Marathon in Findlay, OH.

Bill Frasure

HPU Class of 2011

B.S. in Computer Science; minor in Physics (HPU)

After graduation, Bill moved to Utah where he focused on snowboarding and working as a Java Engineer for Solutionreach, a company that provides software solutions for patient management at medical practices. He now lives in the DC area and works for the same company.

Leah Wilson

HPU Class of 2010

B.S. in Mathematics; minor in Physics (HPU)

Leah received her master's degree in special education from Arizona State University (2012) while she taught in the Teach for America program. She now teaches math at Western School of Science and Technology in Phoenix, AZ.

Andrew Proctor

HPU Class of 2011

B.S. in Math; B.S. in Computer Science; minor in Physics (HPU)

Andrew finished his M.S. in computer science at Wake Forest University (2013) and now lives in San Diego and works in PHP development for TargetCW which provides staffing and payrolling services to businesses.

Jeremy Turkett

HPU Class of 2010

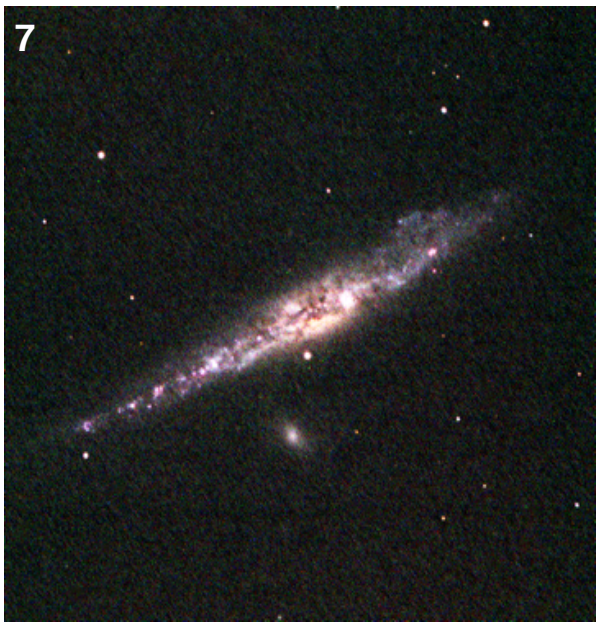
B.S. in Chemistry; minor in Physics (HPU)

Jeremy is a radiochemist for Theragenics, a medical device manufacturer in Atlanta, GA specializing in brachytherapy seeds to treat prostate cancer. Jeremy is involved in both production and process improvement R&D.

Intro Astronomy Students Use Robotic SKYNET Telescopes to Study the Sky

Starting in Fall 2013, students taking Astronomy of the Stars, Galaxies, and the Cosmos were granted access to the robotic SKYNET telescopes located around the world. These telescopes can be controlled from the comfort of your home via a simple web interface, and students used the system to carry out a variety of projects and to make aesthetically beautiful astrophotographs. Some of these pictures are shown at left and below.

Pictured: 1-Trifid Nebula; 2-Thor's Helmet; 3-Jupiter; 4-Sombrero Galaxy; 5-Eagle Nebula; 6-Dumbbell Nebula; 7-Whale Galaxy; 8-Tarantula Nebula.



At
High Point University,
every student receives an
extraordinary education in an
inspiring environment with
caring people.®

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