



Middle School Astronomy

Dr. Debra Burris of the Department of Physics and Astronomy made two school visits to foster interest in the sciences at the middle school level. The first visit was to Penny Laymon's 6th grade gifted and talented class at Atkins Middle School where she helped the students to make moon clocks. Moon clocks allow students to know where the moon is in the sky at any time of the day or night once given its phase. Dr. Burris plans to use this group as *(continued)*



Energized Food Webs

Sally Entrekin was awarded \$5,000 by the University Research Council to study how microbial production fuels aquatic food webs. She will use the money to purchase a Hach minisonde to incorporate microbial production into her current research program. The minisondes represent the newest technology for quantifying changes in dissolved oxygen in aquatic environments. Undergraduate and graduate students will be trained to use the sonde and calculate microbial production metrics at large spatial scales following large-scale alterations.

Energy and nutrients from heterotrophic (bacteria and fungi) and autotrophic (algae) microbes fuel aquatic food webs. Consumers, such as bugs and fish could not survive without microbes; it is therefore, critical that researchers know how productive these organisms are in a given area. Unfortunately, microbial production is difficult to measure at large spatial scales because individuals are small. However, new technology has made it possible to measure microbial production at greater spatial scales (e.g., >100m²). Production and consumption of oxygen provide estimates for the amount of energy and nutrients available to the aquatic community. Microbial production *(continued)*

Save the Date!

Planetarium Public Show
Tuesday, Feb. 1
 7:00 – 8:00 p.m.

Advisor Alert
 Final Date to Make Degree Application for May Graduation
Friday, Feb. 11

Chalk Talks
Tuesday, Feb. 15
 X-period
 Laney 103

Observatory Public Show
Tuesday, Feb. 15
 7:00 – 9:00 p.m.

Bear Facts Day
Friday, Feb. 18

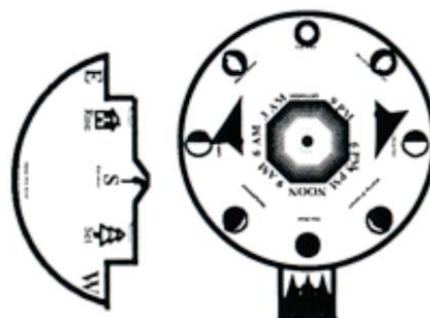


(Energized Food Webs continued) changes when aquatic habitats are altered (e.g., restored, managed, or degraded), indicating changes in energy and nutrient availability to invertebrates and fish.

It is both time consuming and expensive to quantify changes in bug and fish production. Therefore, many studies are using microbial production as a metric to evaluate restoration success or alterations in food webs from anthropogenic disturbance in streams and wetlands.

Hach minisonde deployed in an Alaskan wetland. Changes in dissolved oxygen will be used to estimate microbial production that will inform a broader food web study.

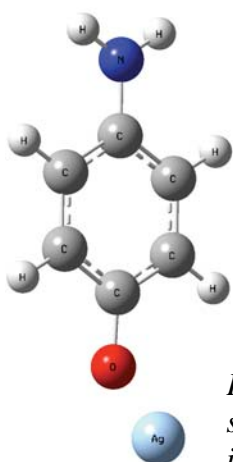
(Middle School Astronomy continued) student leaders when she returns to visit with all of the Atkins 6th grade classes in February. Her second visit was to Wheatley Middle School. Here she worked with the 7th grade classes on the importance of the physical sciences in daily life and with the 8th grade classes on galaxies. School visits give students a unique, hands-on opportunity to experience science with a professional scientist; it also provides them with information about educational and career opportunities in the sciences. For Dr. Burris, “These visits are important to me because these kids need to see that you can be true to your ‘roots’ by being an avid hunter, fisherman, or small farmer, but still pursue an advanced degree and an exciting career in the sciences.”



Nano-Scale Chemistry Publication

“Characterization of Aminophenol Isomer Adsorption on Silver Nanostructures” Perry, D.A.; Cordova, J.S.; Smith, L.G.; Son, H.J.; Biris, A.S. *Vibrational Spectroscopy*, **2011**, 55, 77-84.

Surface-enhanced infrared absorption (SEIRA), temperature-programmed desorption, and density functional theory (DFT) calculations were used to explore the adsorption of aminophenol isomers on vacuum deposited silver films and nanoscale silver powder. Salts of the aminophenolate ions were synthesized to aid in experimental interpretation. It was shown that the presence of the silver nanostructures induced extra hydrogen-bonding interactions in aminophenol layers and catalyzed



new photochemistry of the aminophenol layers upon extended exposure to visible light. This work is expected to have a significant impact in a range of environmental, biochemical, and industrial applications where phenol chemistry is important.

Picture of the DFT optimized structure of the 4-aminophenolate ion interacting with a silver ion.

Clint Smith Presents Chemistry Seminar

On January 20, 2011, Clint Smith presented the first presentation in the Chemistry Departmental Seminar Series of spring semester of 2011. Clint is a UCA chemistry graduate who did research with Dr. Melissa Kelley while at UCA. He is currently a Ph.D. candidate at the University of Kentucky College of Medicine. He presented his work "Regulation of membrane fusion by Viral F protein membrane interacting domains." Prior to the seminar, a free pizza lunch was held for students interested in speaking to Clint about his work or his graduate experience.



Physics Student receives research award

Asami Nishikawa, Senior Physics and Mathematics major, received the Acoustical Society of America's Robert W. Young Award for Undergraduate Student Research in November 2010. The award is competitive with only two students being recognized each year. Ms. Nishikawa's research project is with Dr. William Slaton in the Physics Department and is entitled, "Aeroacoustic Source Strength Measurement of Helmholtz Resonators." The award comes with \$500 which will be used to equip her experiment for computer data acquisition.



Invitations & Presentations

Dr. Danny Arrigo, Associate Professor of Mathematics, accepted the invitation to join the editorial board of the ISRN Mathematical Analysis Journal.

Dr. Clarence Burg, Assistant Professor of Mathematics, gave a presentation on *Computational Mathematics and Subaqueous Debris Flows* in the Department of Mathematics at the Hendrix College on October 19, 2010.

Advanced Microscopy Day for Elementary School Teachers

Twenty-three elementary school teachers from 12 school districts attended a one-day workshop titled "Advanced Microscopy". This activity is part of the Arkansas Science and Technology Authority (ASTA) grant, "Microscopic World". Dr. Uma Garimella is the project director. The workshop was held in Lewis Science Center from 8:30 AM to 3:30 PM with a thirty-minute lunch break. During the morning session, Mr. Jerry Mimms discussed the basics of the Scanning Electron Microscope (SEM) operation, and allowed the teachers to prepare and examine samples. The participants received high-quality images of the samples on a CD to share with their students. In the afternoon session, Dr. Kari Naylor reviewed the capabilities and light path/theory of the Confocal Microscope. During her presentation Dr. Naylor discussed the use of Confocal Microscope in various UCA research projects and allowed teachers to visualize samples under the Confocal Microscope. The group investigated careers, scientists and historical breakthroughs in the field of microscopy.



This workshop addresses the mission of the College of Natural Sciences and Mathematics (CNSM) to introduce high school students and educators to UCA's advanced technologies.



Highlights

October 28, 2010 – MCST 220

Tsung Yen Chen is a junior chemistry major working in the laboratory of Dr. Don Perry in the Department of Chemistry. Tsung Yen described his studies of the interaction of halobenzoic acid molecules with silver nanoparticle surfaces. The silver surfaces enhance the infrared absorption by these molecules, enabling the layers they form to be probed experimentally. Tsung Yen

prepared layers of two different molecules (iodo- and fluorobenzoic acid), deposited from solutions of carbon tetrachloride and heptane onto the silver surfaces. Infrared measurements showed that the benzoic acid molecules were dissociated into their ionic form when in direct contact with the silver surface. These measurements characterized layers of molecules deposited onto the silver and found that successive layers incorporated solvent molecules through halogen-solvent attractive forces. These measurements are among the first to provide evidence for the halogen-halogen interaction in such samples.

Ryan Parker is a senior chemistry major currently work with Dr. Cameron Dorey in the Chemistry Department. He discussed his summer research project at NCTR performed in collaboration with Dr. Dorey. Ryan worked to develop a faster open air method of mass spectroscopy analysis of molecules, with the goal of using the method to rapidly screen samples for specific bacteria by detecting molecular markers emitted by the bacteria. The method Ryan helped develop (DICI, direct impact chemical ionization) used a stream of heated helium atoms, some of which became ionized, to vaporize and ionize marker molecules from bacterial samples inserted into the hot helium stream. He noted that this first design overheated and scorched the

bacterial samples. Subsequent modifications added a protective glass sheath around the bacterial samples (reducing ambient oxygen interference and scorching) and a modified helium heating/ionization source.

Natasha Skiver is a senior biology major working with Dr. J. D. Swanson in the Department of Biology. Natasha pointed out that her work was a promising new outgrowth of Dr. Swanson's research that traditionally involves genetic origins of cell differentiation leading to prickly development in the genus *rubis* (blackberries, raspberries). She explained that a compound called gallic acid is common to these plants and that this compound was a potential anticancer therapeutic. To investigate this possibility, she worked during the summer at NCTR screening variable doses of gallic acid for their cell killing potential against different cancer cell lines.

November 16, 2010 – LSC 100

Philip Cook is a senior chemistry major and Tristan Phillips is an environmental science major working under the direction of Dr. Rick Tarkka in the Department of Chemistry. Philip and Tristan have been working for over a year to establish a clean and efficient synthetic method for anchoring so-called "scorpionate" ligands to solid supports (scorpionate ligands are pincer-like molecular anchors for metal ions). They described very promising preliminary results using a microwave synthesizer to prepare samples of scorpionates in a fraction of the time traditionally required and in higher yields than had been previously reported. Their methods have never before been reported for this widely used ligand class. The utility of their approach should significantly impact the preparation of many existing and new scorpionates, and among these should be ligands well-suited for attachment to solid supports. (*continued*)

(Chalk Talk Highlights continued)

Christopher Kline is a senior computer science major working with Dr. Yu Sun in the Department of Computer Science. Christopher described his work to develop an improved rate control algorithm for video compression. He explained the importance and the challenge of developing effective rate control algorithms for the newest video compression standard - H.264/SVC. His work with Dr. Sun involved the proposed use of an adaptive initial encoding parameter selection for H.264/SVC rate control. He described their research progress that has produced considerable performance improvements in bit-rate regulation and video coding quality when compared with the rate control algorithm adopted by H.264/SVC compression standard.

Kendall Fancher is a sophomore biology/chemistry major who has been working with Dr. Taylor for about a year in the Department of Chemistry. Kendall's work involves a series of experiments conducted on gas-phase ions and molecules in which he is investigating the energy associated with the reaction of gaseous nickel ions (Ni^+) with halogenated methane molecules. Kendall described his use of a technique called electronic state chromatography that allows him to separate his Ni^+

into ground state (lower) and excited state (higher energy) groupings. This separation allows him to select one state over the other and see which of these two states reacts with various halogenated molecules. He is able to identify the products of these reactions by their specific masses (using mass spectrometry and isotope patterns). By correlating the known energies of the two states of Ni^+ with the energies required to produce specific product, Kendall's work should describe some of the specific aspects of the reaction mechanism of Ni^+ with these molecules. Such results help describe fundamental reactive properties of these molecules which can be useful in condensed-phase catalytic processes as well as atmospheric reactions.

Luke Irvin is a senior computer science major. He has worked as a software developer at Clarovista, LLC, a new media agency in Conway, Arkansas. Luke described how he applied his knowledge learned in Computer Science at UCA on developing Apps for the iPhone and iPad. He demonstrated some of the basic routines common to traditional Apps. He also outlined the logic necessary to assemble these routines into a simple App, providing a simple but effective example of the organization involved in these tools so common to modern hand-held electronics.

AP Saturday Prep Session Held on UCA Campus

Approximately 250 high school students from Conway, Greenbrier and Russellville came to the UCA campus to attend the Advanced Placement (AP) Preparatory Sessions. The AP sessions were sponsored by grant from the Arkansas Advanced Initiative for Math and Science Inc. (AAIMS). **AAIMS is a UALR-based program** designed to implement the National Math and Science Initiative. It is a non-profit corporation that works with Arkansas schools and the private sector to maximize the number of students passing AP mathematics, science, and English exams by planning, implementing, and offering incentive programs. Exxon Mobil Corp., the primary supporter of the grant, committed \$125 million to the project. The Walton Family Foundation of Bentonville has provided a \$2.9 million grant to help AAIMS match the ExxonMobil grant.



Two Saturday Prep sessions have already been hosted by UCA. 126 students attended the first session that was held on November 22, 2010 in Lewis Science Center for AP Biology, AP Chemistry and AP Physics courses. The second session was held on January 22, 2011 in the Department of Mathematics and *(continued)*

(*AP Prep Session continued*) approximately 120 high school students attended the sessions in AP Calculus, AP Statistics and AP Computer Science. Both sessions were held from 8:30 AM to 2:00 PM with a thirty-minute lunch break. Drs. Lance Bridges, Pat Desrochers, Marc Hirrel, and Uma Garimella, provided lecture/demonstration sessions for the students and presented a positive public face for UCA's science/math programs to these desirable prospective students.

These events at UCA were coordinated by Dr. Umadevi Garimella, Director of ACMSE at UCA. The Office of Admissions provided the food and door prizes which was coordinated by its director, Dr. Penny Hatfield. Other members who assisted with the success of the program are, Ms. Debbie Bilyeu, Director of AAIMS Science program, Ms. Jean Pharr, Math Content Director, both from UALR, and Ms. Jenna Erbach Williams, a national award winning mathematics teacher at Greenbrier High School.

UCA Astronomical Facilities Spring 2011 Schedule

Observatory

The primary telescope of the UCA Observatory is a Meade 14-inch aperture LX200R GPS telescope. The observatory is used for faculty and student research projects and public observing nights.

The UCA observatory is located on the UCA campus, in the Lewis Science Center (stairs located in front lobby). Longitude = 92 degrees 27 minutes West, Latitude = 35 degrees 5 minutes North

The observatory is open to the public the third Tuesday night of the month (if the sky is clear) for approximately two hours after dark.

Spring 2011 Observatory Schedule:

Tuesday, February 15 from 7 - 9 p.m.

Tuesday, March 15 from 8 - 10 p.m.

Tuesday, April 19 from 9 -11 p.m.

Planetarium

The UCA Planetarium simulates the sky visible to the naked-eye onto a 30-foot diameter dome using a Spitz 512 projector. The seating capacity is 60. The facility is used for astronomy classes and

laboratories, field-trip shows, and monthly public shows.

The UCA planetarium is located on the UCA campus, in the Lewis Science Center, 010 (downstairs).

Field trip shows are available free to public school groups on Thursdays at 10:00 or 11:00 a.m. Reservations are required and can be requested by calling 501-450-5900.

Monthly public shows are usually the first Tuesday of the month at 7:00 p.m. Shows include a tour of the evening sky for the given month, updates on astronomical events, and flights through the universe. Admission is free. Seating limited to 60 people on a first come first serve basis. Shows are not recommended for children under 5 years. No admittance once the show has begun.

Spring 2011 Planetarium Public Shows:

Tuesday, February 1 from 7 - 8 p.m.

Tuesday, March 1 at 7 - 8 p.m.

Tuesday, April 5 at 7 - 8 p.m.

Tuesday, May 3 at 7 - 8 p.m.

Celebrate Darwin's Birthday!

February 7-10, 2011

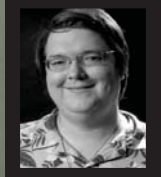
Lewis Science Center Lobby

Week of Darwin's Birthday

- Mon, Feb. 7** Nova "Evolution" program: Darwin's Dangerous Idea, Great Transformations, and Extinction (showing from 10:00-2:00 pm)
- Tues, Feb 8** Nova "Evolution" program: The Evolutionary Arms Race, Why Sex?, The Mind's Big Bang, and What About God? (showing from 10:00-2:00 pm)
- Wed, Feb 9** Flock of Dodos film (showing from 10:00-12:00 pm)
Inherit the Wind film (showing from 12:00-2:00 pm)

Birthday Celebration: Thursday, February 10

- 9:00-3:00 am** Exhibit, food and giveaways in LSC lobby
Nova Evolution series LSC Lobby
- 9:25-10:25 am** Dr. Ben Waggoner LSC 102 Assistant Professor, UCA "Darwin and His Barnacles"
- 11:15 am** Free birthday cake and food in LSC lobby
- 12:15-1:30 pm** Dr. Jason Wiles Speaker LSC 102 Assistant Professor, Syracuse University "Seeing the Light of Evolution: An Arkansan's Journey Toward Understanding and Acceptance of Biological Change"



Research Interests:

Education research in the Life and Earth sciences with special attention to teaching and learning about biological evolution, science education at all academic levels



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