Physics and Astronomy
Western Kentucky University
1906 College Heights Blvd, #11077
Bowling Green, KY 42101-1077

Addressee Name
4321 First Street
Anytown, State 54321

Physics on the Hill

Spring 2009, Volume 7, Issue 1

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UPCOMING EVENTS

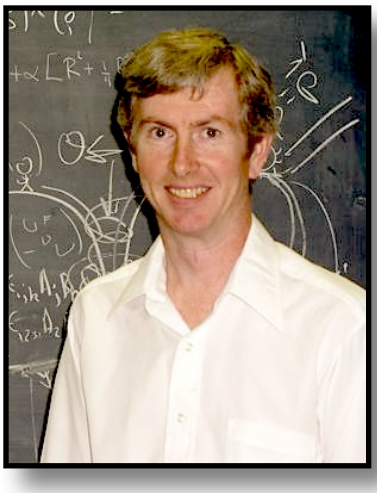
Western Kentucky Physics Olympics
The Physics of Super-villains
February 28, 2009
Registration Deadline: February 19, 2009

ALUMNI PROFILES AND MORE...

WKU Physics Alumni share their experiences at Western, what they are doing now, and how WKU prepared them for their careers. See all their profiles, as well as more information on current and upcoming events at

http://physics.wku.edu

Message from the Chair



February 2009

Greetings from the Department of Physics and Astronomy at Western Kentucky University. This has been an exciting year for the department. We have hired four new faculty, completed a major lab renovation, had students present work at several conferences, opened a Cyber Defense Laboratory, and have started accepting students in to our Homeland Security Sciences MS graduate program and in the new SKyTeach program for teachers. Our newsletter is sent periodically to alumni and friends of the Department to update you on our people and their activities and accomplishments. For more frequent updates, we invite you to visit our website at http://www.physics.wku.edu. There you can always learn about the most recent activities of our faculty and the current students in the program.

We have been fortunate to add four new faculty members to the Department of Physics and Astronomy this year. Details on these outstanding individuals may be found inside our Newsletter, as well as on our website. Let me also offer congratulations to the students who have recently graduated: Noah Kapley, who is now a graduate student at University of Wisconsin-Madison, Jason Smith who joined the work force, and Jason Carson who is a graduate student at the University of Alabama. We are always happy to hear from former students and supporters and to learn where you are, what you are doing now, and how your careers have developed after studying and pre- paring in our program. The Physics Olympics is coming up soon and we look forward to hearing from anyone in high school interested in participating in this event. We invite you to call, write, or email at any time to let us hear from you. In general, the email address for a faculty member at Western is based on their name as: firstname.lastname@wku.edu. Send us a note, and look for our Facebook page to talk with students from any graduating year.

Dr. Keith Andrew

Department Head

Womble Receives Faculty and University Awards for Research and Creativity

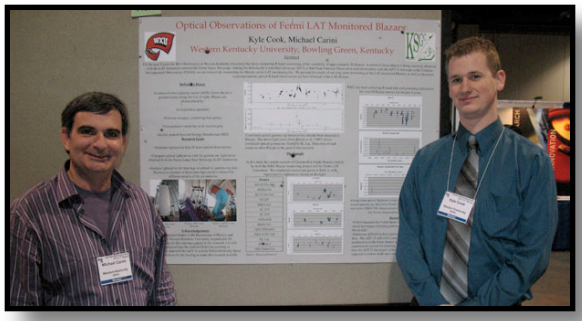
Dr. Phil Womble

Dr. Phillip Womble recently won two major university distinctions for research. Dr. Womble received both the **2008 College Faculty Award in Research and Creativity** from the Ogden College of Science and Engineering, and the **2008 University Award** in the same category, one of the highest distinctions bestowed to faculty at WKU. Dr. Womble typifies the high ideals of scholarship, student engagement, and contribution to the welfare of the university that are the spirit of these awards.

Dr. Womble is the director of the API and the Cyber Defense Lab. Among his accomplishments are 70 national and international publications, 22 of which have been published within the last 5 years. He also mentors over 37 students in research projects. Dr. Womble plans to continue with the same vigor which merited his recognition. "I feel extremely honored, and even more honored, that my nomination came from my colleagues. I guess the best thing to do is to 'keep on keeping on.'"

Student Accomplishments

Kyle Cook (Senior in Physics and Astronomy) received an Honorable Mention from the Chambliss Astronomy Achievement Student Award for his presentation of "Optical Observations of Fermi LAT Monitored Blazars" at the American Astronomical Society's 213th Meeting in Long Beach, CA in January 2009. The Astronomy Achievement Student Awards are given to recognize exemplary research by undergraduate and graduate students who present at one of the poster sessions at the meetings of the AAS.



Dr. Michael Carini and Kyle Cook

38th annual WKU Student Research Conference:

Brian Cooper, "Underwater Threat Detection Using Pulse Neutrons"

Chris Davenport, "Unmanned Ground Vehicles to Defuse IED's"

Matthew Lodmell, "Design of a New Control System for an Electron Neutron Generator"

Kyle Moss, "Design of Electroencephalogram and Electrocardiogram Technology Including Wireless Integration for Use in Polysomnography"

Jason Musser, "Correction in Doppler Broadening in Gamma Ray Spectra for Light Nuclei"

Jason Smith, "Modeling Results for Environmental Acoustic Pressure Obstructions," received **honorable mention** at the conference.

Other National Research Presentations:

Lisa Taylor "Simulating Large Scale Structure: The Effect of Increasing Particle Impulse on Void Probability", 211th American Astronomical Society Meeting, January 2008

Jacob Baxley & **Armin Smailhodzic**, "A Cosmological Solgi Void Probability Function for Gadget II Lambda CDM Models and SDSS Data", Kentucky EPSCoR meeting, October 2008

Jacob Baxley & **Armin Smailhodzic**, "Sloan Digital Sky Survey Data and the Generalized Cosmological Reduced Void Probability Distribution Function", Kentucky Academy of Sciences meeting, November 2008

April Pease "Discovering and cataloging variable objects in the Nearby Galaxies Supernova Search data", 19th Argonne Undergraduate Symposium.

April Pease & **Schuyler Wolff** "Discovering and cataloging variable objects in the Nearby Galaxies Supernova Search data", Kentucky Academy of Sciences meeting, November 2008

WKU Physics & Astronomy Alumni Graduate with Ph. D., M. S.

Wes Ryle (class of 2003) received his Ph. D. in Astronomy in 2008 from Georgia State University. His thesis was an "Investigation of Fundamental Black Hole Properties of AGN Through Optical Variability", H. R. Miller, Thesis Director. Wes is currently an Assistant Professor at Thomas Moore College in Crestview Hills, KY. **Shelly Smith** (class of 2006) received her M. S. in Space Science Systems in 2008 from the Florida Institute of Technology. She is now an Integration Engineer for the Boeing Company.

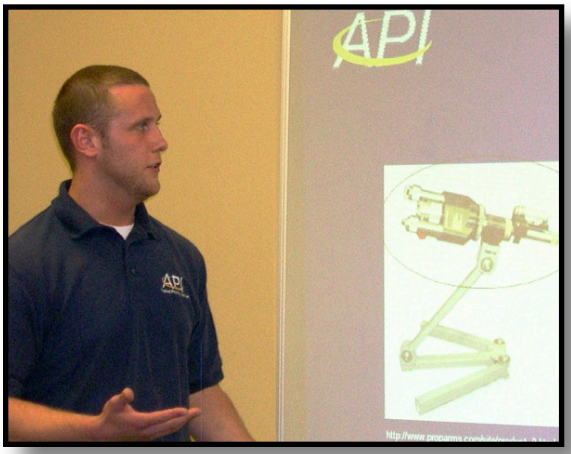
WKU Students Tour Oak Ridge National Laboratory

On Friday October 17th, 2008, students and faculty from Western Kentucky University toured the Oak Ridge National Laboratory (ORNL) facility. During their morning activities, the WKU group toured the Spallation Neutron Source, which included the Target Building as well as the Central Lab and Office Building. While at the SNS, the group heard presentations by Dr. Kenneth W. Herwig, Deputy Director of the Neutron Scattering Science Division, Dr. Eugene Mamontov, Instrument Scientist for the Backscattering Spectrometer (BASIS), Dr. Chris Tulk, Instrument Scientist for the Spallation Neutrons and Pressure Diffractometer (SNAP), Dr. Christina Hoffmann, Instrument Scientist for Single-Crystal Diffractometer (TOPAZ), and Dr. Louis Santodonato, Group Leader for the SNS Sample Environment Group.

After lunch, the WKU group toured the Center for Nanophase Materials Sciences, which is a collaborative nanoscience user research facility for the synthesis, characterization, theory, modeling, simulation, and design of nanoscale materials. The group then toured the High Flux Isotope Reactor. HFIR is the highest flux reactor-based source of neutrons for condensed matter research in the United States, and it provides one of the highest steady-state neutron fluxes of any research reactor in the world. The thermal and cold neutrons produced by HFIR are used to study physics, chemistry, materials science, engineering, and biology. Finally, the group toured the High Temperature Materials Laboratory, which is a DOE User Facility dedicated to solving materials problems that limit the efficiency and reliability of systems for power generation and energy conversion, distribution and use.

Students Attend SPIE Symposium

Two student researchers from the Applied Physics Institute, Chris Davenport and James Lodmell, traveled to Orlando, Florida, on Mar. 16-20 for the SPIE Defense and Security Sympsium, the defense industry's leading meeting. Two physics professors from the API, Dr. Phil Womble and Dr. Alex Barzilov, along with API applications engineer, Lindsey Hopper, accompanied the students.



Chris Davenport presenting at SPIE Symposium

They were given the chance to attend presentations from top defense and security experts such as Under Secretary for Science and Technology from the U.S. Department of Homeland Security, Dr. Delores M. Etter from the U.S. Naval Academy, as well as many others. Various fields of science and engineering were represented at the conference. Scientists and students from many national and international schools also attended the Symposium including MIT, Texas A&M, Michigan State University, University of Kentucky, University of Ottawa (Canada), Beijing University (China), and University of Canberra (Australia).

Davenport and Lodmell represented the Applied Physics Institute for the session of Robotic and Mobile Sensor Technologies and Systems. They wrote a paper to show the research results that they have accomplished at API and also gave a presentation which helped to explain their work on semi-autonomous ground vehicles for defusing Improvised Explosive Devices (IEDs).

New to the Department

Dr. Vladimir Dobrokhotov
attended undergraduate and graduate school in Russia, focusing primarily on plasma physics. He moved to the United States to study at Idaho University where he received his PhD in Physics, working with sensor applications in studying one-dimensional nano-structures. For his post-doctoral research he worked with the university of Louisville's ElectroOptics Research Institute and Nanotechnology Center. At WKU he is teaching University Physics, associated laboratories, and an introduction to electricity and magnetism.

Dr. Edward Kintzel
attended first SUNY for undergraduate studies, then Florida State University, where he received his Master of Science in Physics and then his Doctor of Philosophy in Physics in 2002. His post-doctoral research included working with the Spallation Neutron Source at Oak Ridge National Laboratory and working as a staff scientist and research fellow with the Department of Radiation Oncology at the Washington University Medical School. Here at WKU he will work with the Academic Physics Institute in exploring materials for alternative energy sources, biomaterials, thin films, neutron imaging, and nanoscopic structures.

Dr. Steven Gibson
received two masters degrees, one in physics and one in astronomy, from the University of Wisconsin-Madison. He received his PhD at the University of Wisconsin in 1997 with his thesis on the reflection nebulosity near the Pleiades star cluster. Subsequently he was a postdoctoral researcher at the University of Calgary in Canada and then a staff scientist at Arecibo Observatory in Puerto Rico. His research uses large radio telescopes to map interstellar hydrogen clouds in our home galaxy, measure their properties, and examine their relation to star formation and spiral arms. Currently he teaches University Physics and associated laboratories.

Dr. Ting-Hui Lee
originally taught high school science in Taiwan, received her Master's degree in astronomy from the National Central University in Chung-Li, Taiwan, received her PhD in astrophysics at the University of Calgary in 2004, and performed post-doctoral research at the National Optical Astronomy Observatory in Tucson, Arizona. She has done extensive research on jet structure and planetary nebulae, especially the shaping of bipolar nebulae seen in many Hubble Space Telescope images. She has also studied the "antennae" interacting galaxy pair and has broad expertise in both optical and radio observations and data processing, with recent research involving planetary nebulae, extrasolar planetary transits, and stellar magnetic fields. She currently teaches introductory astronomy and physical acoustics.

New Program

WKU offers MS program in Homeland Security Sciences

The Homeland Security Masters degree program began in the Fall 2008 semester. This multidisciplinary program's goal is to prepare science specialists and technology leaders for careers in homeland security. The program concentrates in applications of physics, biology, and chemistry to detect, quantify, prevent, and decontaminate chemical, biological, radiological, nuclear, and explosive (CBRNE) threats. It requires a minimum of 31 semester hours beyond a bachelor's degree and features a hands-on research component. The core courses include seminars from experts along with studies in classroom and laboratory settings, gaining experience in data acquisition, and analysis using modern techniques and equipment.

For more information about the new master's program, please visit physics.wku.edu/hss or call the Department of Physics and Astronomy at (270) 745-4357.

Alumnus

Graduate Receives PhD at Georgia State University

Wes Ryle, a WKU 2003 graduate, received his PhD in 2008 from Georgia State University. His thesis was "Investigation of Fundamental Black Hole Properties of AGN Through Optical Variability." He is currently an assistant professor at Thomas Moore College in Crestview Hills, Kentucky. To read about other alumni from the physics and astronomy department, visit physics.wku.edu.

SKyTeach

Science and Math teachers for Kentucky

Physics and Astronomy is leading the way in SKyTeach, the new program at WKU for preparing math and science teachers. Modeled after the UTeach program at University of Texas at Austin and supported by the National Math and Science Initiative (NMSI), SKyTeach seeks to both increase preparation of math and science secondary teachers and increase their numbers. Students are encouraged to try out teaching as soon as their first semester in college, to build strong relationships with other math/science teacher candidates, to receive intensive mentoring from experienced teachers, and to learn pedagogy in the context of math and science in this new program, a collaboration between Ogden College and the College of Education. From the department of Physics and Astronomy, Dr. Richard Gelderman is serving at the co-director from Ogden College. Dr. Scott Bonham is the PI on the grant and Melissa Rudloff (WKU physics alumnus) has joined Rico Tyler (WKU physics alumnus) as Master Teachers—experienced secondary teachers who teach the initial classes and mentor students in the program. The first group of 29 students started the program this fall. "I am amazed with the dedication of these students to their teaching," said Rico Tyler. WKU is one of thirteen programs across the nation that has received a $2.4 million dollar grant from NMSI for replicating the highly successful program, and the only one in Kentucky and surrounding states. For more information, visit the SKyTeach website at skyteach.wku.edu.

Biophysics

Biophysics Applications

The Biophysics program at WKU mainly serves the life sciences students: health pre-professionals (pre-meds, -dentistry, -pharmacy, -vets, - optometry), biology students, and chemistry students. These students take biophysics 1 and biophysics 2 with associated laboratory courses. Biophysics is the application of physics to the life sciences, and so a basic knowledge of physics is necessary before the applications may be used. These courses are introductory, so the emphasis is on Physics with the biology component apparent only in some examples. The biophysics 1 and 2 labs are being revised in order to include more biology while keeping the rigorous physics data collection and analysis. One of the new labs is a sedimentation-centrifugation lab, working with pig blood.

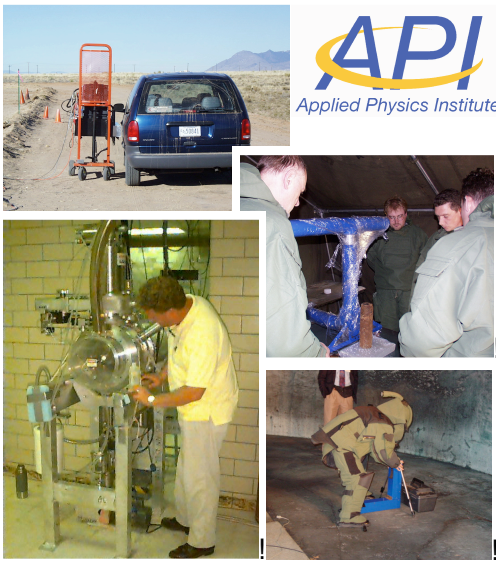
Biophysics courses: General Biophysics, Radiation Biophysics and Medical Imaging. Dr. Ivan Novikov, an Applied Physicist interested in Medical Physics, will return to the Radiation Biophysics class in the Spring of 2008. Medical Imaging is a new course designed by Dr. Wieb van der Meer and has been taught twice already in the spring 2006 and spring 2007 semesters.

API Receives Homeland Security Grants

Portable community infrastructure resiliency system

The idea of this project, lasting one year and headed by Dr. Womble, is to develop a portable lightweight power converter that would replace electrical power substations after a catastrophe and provide communications to the temporary substation, as well as an area of one square mile around it. The system is being developed for rapid response to a crisis in our nation's electrical-energy infrastructure, which is susceptible to natural events like earthquakes, floods, and hurricanes. It is also meant to defend against human interference, such as possible terrorist attacks.

To bring the electric power grid to a safe, stable operating condition as quick as possible, a communication hub and remote-control station will be located with the transformer. WKU will combine both systems into a deployable unit and test their functionality.



Waterborne threat interdiction utilizing underwater impulse generation

The API is to develop an impulse generator for deterring hostile underwater intruders and disrupting underwater equipment that could threaten our ports and naval assets. Prime targets of underwater attacks are facilities and ships which handle large quantities of liquefied natural gas and liquefied petroleum gas, petroleum tankers, port-side refineries, chemical plants, and off-loading terminals. Vulnerable facilities on land might be dams, locks, levies, and river-front terminals. While there are highly developed technologies for detecting and monitoring hostile intruders in restricted waters, there is no current viable way to stop these same intruders closer to the US coast. Dr. Womble will also be leading this project.

Cyber Defense Lab

The CDL project began February 19, 2008, when US Senator Mitch McConnell launched a simulated attack on a computer network. The project is WKU's contribution to the war in cyberspace as a collaborative effort with Mississippi State University, University of Arizona and EDAptive Computing Inc. sponsored by the Army Research Lab, Center for Intrusions Monitoring and Protection. The Network Attack Characterization Modeling and Simulation Testbed, or NACMAST, is funded by $2.8 million in defense appropriations secured by Sen. McConnell. In September, a Senate Defense Appropriations bill gave $73.6 million towards funding numerous Kentucky defense-related projects, of which $6 million will go to the CDL.

Giving Back to the Department

Alumni contributions to the **Department of Physics and Astronomy** will go a long way to ensuring that we have sufficient laboratory equipment and scholarship support for our students. Your help is needed more than ever as budgets remain extremely limited. Please consider making a contribution to the Department and to the University. Donations can be specified to be used for laboratory or instructional equipment use or for any one of our departmental scholarship funds listed.

http://physics.wku.edu/support.html

Information on how to contribute is also available on the website or call (270) 745-4357.

Physics Olympics 2009

THE PHYSICS OF SUPERHEROES VILLAINS!

Western Kentucky **Physics Olympics** is a half-day competition consisting of a pentathlon of challenging problem-solving activities that reward **teamwork, creativity**, and **communication**. The WKU Department of Physics & Astronomy challenges each high school to send one or more teams of four to compete in the 2009 Western Kentucky Physics Olympics, **The Physics of Supervillains**. This year's event will be held **Saturday, February 28** from 8:30 a.m. until about 2:00 p.m. in the Thompson Center, Central Wing on WKU's Bowling Green campus. **Each of the four contestants on the team with the best score in the overall competition will receive a $500 scholarship to attend Western Kentucky University.**

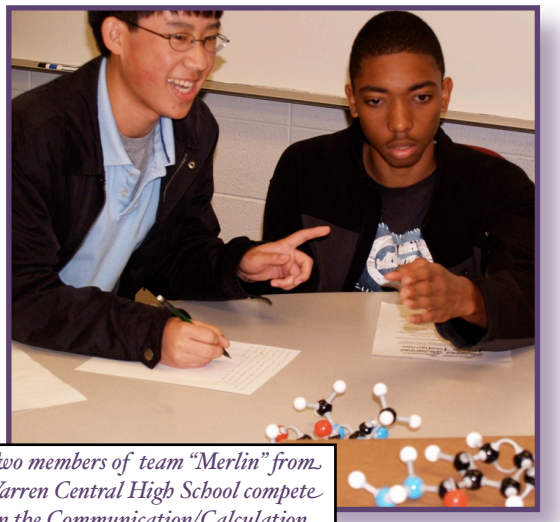
The activities for this year include:

Save the Citizen: Every supervillain depends on the existence of hapless citizens to ensure the attention of his arch-nemesis, the superhero.

Escape Pod: For those times when plans go awry and world domination is not going to happen, the successful supervillain has an escape plan.

Loot Lift Impromptu Team Activity: Activity is the key word for this competition, with the goal being for each team to achieve the desired result as quickly as possible. The situation is designed to reward teamwork and common sense thinking as well as knowledge of physics and the ability to work with formulae. Every team will come away with smiles and good memories regardless of how well they master the particular challenge.

Order-of-Magnitude Quiz (also known as Fermi Questions)**:** Arrive at a reasonable approximation for the value of a complex situation with very little to no information available to directly compute the answer. In this quiz, the contestants will need to quickly make assumptions for values to use in simple calculations in order to arrive at the "correct" answer, stated as the power of ten of the number that fits the accepted value.



Two members of team "Merlin" from Warren Central High School compete in the Communication/Calculation challenge during the 2008 Physics Olympics: The Science of Wizardry.

Communication / Calculation Challenge: Students will use teamwork, communication and calculation skills to achieve the as yet unspecified goal. Two members of the team will be presented a task and must write out a plan to solve the assigned problem. The remaining two team members will then be presented with these written instruction and be required, with no additional communication, to execute the solution.

Teams can find further information, and register online at http://physics.wku.edu/olympics.