

The Leading Edge

Hoffman Environmental Research Institute

The mission of Hoffman Environmental Research Institute is to be a leader in basic and applied research that aims to better understand landscape/atmosphere/water/human interactions. The Institute involves post-doctoral, graduate, and undergraduate students in all aspects of this work to increase their critical thinking skills and technical expertise in the environmental discipline, and in combination with extensive international ties, to prepare these students for success in a global society.

Major programs:

The *China Environmental Health Project* develops US-Chinese academic partnerships to enhance the quality of public health in China by building sustainable capacity through the engagement of Chinese scientists, students, local governments, and citizens in hands-on training and community outreach. CEHP has provided training to more than 1,000 students, scientists, and government officials, and in 2009 we partnered with *A Child's Right* install 105 water treatment systems in six Chinese provinces, supplying pure water to more than 27,000 orphans and elderly residents of China's Social Welfare Institutes.

In its 30th year, the *Center for Cave and Karst Studies Karst Field Studies Program* offers specialized training in topics associated with the study and protection of caves and karst landscapes. We also regularly implement international technical workshops and conference sessions in karst water resource development and protection and joint research efforts under the auspices of the United Nations Educational, Scientific, and Cultural Organization UNESCO), recently in China, US, Barbados, Norway and Slovenia.

The *Crawford Hydrology Laboratory* specializes in groundwater flow investigations for both basic and applied research questions. Projects are underway for the National Park Service, Department of Agriculture, and the Department of Energy. In 2007-08, with the support of the US Agency for International Development, we designed, installed and trained staff for

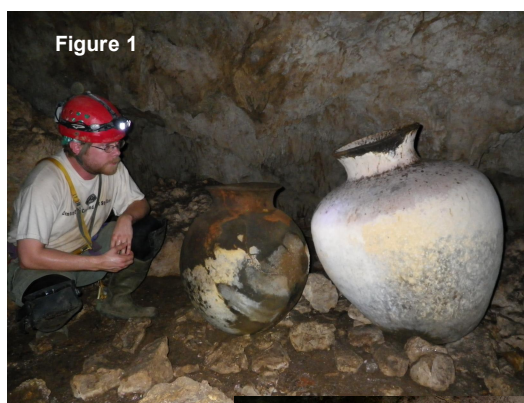


Figure 1: Hoffman graduate student Ben Miller examines ancient Mayan pottery discovered in a 2010 research expedition at Chichem Masin, Belize.

China's first state-of-the-art fluorescent dye groundwater tracing laboratory at Southwest University in Chongqing.



Figure 2: Stacy Antle programs an automatic water ampler to study agricultural impacts on groundwater quality in Crumps Cave, Kentucky.



Figure 3: WKU Semester at Sea group pauses for a photo at Cueva Ventana, Puerto Rico

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FEATURE
ARTICLE I

Institute for Astrophysics and Space Science

The Institute for Astrophysics and Space Science (IASS) was established as a center in the Applied Research and Technology program in 2001. Its mission is to engage undergraduate students in mentored research experiences in the areas of Astrophysics and Space Sciences and to help provide resources for students and faculty engaged in research in these areas. Through an extensive outreach program we engage the public and K-12 community in astronomy and space science.

The center consists of nine faculty, the Observatory Education Scientist and anywhere from 6-12 undergraduate students at a time, including students enrolled in the Gatton Academy of Math and Science. We have a 12.5 inch telescope located on the roof of TCCW, which is used for public viewing opportunities and laboratory activities associated with our undergraduate astronomy classes. Students and faculty have unlimited access to two research grade astronomical telescopes: the 0.6 meter telescope of WKU's Bell Observatory, located 12 miles southwest of campus, and the Robotically Controlled Telescope (RCT), a 1.3 meter autonomously operated telescope located at Kitt Peak National Observatory (KPNO) outside of Tucson, AZ. The RCT is operated by a consortium of Institutions, led by IASS faculty. In addition, WKU students and faculty have access to observing time on the 1.3 meter AZT-11 telescope of the Crimean Astrophysical Observatory (CRAO) in the Ukraine. A memorandum of understanding between the IASS and the CRAO is in place to provide us the access to this facility. IASS faculty operate the Hardin Planetarium, producing and presenting four-five Planetarium shows per year.

Students' who participate in our research activities are very successful in their post WKU careers. Three typical examples are Ms. Shelly Smith Baker, Dr. Wes Ryle and Mr. Kyle Cook. Ms. Baker graduated from WKU in 2006 and received a MS in Space Systems from Florida Institute of Technology in 2008. She is currently employed by the Boeing Company as an Integration Engineer at Kennedy Space Center. Dr. Wesley Ryle graduated from WKU in 2003 and went to Georgia State University where he received a PHD in Astronomy in 2008. Dr. Ryle is now and assistant professor at Thomas Moore College. Mr. Kyle Cook graduated from WKU in 2010. While at WKU, Kyle Cook received national recognition for his research at two annual meetings of the American Astronomical Society, receiving two Chambliss Astronomy Achievement Student Awards. He received an honorable mention in 2009 and was a medal winner in 2010. Kyle is currently a graduate student at Texas A & M University pursuing a PhD in Astronomy. At the time of this articles writing, he was at Las Campanas Observatory in Chile collecting data for his thesis.

Our outreach activities bring the wonders of astronomy to the general public and K-12 community. The Hardin Planetarium runs four shows during the academic year, impacting on average 10,000 K-12 students, WKU students and members of the general public a year. A summer show was run for the first time in June and July 2010, and was very successful, indicating a demand for year round activities at the Planetarium. Monthly public observing nights are hosted at the 12.5 in telescope on the roof of Thompson Central Complex Wing from September thru June. These have been popular and the demand is large enough that we will be providing two observing opportunities per month starting in September 2010. Institute faculty are organizers of the Physics and Astronomy Department's annual Physics Olympics competition, and we are major participants in the Science Olympiad State competition hosted at WKU each spring. We provide observatory tours and observing on a request basis for students enrolled in astronomy classes in Kentucky's community college system. Assistance is provided to local boy and girl scout troops in obtaining their astronomy badges. IASS faculty make multiple visits each year to K-12 classrooms across KY to aid teachers in teaching astronomy and physics related core-content items. The Observatory Education Scientists has assumed the leadership role for WKU's annual Girls in Science program. Over the years IASS faculty have run numerous professional development workshops for middle and high school teachers, supported via the National Science Foundation and NASA. IASS faculty worked closely with Gifted and Talented program staff in making the Gatton Academy of Science and Math a reality and they were instrumental in bringing the SKYTEach program to WKU. Our outreach efforts also have an international flavor: IASS faculty have been heavily involved in improving astronomy on the African continent and have been recognized for these efforts in a recent article in Science magazine (Science Vol. 327, p400).

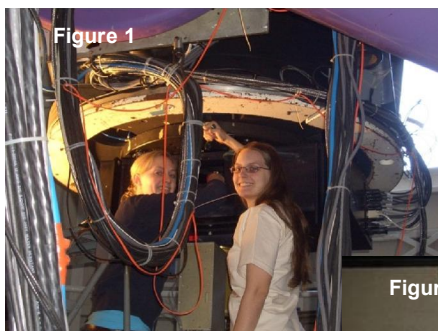


Figure 1: IASS students Schyler Wolf and April Pease working on the autoguiding system of the RCT 1.3m telescope.

Figure 2: Kyle Cook (Right) and Dr. Mike Carini (Left) in front of Kyle's poster at the AAS meeting.



Figure 3: Undergraduate students at the 12.5 telescope.

– Applied Research In The News –

IN 'THE NEWS' WESTERN KENTUCKY UNIVERSITY

Agriculture Research and Education Complex

Director:
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- Five graduate students and two undergraduate students were supported in their participation in summer field research.
- One graduate student and three undergraduate students were supported in participation in the national conference of the American Forage and Grassland Council in Springfield, MO. These students won second place in the national Forage Quiz Bowl competition.
- Support was provided for the annual Meats Tour in which the animal science faculty take graduate and undergraduate students to visit production operations, industry sites, policy makers and others involved in all aspects of animal husbandry.

Applied Physics Institute

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- Three graduate students and 8 undergraduate students participate in faculty guided summer research projects at API starting May 15.
- API student researcher Mayme van Meveren presented at the Student Conference of American Nuclear Society (Ann Arbor, MI, April 8). Her work is on computational studies of brachytherapy treatment for different radiation source distributions.
- API team led by Dr. Bruce Kessler presented work on experimental testing of the wavelet-based classification algorithm on KY Innovation and Entrepreneurship Conf. (KIEC 2010, April 6, Lexington, KY).
- Dr. Novikov participated in the 9th International Symposium on Technology and the Mine Problem which took place at Naval Postgraduate School, Monterey, CA.

Architectural and Manufacturing Science Institute

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- Three students employed this summer developing 8 design projects on the drawing board.
- Seven Architectural Design Projects under construction including a new Equine Facility at WKU Farm and a new Fire Station for Richlandville.
- AMSI is continuing to perform water jet services for WKU and local industries.
- Recent Graduate News – all were Interns for AMSI: + Bryant Hawkins will be attending Univ. of Illinois/Chicago to obtain his Masters of Architecture. + Terry Zink will be attending Univ. of Maryland to obtain his Masters of Architecture, he has been awarded a Graduate Assistantship. + Chris Harris, Eric Lahm and Matt Nett graduated in May from University of Kentucky with their Masters degree in Architecture and will be attending UCLA for post-grad study.

Center for Biodiversity Studies

Director:
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- WKU Biology graduate student Danielle Racke received the John D. Minton Graduate Student Award for Outstanding Contributions to WKU and was also recognized as the Outstanding Graduate Student in the Ogden College of Science and Engineering Student Awards Reception.
- Hillary Jones (Georgetown College) and Mark Callaghan (CSU-Monterey Bay), NSF REU undergraduate students studying at WKU during summer 2010, are working on insect systematics projects in the laboratory of Dr. Carl Dick and Dr. Keith Philips.
- WKU Biology graduate students Margaret Hook and Malgorzata Wisniewska, working in the laboratory of Dr. Bruce Schulte, initiated their MS research in June on elephant behavior in South Africa at Addo Elephant National Park.
- WKU Biology graduate student Mary Penick presented on her Green River algae research in April at the Upper Green River Aquatic Fauna Symposium at Campbellsville (KY) University and in June at the North American Benthological Society meeting in Santa Fe, New Mexico

Biotechnology Center

Director:
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- Drs. Shivendra Sahi and Rodney King were the lead PI's for a NSF-REU (Research Experiences for Undergraduates) that brought nine undergraduates from institutions around the country to WKU in May 2010. Several of these students are considering transferring to WKU because of their successful experience.
- Dr. Chandrakanth Emani had an article published in The American Biology Teacher entitled, "DNA Story". The article describes an instructional tool to inculcate the scientific thought process in the classroom.
- Undergraduate Biotechnology student Khushbuben Patel is conducting research in the laboratory of Dr. Jonathon Whetstone at Harvard University this summer on epigenetics.
- Undergraduate Biotechnology student Bonnie McCullagh is conducting research in the laboratory of Dr. Jeffrey Marcus at the University of Manitoba this summer on the genetic control of color pattern formation in butterflies.
- The Biology Department hired Dr. Jarrett Johnson as a tenure-track assistant professor in Genetics, and Dr. Ajay Srivastava as a tenure-track assistant professor in Developmental Biology. Both will join the Biotechnology Center this fall.

Bioinformatics & Information Science Center

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- Eight WKU posters were presented at the UT-ORNL-KBRIN Bioinformatics Summit held at Lake Barkley State Resort Park, Kentucky March 19 – 21, 2010. The proceedings and poster abstracts were published at BMC Bioinformatics Vol. 11 Suppl. 4 accessible at <http://www.biomedcentral.com/1471-2105/11?issue=S4>
- Two Mycobacterium bacteriophages, Wizard and Backyardigan, were sequenced and fully annotated by the Genome Discovery and Exploration class of 14 students during the Spring 2010 semester. Brittany Howard presented the results of the genome annotations in a talk presented at the National Genomics Research Initiative Second Annual Symposium at Howard Hughes' Janiella Farm Research Campus, Asburn, Virginia, June 12-13, 2010. The two annotated bacteriophage genomes have been submitted for review and will be published in the NCBI GenBank.
- Dr. Sigrid Jacobshagen (Biology), Dr. Bruce Kessler (Math), Mike Young (Ogden College Instrument Shop), Claire Rinehart (Biology), and Biology graduate students Christa Gaskill and Jennifer Forbes-Stovall published a paper: "Improved automated monitoring and new analysis algorithm for circadian phototaxis rhythms in Chlamydomonas." In Jean-Claude Kader (Ed.), Plant Physiology and Biochemistry 48: 239-246. Amsterdam: Elsevier.

Center for Water Resource Studies

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- During the quarter, the CWRS began a project for the National Institute for Hometown Security on best practice protocols for response and recovery operations in contaminated water systems.
- Dr. Andrew Ernest, Jana Fattic and Alanna Storey, CWRS employees, gave oral presentations at the American Society for Engineering Education annual conference in Louisville, June 21-23.

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**Engineering
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- Conference presentations: Harlow, Choate, Lenoir, Wilson, Cambron at ASEE Conf., Louisville, June; Byrne at Forest Products Soc. Intnl. Conv., Madison, June; Harlow, Choate, Lenoir at ASEE Southeast Region Conf., Blacksburg, April.
- EE Senior Projects: Logan Aluminum PLC Trainer, Heath Co. automated test equipment, Xhale automated test equipment, development of Amphibulator, R.W. Beck power line sensor, WRECC substation feasibility study.
- ME Senior Projects completed: Logan Aluminum PLC controlled calibration system, Logan filter paper system, Des-Case oil filtration and air filtration test systems, WKU EPF CNC mill upgrade.
- CE Seniors attended ASCE regional competition, April in Lexington with 12 schools, competing in concrete canoe (finished 2nd), steel bridge, concrete bowling, surveying and other events.
- ME Juniors participated at ASME Student Design Comp., St. Louis, April. Four WKU teams competed, finishing third and fourth of 22 schools.
- CE/EE/ME student team competed in NASA Lunabotics Comp., Kennedy Space Center, May, 3rd place of 22 schools.

**Institute for Combustion Science
and Environmental Technology**

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- For past year, the Anhui University of Science and Technology (AUST) -ICSET team has focused on the installation of a pilot-scale reactor system (6 KW) at the Anhui Huainan Chemical Plant. This pilot scale set up was completed at the end of March, 2010. The first batch of ammonium bicarbonate was produced in the week of June 21, 2010. This pilot scale can handle 1000 m³ /h of flue gas, CO₂ removal efficiency can achieve over 80%, and approximately around 110 m³ /h of CO₂ (CO₂ concentration is calculated at 13% in flue gas) was captured and converted to ammonium bicarbonate fertilizer around 270 kg/h. This unit will be one of the largest pilot scale to capture CO₂ using NH₃ in China. The total cost to build this unit is more than 1.5 million RMB (US\$224,000) and includes financial support from Huainan Chemical Plant, Huainan City Government, Ministry of Science and Technology (MOST) in Beijing and USAID.
- Chengli Wu has received his Ph.D. degree from AUST on June 12, 2010 under the supervision of Dr. Yan Cao at ICSET.

**Hoffman Environmental
Research Institute**

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- Jason Polk and Leslie North, along with 10 other faculty and students, studied karst hydrology and geomorphology on 10 Caribbean islands during the Semester at Sea program.
- The Hoffman Institute and WKU School of Journalism presented Hidden Waters, Dragons of the Deep: The Freshwater Crisis in China's Karst Regions, including a presentation about the Institute's water resource development efforts in China, along with a photo gallery exhibit by photojournalist J. Carl Ganter.
- Jason Polk and graduate student Ben Miller travelled to Belize to collect geologic samples to examine dynamics of environmental change related to collapse of the Mayan civilization.
- Dr. Vu Nguyet, visiting the Hoffman Institute this year from Vietnam's Institute of Geosciences and Mineral Resources, worked with Institute Director Chris Groves to complete geochemical modeling efforts to understand groundwater hydrochemistry at the WKU's Cave Spring Caverns Educational Preserve.

**Kentucky
Climate Center**

Director:

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- The Kentucky Mesonet reached a milestone with the addition of its 50th operational station. The site in McCreary County is in partnership with the U. S. Forest Service.
- The Kentucky Climate Center made an invited presentation on the Kentucky Mesonet at the board of directors meeting of the Center for Renewable Energy Research and Environmental Stewardship at the University of Louisville.
- Astrid Gonzalez, an undergraduate research assistant with the Kentucky Climate Center, recently accepted a fellowship to pursue a M. S. in Meteorology at Penn State University. Jane Marie Wix and Danny Gant, also undergraduate research assistants, gained full-time employment with the National Weather Service.
- Faculty and associates of the Kentucky Climate Center published research articles in the Bulletin of the American Meteorological Society and the Journal of Hydrologic Engineering.

**Institute for Astrophysics
and Space Science**

Director:

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- The 2010 KY Science Olympiad final for middle and high school students, was held at WKU with a third run by IASS faculty and students, including rockets, NASA research and circuit building events.
- Several senior IASS undergraduate students were awarded grants to undertake research during the summer, both at WKU and national institutes.
- Evenings for VAMPY and Governor's Scholars students highlighting both the research paths and career opportunities at WKU, were held over the summer.
- IASS members took students at the Simpson County annual 4th grade Science Fair through the highly popular 'Scale model of the Solar System' activity.
- Multiple college students toured WKU's astronomical facilities as part of the requirements for online Astronomy courses run by colleges throughout the state.
- The Hardin Planetarium premiered a special summer show 'The Amazing Night Sky' presented by IASS member, Dr. Rachel Campbell.

**Advanced Materials
Institute**

Director:

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- Aaron J. Celestian (Dept of Geography and Geology) has been appointed as the new director of the AMI starting July 1, 2010.
- Pauline Hack has been hired as the new Laboratory Manager of the AMI.
- Seven WKU chemistry majors and their mentor, Prof. Eric Conte, have returned from performing research in the Chemical Engineering Department at the National Chung Hsing University in Taiwan, where Prof. Conte has collaborators. Research projects include studies on the preparation of clay and dendrimer modified synthetic membranes and the application of these materials for chemical adsorption and electroanalytical chemistry. Funds for this trip were paid through a National Science Foundation, Office of International Science and Engineering grant.