

UNDERGRADUATE RESEARCH Highlights

Carson, J Carson, Thalmann, C, Janson, M, Kozakis, T, Bonnefoy, M., Biller, B, Schlieder, J, Currie, T, McElwain, M, Goto, M, Henning, T, Brandner, W, Feldt, M, Kandori, R, Kuzuhara, M, Stevens, L, Wong, P, Gainey, K, + 38 authors. Direct Imaging Discovery of a “Super-Jupiter” Around the Late B-Type Star Kappa Andromedae. *Astrophysical Journal Letters*. 2013; 763: 32. (College of Charleston, Max Planck Institute for Astronomy, + 12 institutions)

This manuscript describes the direct imaging discovery of a ‘Super-Jupiter’ around the nearby, high mass star Kappa Andromedae. With an orbital semimajor axis about twice that of Neptune, and a mass about 12.8 Jupiter masses, the discovery represents one of only a handful of extrasolar planets ever directly imaged, and the only such case around a star so massive. The discovery suggests that stars as massive as 2.5 solar masses are still fully capable of producing planets within their primordial circumstellar disks. Joe Carson is an assistant professor of physics & astronomy at the College of Charleston. Undergraduate authors Thea Kozakis, Laura Stevens, Palmer Wong, and Kevin Gainey, all astrophysics majors, participated in the investigation for summer research, senior thesis research, and independent study, from 2011 to 2012. The research was supported by a grant from the National Science Foundation (awarded to Carson) and the College of Charleston SURF program (awarded to Kozakis).

Retzler A, Wilson MA, Avni Y. Chondrichthyans from the Menuha Formation (Late Cretaceous: Santonian–Early Campanian) of the Makhtesh Ramon region, southern Israel. *Cretaceous Research*. 2013; 40:1: 81–89. (The College of Wooster)

This study examined chondrichthyan teeth from exposures of the Menuha Formation (Santonian–Early Campanian, Mount Scopus Group) in the Makhtesh Ramon region of the southern Negev. The isolated teeth represent at least ten different species: eight sharks and two other fish. This assemblage has important implications for Late Cretaceous chondrichthyan palaeobiogeography and the structural origin of the Ramon region. The majority of teeth were contained within a glauconite-rich, yellow-brown, soft chalk that included oysters, trace fossils, phosphatic peloids, and

foraminiferans. The Menuha Formation probably represents a temperate to subtropical, shallow, open-shelf environment deposited during the formation of the Ramon anticline. Mark A. Wilson is a professor of Geology at The College of Wooster; Yoav Avni is a geologist with the Geological Survey of Israel. Andrew Retzler completed this work in 2011 as his Independent Study project at The College of Wooster. He is currently a graduate student at Idaho State University. The fieldwork was supported through the Wengerd and Luce Funds of The College of Wooster. The Geological Survey of Israel also contributed field vehicles and library resources.

Marunde MA, Samarajewa DA, Anderson JA, Li S, Hand SC, Menze MA Improved tolerance to salt and water stress in *Drosophila melanogaster* cells conferred by late embryogenesis abundant protein. *Journal of Insect Physiology*. 2013; 59: 377-386. (Eastern Illinois University)

Some animals in nature possess a mechanism to survive severe water loss through the expression of highly hydrophilic proteins. These proteins are named LEA proteins and are thought to interact with membranes and proteins in order to protect and maintain cellular functions during drying and rehydration. Cells from the fruit fly *Drosophila melanogaster* cells were genetically engineered to express a specific mitochondrial targeted LEA protein from the brine shrimp *Artemia franciscana* (AfLEA1.3). Expression of AfLEA1.3 significantly reduced the negative effects of freezing and osmotic stress on fly cells and mitochondria. Our study demonstrates that AfLEA1.3 exerts a protective influence on mitochondrial functions and increased the viability of *D. melanogaster* cells in several water stress models. Dr. Michael Menze is an Assistant Professor of Biology at Eastern Illinois University. Matthew Marunde is an undergraduate student at Eastern Illinois University majoring in Biology with a minor in chemistry. He conducted most of his research in 2011 and 2012, especially in the summers of 2011 and 2012. Matthew’s future goal is continue his education at medical school. Eastern Illinois University Honors College URSCA grants, Eastern Illinois University Council on Faculty Research grants, National Science Foundation IOS-0920254.

Klosterboer B, Hartmann-Mahmud L. 'Difficult to Repair': Applying African Models of Transitional Justice to Peace and Restoration Prospects in the Democratic Republic of the Congo. *African Conflict and Peacebuilding Review*. 2013; 1:3: 56-82. (Centre College)

This paper highlights the limits of applying macro-level peace and reconciliation strategies to the Congolese situation and asserts that political, economic, and social cleavages at the local level continue to fuel national instability. The study draws on African experiences of transitional justice in Sierra Leone and Rwanda to offer specific lessons on how institutions at multiple levels of analysis can work together to foster peace and accountability. Lori Hartmann-Mahmud is the Hower associate professor of international studies Brian Klosterboer is the primary author of this article. He conducted the research throughout the year 2011-12 for his senior thesis project with support from the John C. Young scholars program at Centre College. Brian is currently in Uganda on a Fulbright Research Grant, studying the relationship between the media and peace-building. The John C. Young program supports senior research for a small number of highly qualified students (usually 6-10 per year), of which Brian was one in 2011-12.

Lin X, Brooks J, Bronson M, Ngu-Schwemlein M. Evaluation of the association of mercury(II) with some dicysteiny l tripeptides. *Bioorganic Chemistry*. 2012; 44: 8-18. (Winston-Salem State University)

The present study was undertaken to gain insight into the associations of mercury(II) with dicysteiny l tripeptides. We investigated the effects of increasing the distance between cysteiny l residues on mercury(II) associations and complex formations. The results from this study show that dicysteiny l tripeptides are effective in binding mercury(II) and they are promising motifs for the design of multi-cysteiny l peptides for binding more than one mercury(II) ion per peptide. Maria Ngu-Schwemlein is a professor of chemistry. Jeremy Brooks is currently working as a chemistry at Kelly Scientific Resources. Matthew Bronson is a graduating senior. This research was supported by the NSF RUI Grant CHE 1011859, and the NIH NIGMS SC3 Grant SC3GM088134. J.B. and M.B. acknowledge support from the NSF HBCU-Undergraduate Program.

Byrne DP, Donner MJ, Sibley TQ. Groups of Graphs of Groups. *Contributions to Algebra and Geometry*. 2013; 54:1: 323-332. (St. John's University)

This paper completely classifies the group of color preserving automorphisms for the graph of any finite group. These complete edge colored graphs, related to Cayley digraphs, generalize to algebraic structures besides groups. Tom Sibley is a professor of mathematics. David Byrne and Matt Donner did their research for their honors theses their senior year (2010-2011). David is in a doctoral program in mathematics at Bowling Green State University. After volunteering abroad, Matt is applying to doctoral programs in mathematics. We received an NSF grant through CURM, the Center for Undergraduate Research in Mathematics.

Chartas, G, Kochanek, C S, Dai, X, Moore, D, Mosquera, A M, and Blackburned, J A Revealing the Structure of an Accretion Disk through Energy-dependent X-Ray Microlensing. *Astrophysical Journal*. 2012; 757:137. (College of Charleston)

We presented results from monitoring observations of the gravitationally lensed quasar RX J1131-1231 performed with the Chandra X-Ray Observatory. We detected significant microlensing in the X-ray light curves of the lensed images of the quasar. Our microlensing results place constraints on the sizes of the black holes accretion disk and the hot corona. We also reported the detection of evolution of the fluorescent Fe line that originates from the accretion disk during the microlensing event. This evolution is consistent with the line distortion expected when a caustic passes over the inner disk where the shape of the fluorescent Fe line is distorted by general relativistic and Doppler effects. George Chartas is an assistant professor of physics and astronomy at the College of Charleston. Drew Moore, an astrophysics major, participated in the research for independent study credit during his sophomore and junior years. Drew Moore is currently a senior astrophysics major at the College of Charleston. The research was supported by NASA via the Smithsonian Institution Grants SAO GO0-11121A/B/C/D, SAO GO1-12139A/B/C, and GO2-13132A/B/C.

Galván VV, Vessal RS, Golley MT. The Effects of Cell Phone Conversations on the Attention and Memory of Bystanders. *PLOS ONE*. 2013; 8:3. (University of San Diego)

In this study, participants either overheard a one-sided (cell phone) conversation or a typical (two-sided) conversation. Participants only overheard the conversation one time and were unaware that the conversation was part of the study. Results revealed that participants who overheard the one-sided conversation found the conversation more distracting and annoying. They also remembered more words from the conversation and were more confident in some of their answers on a surprise memory test. This is the first study to use a 'naturalistic' situation to show that overhearing a cell phone conversation is a uniquely intrusive and memorable event. Veronica V. Galván is an assistant professor in the department of Psychological Sciences. Rosa S. Vessal is a senior psychology major and volunteered as a research assistant. Matthew T. Golley conducted this study as a senior psychology student for credit through his home university, D'Youville College. Mat is currently a graduate student in clinical psychology at Palo Alto University. This research was funded by a Faculty Research Grant.

Lindquist NC, Johnson TW, Jose J, Otto LM, and Oh S-H. Ultrasmooth metallic films with buried nanostructures for reflection-mode plasmonic biosensing. *Annalen der Physik*. 2012; 524: 687-696. (University of Minnesota)

A new sensor with gold nano-structures buried underneath ultrasmooth gold surfaces was developed for surface plasmon resonance (SPR) biosensing. Unlike other SPR biosensors, this device allowed the use of opaque or highly scattering liquids as well as spectral tunability and wide-field imaging. Beyond biosensing, these buried nanostructures with ultrasmooth surfaces can benefit nano-photonics waveguides, surface-enhanced spectroscopy, nano-lithography, and optical trapping for biological research. The work was featured as a backside cover article. Nathan Lindquist is an assistant professor of physics at Bethel University and Sang-Hyun Oh is an associate professor of Electrical Engineering at the University of Minnesota. Lauren Otto began work on this project during the summer of 2011 as an REU student and is currently supported by a PhD fellowship at the University of Minnesota. The research was supported by a National

Nanotechnology Infrastructure Network (NNIN) REU that was awarded to Lauren.

Flowers PA, Blake DA. Submicroliter Electrochemistry and Spectroelectrochemistry Using Standard Electrodes and a Polymer Electrolyte Salt Bridge. *Analytical Chemistry*. 2013; 85:6: 3059–3063. (University of North Carolina at Pembroke)

The development of spectroscopic and electrochemical devices that can accommodate very small samples is of considerable importance to many areas of science and technology. This article describes the design and characteristics of a simple apparatus for the electrochemical and spectroelectrochemical analysis of submicroliter aqueous samples. Excellent performance has been demonstrated via measurements on aqueous ferricyanide solutions using sample volumes as low as 20 nL. Paul Flowers is a professor of chemistry. David Blake is an undergraduate student majoring in chemistry. He assisted Flowers in conducting the published work during the summer of 2012 with support from an Undergraduate Scholar Assistantship provided by the Pembroke Undergraduate Research and Creativity Center. Blake is currently applying to graduate programs.