WKU PHYSICS AND ASTRONOMY

Physics on the Hill

Spring 2016, Volume 12, Issue 1

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Welcome from the Interim Department Chair, Dr. Michael Carini

It has been another exciting and productive year in the Department of Physics and Astronomy. Physics students continue to excel in the classroom and the laboratory, and our faculty remain highly productive in research while continuing the department's tradition of academic excellence in the classroom. The observatories continue to produce hands-on experiences for our students and valuable data for student and faculty research projects. The API is heavily engaged in a number of interesting and fascinating projects centered around development of smart sensor technologies. The NOVA center is growing in reputation, and demand for time is as high as ever on the large chamber scanning electron microscope . Our materials science research lab and our newly established laser labs are engaging students, working with faculty and students from other departments on multidisciplinary projects, receiving external funding, and expanding the department's national and international reputation. This year we will graduate one of the largest cohorts of students yet from the Homeland Security Sciences MS program. The Hardin Planetarium continues to expand our reach in the area of STEM informal education; two new initiatives to engage the larger Bowling Green community, a lifelong learning class and Science Cafe, began this year. I am proud to announce that Dr. Richard Gelderman, Director of the Hardin Planetarium, is the recipient of the 2016 Ogden College of Science and Engineering Public Service Award.

At this year's SPS banquet, in addition to honoring our students for their accomplishments, we will also celebrate the retirement of Dr. Keith Andrew. Keith stepped down from the department headship in January of 2015 to focus on some exciting research opportunities, and he has now decided to retire formally from WKU. He will be sorely missed by all of us.

As I write this, I look out my window and see the walls of the new Ogden Hall science building being built on the site of what was Thompson Complex North Wing. Physics will have several new modern teaching and research laboratory spaces in Ogden Hall for our faculty and students. Our hope is that the construction will go smoothly; this will allow a badly needed renovation to occur in Thompson Complex Center Wing. We are equally excited about that renovation. If it occurs, we will gain additional teaching laboratory space and modern classrooms, including an expanded interactive classroom.

As you peruse the pages that follow, I hope you gain a sense of the exciting things we are doing in the department, as well as remember fondly your days studying (or for some of you, teaching) physics on the Hill.

Recent News: Comings and Goings

Retiring Professor Spotlight: Dr. Keith Andrew

The Department of Physics and Astronomy bids a fond farewell to Dr. Keith Andrew, professor and former department head. Dr. Andrew obtained his B.S. in physics at Worcester Polytechnic Institute, then went on to receive his M.A. and Ph.D. in theoretical physics at the University of Arkansas. He has made tremendous contributions to the department since his 2004 arrival. He worked with over three dozen WKU and Gatton Academy students and numerous faculty in such diverse areas as neutralino dark matter, chaotic cosmology, quark stars, electron microscopy of fractures, cyber threat detection, and information waves in social media. Dr. Andrew's infectious enthusiasm for teaching physics made him a constant draw in both introductory and advanced courses. During his 11-year tenure as department head, his unflagging leadership and support was critical in fostering the development of the Homeland Security masters and SKyTeach teacher training programs, the revamping of instructional laboratories, digital and curricular upgrades to Hardin Planetarium, building extensive new research facilities at the Applied Physics Institute, NOVA Center, Cyber Defense Laboratory, WKU Observatories, and many other initiatives enhancing student learning and the department's collegial atmosphere. We wish him all the best in his retirement!

New Faculty Spotlight: Dr. Ting-Hui Lee

The Department of Physics and Astronomy welcomed Dr. Ting-Hui Lee as a permanent full-time instructor in 2015. Dr. Lee has been a visiting professor in Physics and Astronomy since 2008. She earned her B.S. in Earth Science from National Tawain Normal University, her M.S. in astronomy from National Central university in Taiwan, and her Ph.D. in astrophysics from the University of Calgary . Before coming to WKU, Dr. Lee was a postdoctoral researcher at the National Optical Astronomy Observatory. She pursues innovative teaching and conducts research with WKU students on the chemical composition of planetary nebulae, stellar evolution and galactic structure. She also advises the Chinese music club in her spare time.

New Faculty Spotlight: Dr. Ali Er

We welcome Dr. Ali Er, who joined our department as an assistant professor in 2014. Dr. Er received his B.S. in physics from Ortadogu Teknik University in Turkey and his PhD from Old Dominion University. He held postdoctoral positions at the University of California Irvine and Princeton University before coming to WKU. Dr. Er's research uses ultrafast laser pulses for a variety of applications at the intersection of physics, chemistry, medicine, and engineering. His research includes investigations into material deposition with femtosecond pulsed lasers, low-temperature non-partical growth and photo-deactivation of bacteria and viruses. He has won several research awards and holds several patents for his work.

Alumni News

Alumnus Spotlight: Jordan Lindsey

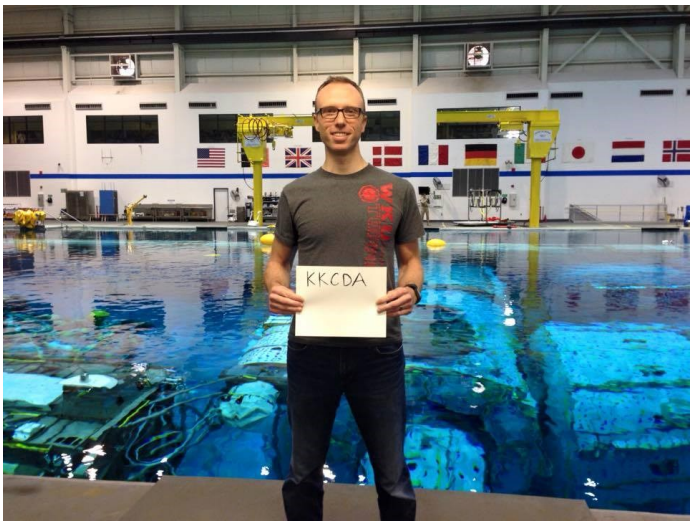


Photo Courtesy of Jordan Lindsey

Jordan Lindsey is a 2002 graduate of the WKU Department of Physics and Astronomy, where he received his B.S. in physics. He is currently employed at Stinger Ghaffarian Technologies, Incorporated (SGT, Inc.). His primary responsibility at SGT, Inc. is training US and International Partner astronauts for spacewalks; he instructs these astronauts from the time they arrive as astronaut candidates to the time they are given their expedition assignment to the International Space Stations (ISS). Lindsey provides training for Extravehicular Activity (EVA) and spacesuit operation.

Lindsey's Work in the Neutral Buoyancy Laboratory (NBL)

Lindsey educates astronauts about their spacesuits at the NBL. During this training, Lindsey teaches astronauts how the spacesuits function as well as how to operate them. These astronauts learn how each system in the spacesuits works together to protect them from the vacuum of space during an EVA. In order to train these astronauts how to properly operate their spacesuits, Lindsey—who serves as a test conductor (TC)—puts them through simulated spacewalks in the pool. These simulations range from simple spacewalks to extremely complex spacewalks that simulate failures with hardware, tools, and spacesuits. Not only does Lindsey serve as a TC, he also SCUBA dives and swims to the different mockups of the space station at the NBL to help astronauts prepare for simulations.

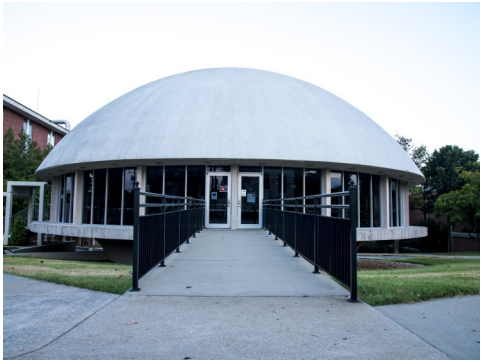
Lindsey's Reflection on Physics

When asked what he would say to students wishing to pursue a career in physics, Lindsey responded that physics is a highly useful discipline because it, "touches all areas of science, technology, engineering, and mathematics." He emphasized the many opportunities that his physics degree has given him, and he highlighted that getting a physics degree does not lock you into a specific field, it gives you possibilities.

Photo Courtesy of NASA

Hardin Planetarium

Planetarium Immerses Audiences in Interactive Storytelling Experiences



In early 2013, the arrival of a new digital projector to WKU marked a new beginning for the presentation capabilities of the Hardin Planetarium. Dr. Richard Gelderman, Planetarium Director, has focused his attention on engaging with audiences through interactive shows designed to showcase specific information concerning the solar system. The goal of the planetarium shows, according to Gelderman, is to present scenarios that inspire curiosity and force the audiences to ask questions. Public involvement has become the new force that drives the shows forward.

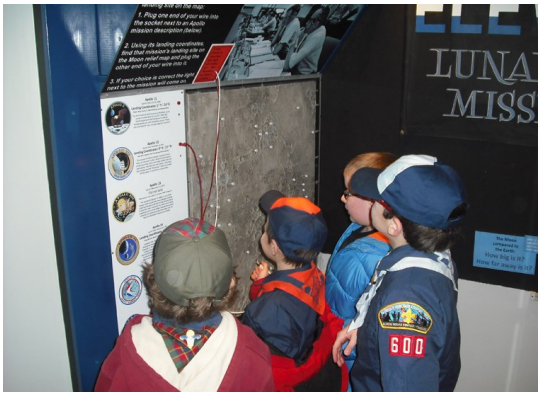
Recent planetarium shows have successfully blended science fiction with science fact. "Humans on Mars" asks viewers what it would take to fund, plan, and execute a human journey to the Red Planet. Instead of simply presenting facts and strategies to the audience, planetarium staff have incorporated a storytelling element that engages with the crowd, promoting them to ask questions about the exciting prospect of space travel.

The department's vision for new planetarium shows is to ensure that audiences leave with important questions on their minds. Developing shows that encourage interactivity between presenters and the public broadens the educational scope of the planetarium. Thanks to the thriving volunteer core at the Hardin Planetarium, live shows have become a yearlong activity for the Department of Physics and Astronomy with shows held on Tuesdays, Thursdays, and Sundays.

Planetarium Broadens Community Outreach

Mr. Ronn Kistler, Planetarium Coordinator, and Dr. Richard Gelderman, Planetarium Director, stress the need for community outreach and interactivity with the audience. Since Kistler became the Planetarium Coordinator in 2012, he has worked to update the exhibits outside of the star chamber. Hardin Planetarium is an informal science education facility that relies on engaging displays and shows to bring in audiences. "To make everything here something that people could touch, and stop, and play with, and explore would be a big goal," Kistler said. He noted that community outreach is a major part of working at the planetarium. The first type of outreach is the public shows themselves. The second type is booking shows for school or nonprofits. The third type is hosting Science Curiosity Investigation Camps for 3rd through 6th grade students during spring, summer, and fall breaks.

If you would like to register your child for the camp, view a schedule of events, or inquire about volunteering at the Hardin Planetarium, please visit www.wku.edu/hardinplanetarium/.



Cub Scouts view a display at the planetarium

Physics and Astronomy Events

Physics and Astronomy Colloquia Spotlight Research

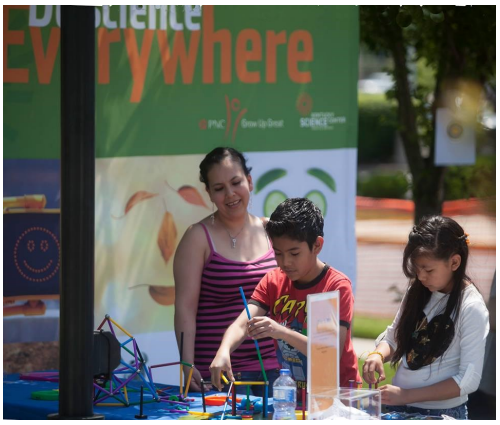
During the Spring 2016 semester, the Department of Physics and Astronomy hosted research presentations from institutions across the United States, including Princeton, Vanderbilt, the Space Telescope Science Institute, and the Agricultural Research Service. Additionally, Professors Richard Gelderman, Muhammad Jahan, and Sanju Gupta presented their own research. Below are some examples of the research presented by guest speakers.

Dr. Denys Bondar, a Postdoctoral Research Associate at Princeton University, presented his research on the modeling of quantum and classical dynamical systems. His discussion on February 8th concerned the minimum requirements and observations needed to formulate a physical theory. Bondar argues that a new approach, termed the Operational Dynamical Modeling (ODM) method, allows physicists to deduce equations of motions from time evolution of observables and re-derive widely known theorems.

On February 15th, Dr. Aleksandr Kavetskiy and Dr. Galina Yakubova from the Agricultural Research Service presented their analysis on the Inelastic Neutron Scattering (INS) Soil Carbon Method for measuring the carbon level of soil. The researchers found INS to be an effective alternative method for measuring soil carbon.

Dr. Richard Galvez of Vanderbilt University spoke on February 29th regarding the use of inflation in order to reduce the size of string theory landscape. Dr. Galvez gave an introduction to string theory, cosmic inflation, and geometric compactifications before concluding with a discussion of research on the scope of string theory landscape.

Science Café March 28, 2016



A demonstration at the 2015 Expo Day

Science Café

On the last Monday of every month, the Department of Physics and Astronomy invites other science enthusiasts to join them at 643 Sports Bar. Structured like a dinner party conversation, a guest speaker presents their research as a conversation between themselves and those present.

SKy Science Festival

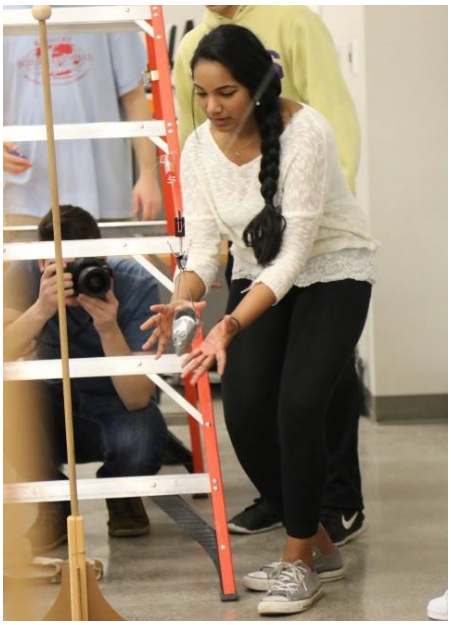
Expo Day at the SKy Science Festival is a celebration of science in Kentucky. The event allows attendees to have the opportunity to watch interactive demonstrations of science and technology. Although the 2016 Expo Day was put on hold due to weather, the event takes place annually.

Physics Olympics

This year's WKU Physics Olympics concluded with a record 17 high school teams represented. Thanks to the organizational efforts of the Department of Physics and Astronomy, as well as thriving volunteer work, the 2016 Physics Olympics was the largest in the event's 14-year history. The department is looking forward to the 2017 Physics Olympics with continued volunteer support from the community and alumni. Below are brief descriptions of each of the five Physics Olympics events. The events challenged the teams to problem-solve creatively.

Mission Procurement

Students were tasked with shipping two Pringles potato chips to the University of Virginia Department of Astronomy in the smallest package possible. To complete the challenge successfully, the Pringles must arrive in an orientation different from their normal "stackable" position and must be free of damage.



Cavern Mapping

The teams split into pairs in order to accurately map the geography of Thompson Complex. The first pair of students were tasked with strategically placing markers around the building and providing instructions so that the second pair could enter the building and find them. The goal was to map as much of the building as possible with the markers.

Zip-Line Relay

Each team was entrusted with crafting a harness that allowed them to transport chicken eggs using a zip-line provided by the organizers. To complete the challenge, teams had to transport four eggs in succession without damaging them.

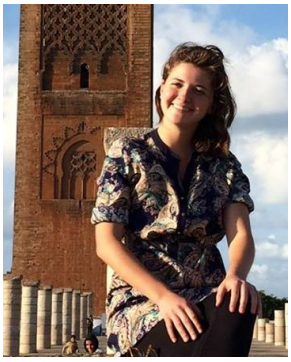
An Impromptu Activity

The details and rules of this event were not revealed until the beginning of the event itself. It tasked students with building a barge out of tin foil that can hold as many marbles as possible without sinking. The students were challenged to think quickly.

Fermi Questions

This traditional event is also known as the "Order of Magnitude" quiz. Students were given 15 minutes to solve a complicated physics question without outside resources. The goal of the event was to test students' ingenuity under pressure.

Student Accomplishments



Senior Profile: Brittany Broder

Brittany Broder, a double major in physics and Arabic, studied in Morocco for a semester in 2014. She spent a month with a host family in Rabat before going to Al-Akhawayn University in Ifrane, Morocco.

She took a linear algebra class, but had already taken the physics classes the university offered. She used her time abroad to further her knowledge of Arabic, and spent a lot of time speaking in Arabic to gain a working proficiency.

Broder said, "The best part of my experience was being able to talk to people in Arabic and learn more about the Moroccan culture. As an Arabic major, it's very helpful to hear about life and culture from people who are experiencing it." Some of her favorite memories are of shopping in the markets and eating Moroccan food. Broder graduates in May 2016.

Honors Thesis Award: 2016 graduate Mary Spraggs was recognized with the award for the best WKU Honors thesis. Mary is the second WKU Physics and Astronomy graduate to receive this award.

2016 Graduating Seniors

Brittany Broder

Eli Heintzman

Brian Luna

Mary Spraggs

Joshua Stewart

2016 Sigma Pi Sigma Physics Honors Society Members Elect

Brittany Broder

Eli Heintzman

Mary Spraggs

Joshua Stewart

Quantum Leap Achievement Award

Awarded yearly to students who have successfully completed the core physics requirements.

Trason Carter

Seth Harper

Carson King

Andrew McGuffey

2016-2017 Society of Physics Students Officers

President—Trason Carter

President-Elect—Nikola Cvijanovic

Treasurer—James Pierce

Secretary—Dakota Burns

2016 Student Awards

Dr. George V. and Sadie Skiles Page Award for Excellence in Scholarship*

Awarded to the graduating Physics major with the highest academic standing.

Brittany Broder

Brittany Broder, a senior with majors in Physics and Arabic, receives the Page Award for Excellence in Scholarship based upon her outstanding academic record while a student at WKU. In addition to being a President's List recipient during every semester of her WKU tenure, Brittany has also been active in a variety of research activities both in the WKU Department of Physics and Astronomy and at other institutions. She has served as a research assistant at the WKU NOVA Center working with Dr. Ed Kintzel on the Lunar/Martian Regolith Simulant Project. She spent the summer of 2015 on an internship at the Stanford University/Lockheed Martin Solar and Astrophysical Laboratory and will spend the summer of 2016 at the Brookhaven National Laboratory on a DOE sponsored internship. Brittany was also part of the WKU Forensics state and national championship teams in 2014 and 2015 and international championship team in 2014. She has recently been selected as a Fulbright US Student Awardee and plans to continue her studies at the Mines-Nantes Graduate School of Engineering in France starting in the Fall of 2016.

Dr. Randall Harper Award for Outstanding Research in Physics and Astronomy*

Awarded to the junior or senior student with research exhibiting significance, effort, originality, and creativity.

Brian Luna

Brian Luna, a senior physics major with a minor in math, works with Dr. Scott Bonham as an undergraduate research assistant on Physics Education. Brian receives this award for his work on Improving Writing Instruction with Peer Review in Physics Labs. He has worked in the University Physics Laboratory for the past two years and continued his research. Brian has presented his work at multiple conferences, including the Kentucky Association of Physics Teachers, the American Association of Physics Teachers, and the WKU Student Research Conference. As a music minor, he has been a member of the Symphony at WKU since 2012 and toured with them in China during the summer of 2013.

Dr. Douglas Humphrey Award for Outstanding Service*

Awarded to the junior or senior student with a record of service within the department and to science outreach to the community.

Joshua Stewart

Joshua Stewart, a senior with majors in Physics and Mathematics, receives the Doug Humphrey service award because of his longstanding good citizenship in supporting a range of faculty and student activities in the department. In his two-year tenure as treasurer of the WKU Chapter of the Society of Physics Students, Josh has been a key player in building the membership and camaraderie of the organization, cheerfully aiding in promoting and supporting physics among the student body and facilitating student connections with faculty and staff. In addition, Josh has worked with Dr. Gibson on analysis of radio emissions from the planet Jupiter and the Sun and is currently investigating interplanetary travel dynamics for his senior seminar in mathematics.

Contact Us

Our alumni, former faculty, and friends are very important to us, and we want to hear what exciting activities you are up to since leaving the Hill.

Alumni Survey: physics.wku.edu/newstudents/alumni_story_submission.html

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WKU PHYSICS AND ASTRONOMY

Thanks to Michael (Chaz) Lively, Adriana Funke, Asia Tobin, and Jennifer Troth— students in Professor Angela Jones' ENG 402 class for their significant efforts in putting together this edition of Physics on the Hill.

WKU Department of Physics and Astronomy: A community of faculty, staff, and students engaged in better understanding the physical world.