

## Contents

- Greetings from the Chair.....1**
- Particle Accelerator...2**
- Rocket Girl and Retirees.....3**
- New Kid on the Block.....4**
- Student/Teacher Spotlight.....5**
- Latest News and Upcoming Events.....6**

# Physics on the Hill

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## Greetings from the Chair

Keith Andrew



Dr. Keith Andrew

This semester, Western Kentucky University continues to expand with another year of record freshman enrollment. The Ogden College of Science and Engineering has added a new Biology and Engineering building with plans for a new science complex in the making. In the Department of Physics and Astronomy, we have added a few new faces to our team. Dr. Louis-Gregory Strolger joins us from the Space Telescope Science Institute working in astronomy. Dr. Brett Bolen, from the University of Mississippi, is working in physics with quantum gravity. The department is also looking to deliver physics and astronomy classes at the Glasgow campus, with the help of Doug Jenkins of Warren County High School.

As the fall semester continues to fly by, the department has been the center of many exciting things. Enjoy reading our latest edition of *Physics on the Hill*, and we hope that you will come and see what opportunities await you at Western.



Dr. Keith Andrew explains the finer points of the Schrodinger equation to his Modern Physics II class.

## Particle Accelerator

Sarah McMurray



Tim Morgan inspects the interior mechanics of Western's new particle accelerator.

After a year of planning and negotiating, the Applied Physics Institute's (API) new particle accelerator arrived May 15. The API plans to use the accelerator primarily for material analysis and elemental characterization, with possible applications in condensed matter and solid-state physics. Dr. Phillip Womble, director of the API, hopes to encourage cross-disciplinary studies in biological and geophysical areas as well.

"There's your time, my time, and Army time," said Dr. Womble, explaining why the accelerator was a year in arriving.

He first learned of the opportunity to obtain an accelerator in April 2004 from a colleague at Murray State, Dr. Pallone. The army research lab at the Aberdeen Proving Grounds, in Aberdeen, Md., had an accelerator that they had no more use for.

Dr. Womble discussed acquiring the accelerator from Dr. Andy Nilier, who would soon be retiring from the lab. Once Dr. Nilier found that no other army facility needed the accelerator and the components were not radioactive. He then wrote a letter to his superiors explaining why it would not be sold for scrap. This allowed Dr. Nilier to sign an agreement with WKU's Office of Sponsored Programs and the API.

The Army donated the accelerator to the API on the conditions that the API would pay the shipping, and not resell it. Shipping charges were \$2500, but Dr. Womble estimated that acquiring a new, comparable accelerator would cost in the neighborhood of \$1 million.

The Van de Graaff particle accelerator operates on two basic principles: like charges repel; and opposite charges attract. Positive charges are placed on a moving belt that carries them to the center of the accelerator. A huge resistor is used to keep the charges there, creating a potential of 2.5 million volts. Here, hydrogen or helium has an electron stripped away to create a positively charged ion.

In the midst of this huge positively charged area, the ion is sent repelling down an evacuated beam line, then guided and focused by magnets to a research area. At the research area would be a material, and a number of detectors. These detectors would detect the types of rays created and the scattering patterns.

This accelerator uses strictly gaseous sources. The primary sources are helium, hydrogen and deuterium. Therefore, protons and alpha particles will be most frequently accelerated. The alpha particles are able to travel at 3.6 percent the speed of light, while the protons are capable of traveling at 7 percent the speed of light.

Dr. Womble hopes to have the accelerator on line by the end of the spring term. Because the accelerator was built in 1979 and has not been used for 12 years, the API has found it difficult to move the accelerator to an operational status.

The field of acceleration physics has undergone a great deal of change in the past few years. As cutting edge accelerators get larger, many schools are either abandoning their accelerator programs or readjusting them for different purposes. The API's use their accelerator for material characterization gives WKU a distinct advantage. Other universities in the region that have accelerators are using them for different purposes such as medicine, cancer treatment and space research. Researchers in material characterization often do not have the opportunity to train on an accelerator. Students interested in the field will be given a distinct opportunity to learn how to use this valuable tool.



Tim Morgan reviews documentation for the Van de Graaff particle accelerator.



## Rocket Girl

Dr. Keith Andrew and Dr. David Barnaby

Over the last three years, high school senior, Kristen Donahue from Waterloo, Ill., has been working with WKU astronomy faculty member, Dr. David Barnaby, on various astronomy research projects.

Ms. Donahue's project, "First Measurements of Size and Surface Temperature for the Eclipsing Binary Star 1ES 1959+650#5", was completed in spring 2005 and won first place at the Illinois Science Fair. Ms. Donahue has won first place for two consecutive years and most recently won a trip to NASA's 2005 Space Academy.

Using images collected at the department's Bell Observa-



Dr. Barnaby and Kristen Donahue working together in the astronomy lab.

tory, Ms. Donahue constructed a detailed light curve for the short-period binary star. From the eclipses evident in the data, she was able to show that the component stars have nearly identical temperatures but are unequal in size. This proved that the system was of the W UMa class of contact binaries.

Ms. Donahue is now writing her results for an on-line journal. Last year, Ms. Donahue's project "Applying Newton's Laws: Measuring the Density of Saturn" also won first place at the Illinois Science Fair. Ms. Donahue has also received awards from the Office of Naval Research, the US Metric Association and an invitation to the National Science Fair in Washington D.C.

Now in her senior year, Ms. Donahue has her eyes set on analyzing an active galaxy, thereby contributing to one of the core projects pursued by WKU astronomers.

## Department Recognizes Retiring Faculty

Dr. Doug Harper

The Department of Physics and Astronomy would like to recognize Dr. Doug Humphrey and Mr. Clarence Wolff who retired at the end of the 2004-05 academic year. Together they provided over 75 years of dedicated service to students in our department.

Dr. Humphrey joined the faculty in 1965 after receiving his doctorate in physics from Ohio University in Athens, OH. He taught virtually every subject offered in the department at some time during his tenure on the faculty. His area of research expertise was experimental nuclear physics and he was a key contributor to the early success of the WKU Applied Physics Institute. Dr. Humphrey was a strong proponent of improving the laboratory experiences for our students. He was a principal investigator on a National Science Foundation grant that supported the modernization of the physics laboratories to their current state.

In recognition of his many years of service to the students of the department, the Society of Physics Students recently established a fund at the College Heights Foundation to support an annual award to be given in Dr. Humphrey's name. The award is given to the junior or senior physics major with the best record of service both within the Department of Physics and Astronomy and to science outreach in the community. Donations to this fund can be made through the College Heights Foundation.

Mr. Wolff joined the department in 1969 after receiving his master's degree in physics from Western Kentucky University in Math and Science Education. Mr. Wolff taught a variety of classes but he specialized in courses for future teachers. He was the supervisor for numerous student teachers. For many years, Mr. Wolff played a leading role in advising students in various science disciplines who desired to teach at the secondary level. Prior to joining the WKU Department of Physics and Astronomy, Mr. Wolff taught algebra, chemistry, general science and physics at Bowling Green High School (BGHS) in Bowling Green, Ky. During part of his time at BGHS he also served as head of the Science Department and assistant principal.



Dr. Humphrey (on the left) and Mr. Wolff at the Sigma Pi banquet in April 2005.

## New Kid on the Block

Dara Hardin



Dr. Louis-Gregory Strolger

Over the summer, the Physics and Astronomy Department added a new member to its team.

Dr. Louis-Gregory Strolger, a former researcher for the Space Telescope Science Institute in Baltimore, Md., was hired to bring his knowledge and enthusiasm to the department's physics and astronomy courses as well as to complement and expand the astronomy research in the department.

"Western's nice," Dr. Strolger said. "It's challenging to get organized to where I can do research and teach, but the students have been very eager to learn about astronomy." Dr. Strolger says his interest in space started at an early age and has only progressed over the years. Born in San Antonio, Texas,

he grew up in Reston, Va. Dr. Strolger said his parents played an important role for his interest in science. "My father was always technology driven," Dr. Strolger said, "and my mom always tried to keep that scientific interest in me." As a kid, Dr. Strolger visited the Smithsonian Air and Space Museum in Washington D.C., and attended summer camp at the U.S. Space and Rocket Center in Huntsville, Ala.

But Dr. Strolger has come a long way from his early experiments with metal objects and electrical sockets. He received his undergraduate degree in physics from Earlham College in Richmond, Ind., while playing nose guard for the football team. He continued his education at the University of Michigan by earning his masters and doctorate in astronomy.

At graduate school, Dr. Strolger worked as a teaching assistant for large, introductory level lecture courses and instructed a naked-eye astronomy class with a backyard approach.

"It was held inside a planetarium and allowed students to get a better concept of constellations," Dr. Strolger said.

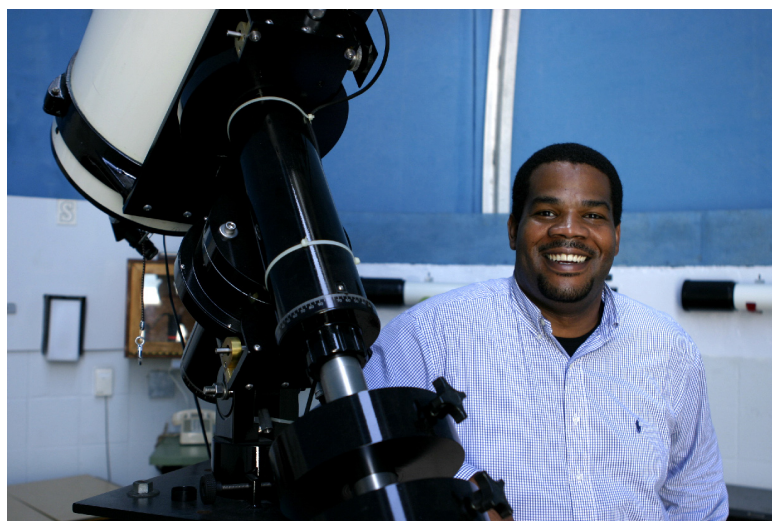
As Dr. Strolger continues to personalize his teaching methods at Western, he is also making plans to become involved with the Robotically Controlled Telescope (RCT). The RCT is an ongoing project to refurbish a research telescope in Arizona and automate its operation so it operates productively without a regular human presence. It is estimated to be completed within the next year. "The idea is to give the telescope a list of things to do at the beginning of the month and collect the data at the end of each night," Dr. Strolger said. "I'm looking forward to using it for supernova studies."

Dr. Strolger has dedicated much of his time and research to supernova studies, otherwise known as the study of exploding stars. Most recently, he submitted a paper to the international scientific journal, *Nature*, on the difference in gamma ray bursts and supernova environments.

"Another creature that goes bump in the night," he said, laughing.



Dr. Strolger instructs an introductory astronomy course.



Dr. Strolger, shown above at the TCCW Roof-Top Observatory, comes to WKU from the Space Telescope Science Institute.





## You're in the Spotlight



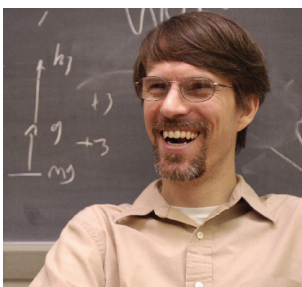
### Student Spotlight: Charles Poteet By Dr. Sergey Marchenko

Charles agreed to assist me in managing the large groups of students coming for the roof-top labs. He wasn't afraid to ask questions and some even put me in a mildly panicking state. Nevertheless, he turned out to be an enthusiastic, knowledgeable aide.

Time-to-time, I saw him working on images supplied by the remotely controlled telescope. I introduced him to a Wolf-Rayet star, and to my delight, he became interested in putting together data collected at various sites. Oh, how I needed a diligent, quick-learning assistant who would carry this neck-breaking burden of the seemingly endless row of images, and never bother me again before the job is done. And I found such an assistant. I loved his "get the job done no matter what" attitude! He started working on the extensive photometric data set in January 2004, and successfully finished the complete reduction cycle in May.

Closely supervising him in his first steps, I once again saw him as a mature, steady worker. His flexibility and steep learning curve allowed me to introduce him to a different project oriented on interpretation of the X-ray, optical and IR properties of pre-main-sequence stars in the star-forming region NGC 3603. This project demanded even higher commitment, substantially increasing complexity of the tasks and providing greater independence. Charles' dedication and enthusiasm fueled the rapid advancement of the project, allowing us to present preliminary results in a poster at the AAS meeting in San Diego, Calif. We are expanding our search and planning to publish final results in an article.

It seems likely that Charles will be a leading author... if he manages to find and efficiently commit enough time to the final stage of the research. If not... too bad, Charles. You have "wasted" the whole summer of 2005 by taking up that prestigious internship at the Penn State. Too bad!



### Teacher Spotlight: Dr. Bonham By Tim Morgan

Most people remember their "firsts" (first car, first kiss, etc.) and I not being any different, remember Dr. Bonham as my first physics research mentor.

He had the courage to take on such a novice to assist him in his physics education research (PER), examining the difference between homework essay responses submitted online versus paper. Much patience was shown on his part coaching me through the research process and developing the mentality to handle it all. With his methodical thought, we were successful in executing our experiment, analyzing the results and presenting our research at the summer 2003 American Association of Physics Teachers (AAPT) meeting. His constant encouragement as a mentor helped increase my interest in physics to continue my journey investigating it.

Though I changed research mentors, Dr. Bonham and I continued to help one another out. He encouraged me to explore my new avenue of research, which has brought me to my current interest, condensed matter physics. This happens to be the field in which Dr. Bonham received his doctorate. He later called on me to be a Physics Applets for Drawing (PAD) debugger and teaching assistant for College Physics I, while I asked for letters of recommendations for Research Experience for Undergraduates (REU). He was always there to help me in my pursuit to become a physicist. He later became my Modern Physics II instructor, where he showed his ability to instruct higher level physics. He put forth great effort in developing a class that would ensure the students would have an opportunity to gain a thorough understanding of the topic.

Dr. Bonham continues his PER, but his skill is not solely in improving physics education. He has displayed his prowess in developing students to become motivated, skilled pupils of physics.

## Latest News and Upcoming Events

### Student Research Achievements

#### Summer 2005 Research Experiences

Michael Holcomb: NASA Undergraduate Research Program at NASA Glen Research Center.

Tim Morgan, University of Arkansas, microEP REU.

Charles Poteet, Penn. State University.

Ryan Simpson, Marshall Space Flight Center.

Shelly Smith, WKU.

Richard Walters, WKU.

#### Sigma Xi Undergraduate Research Conference

Tim Morgan, "Triangulation of radioactive sources via WiFi-based radiation detectors".

Ryan Moore, "A tracking technology for security personnel and first responders".

Noel Simms, "MultiWavelength Light Curves of TeV Blazar MKN 421".

#### Awards won by Students

Charles Poteet, 2005 Randall Harper Award for Outstanding Research in Physics.

Derek Stice, 2005 Douglas Humphrey Award for Outstanding Service in Physics.

Sarah Witten, 2005 George V. Page Award for Excellence in Physics Scholarship.

Tim Morgan, best presentation of summer research during department colloquium series.

Tim Morgan, Second place in category for 2005 Sigma Xi Research Conference.

### 2006 Physics Olympics

The Department of Physics and Astronomy is inviting each high school in the region to send one or more teams of four to compete in the Western Kentucky Physics Olympics. This year's event will be held Saturday, February 25 from 8:30 a.m. until about 2:00 p.m. in the Thompson Center, Central Wing on WKU's Bowling Green campus.

The theme will be centered around "Star Wars". The event will consist of five different activities.

The competition will commence with two activities that involve competitors arriving at the event ready to compete with devices they have designed, constructed, and tested. The Do-Ahead Project is currently being titled "Hans Solo in Carbonite", and the Plan-Ahead Project is called "Evacuation of the Rebel Base". The Calculation / Communication Challenge, requiring two members of the team to make a series of measurements and the other two members to use that data to calculate the desired result is still being planned. The final two events - the On-the-Spot Activity, a mostly hands-on, impromptu challenge, and the Order-of-Magnitude Quiz, a brain teaser which asks contestants to quickly estimate answers for extreme situations - will remain cloaked in secrecy until those events actually begin.

Additional details about the 2006 event will be announced soon. Registration: <http://physics.wku.edu/olympics/>



### Department of Physics and Astronomy website:

<http://physics.wku.edu/>

**Society of Physics Students:** <http://sps.wku.edu/>

**Hilltopper Astronomy Club:** <http://has.wku.edu/>

#### New Tour of the Solar System

at Hardin Planetarium

#### Astronomy Public Viewing

at TCCW Roof-Top Observatory

#### Annual Undergraduate Symposium

Argonne National Laboratory

November 4<sup>th</sup> & 5<sup>th</sup>

#### Weekly Colloquia Series

Guest speakers in various areas of Physics and Astronomy  
(for more details visit <http://physics.wku.edu/>)



### Western Kentucky Physics Teachers Alliance

Fall 2005 Meeting  
Thursday, Nov. 10 at 5:30  
Greenwood High School  
(270) 842 - 3627  
contact: Catherine Poteet

The WKPTA is a gathering of people interested in physics teaching, including middle, high school and college teachers. We meet once a semester to share ideas, discuss concerns and further our own professional development. A light dinner will be provided courtesy of the WKU Department of Physics and Astronomy.

Keith Andrew recently attended a "Physics Tutorials" workshop led by physics education researcher, Lillian McDermott. Dr. Andrew will introduce a hands on activity for circuits capacitors and share research on typical student responses and learning results for electric circuits. Each participant will receive circuit kits that include batteries, lightbulbs and capacitors.