

UMSL *Physicist*

Department of Physics & Astronomy

<http://www.umsl.edu/~physics>

November 2006

NOTE FROM CHAIR

Unlike years past, I enjoyed attending the annual Chancellor's State of the University Address. I encourage you to take a look at the presentation by Chancellor George: <http://www.umsl.edu/chancellor/speeches/speeches.htm>. He has made tremendous advances for the campus in terms of increasing the number of faculty, increasing the number of scholarships, and increasing the funding to the campus. You may have noticed the new building off Interstate-70 at Florissant Road. It is the corporate headquarters for Express Scripts and the first tenant for the UMSL Business, Technology, and Research Park. This fall, the campus opened a new residence hall on the south campus that gives us a 1400 student on-campus capacity.

Things are upbeat for the Department as well. For the third straight year, we have added a new faculty member. After a two year search, Dr. Jingyue Liu has accepted the Directorship for the Center for Molecular Electronics. Dr. Liu is a distinguished scientist and also a full professor in Physics & Astronomy. We are excited about the new research directions he will bring the Center. While we were sorry to hear of Dr. Ta-Pei Cheng's plans to retire in spring 2007, a search is underway for his replacement. After teaching geology courses at UMSL for the past 30 years, Mike Fix has been reappointed as a full-time lecturer. We also welcomed Dr. Vassiliy Tsytsarev's appointment as a Research Assistant Professor.

The research activity in Physics & Astronomy has taken an upturn with the addition of new faculty. Dr. Sonya Bahar was awarded a five-year CAREER grant from the National Science Foundation and Dr. Erika Gibb received grants from the National Science Foundation, NASA, and the Missouri Research Board. In March, Dr. Bahar assumed Directorship for the Center for Neurodynamics, replacing Dr. Frank Moss who founded the Center in 1996. Our research programs have been highlighted locally at the Annual Meeting of the American Association for the Advancement of Science in St. Louis, the 15th Annual Meeting of the NASA/Missouri Space Grant Consortium, and UMSL's Undergraduate Research Symposium. We expect to advance further both graduate and undergraduate

research through the new UMSL Chapter of Sigma Xi, which was officially installed in September.

One of the most satisfying events of the past year for me was the Annual Alumni Awards Luncheon in May. In addition to our guest speaker, Dr. Marty Mlynczak, a record number of alumni attended the luncheon and afternoon talk. They were also witness to the numerous awards given to deserving physics students made possible through the generous contributions of our alumni.

Bruce A. Wilking, Chairperson

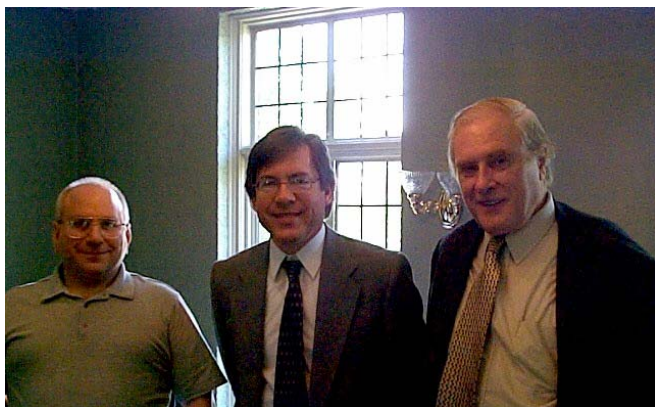


Dr. Jingyue Liu

New Director of the Center for Molecular Electronics

After an exhaustive national search, Dr. Jingyue (Jimmy) Liu has been named as the Director for the Center for Molecular Electronics as of September 1. Dr. George Gokel was named as Associate Director. Dr. Liu is also a Professor in both the Department of Physics & Astronomy and in Chemistry & Biochemistry. Dr. Liu received his Ph.D. in Condensed Matter Physics from Arizona State University in 1990, working with the late John M. Cowley. Previous to his appointment as Director, Dr. Liu had been at Monsanto Company since 1994. In 2002, he received the Monsanto Edgar M. Queeny Award for breakthroughs in the

development of nanocatalysts that significantly reduced the cost of manufacturing Monsanto products. Most recently, he was a Senior Science Fellow at Monsanto and Manager in Proteomics, Metabolomics & Subcellular Biology. Dr. Liu is a distinguished scientist, with over 150 publications in refereed journals, books, and conference proceedings, three patents, and numerous disclosures. He had already several collaborations with UMSL faculty and was an adjunct professor in our Department. We are very pleased to welcome him as a member of our Department and look forward to working closely with the Center.



Alumni Maurice Pierce and Dr. Marty Mlynczak, with Dr. Peter Handel

Dr. Marty Mlynczak Delivers Alumni Lecture

The annual Physics & Astronomy Alumni Awards luncheon was held on May 5, 2006 at the Alumni House. Dr. Marty Mlynczak (B.S. 1981) was the guest of honor along with Dr. Lu Fei (M.S. 1991, Ph.D. 1996). Dr. Mlynczak, Dr. Fei, and Dr. Lucy He (M.S. 1991, Ph.D. 1994) received the Department's Distinguished Alumni Awards. Dr. Mlynczak is an atmospheric scientist at NASA Langley Research Center in Virginia. Dr. Fei is an Associate Fellow at MEMC Electronic Materials in St. Peters, MO and Dr. He is a Senior Systems Administrator at Maritz, Inc. The luncheon was well attended with a record number of alumni present. Graduating seniors Ryan Cleaver and Dion Mauer shared the Jeffrey Earl Award and each received a set of the Feynman Lectures. Will Lowes received the Senior Alumni Award (\$500). Eric Pulley was awarded the first annual Richard D. Schwartz Scholarship in Physics which provides a junior physics major \$1500 annually. Will Lowes, Christopher Jost, Michelle Brockschmidt, and Meredith Ordway are recipients of the Physics & Astronomy Alumni Scholarships that provide \$1000 for the academic year. Graduating seniors Ryan Cleaver, Earl Gadel, Dion Mauer, and Gordon Stangler were also recognized. Nathan Dees received the Outstanding Graduate Teaching Assistant Award which is a \$100 prize and a one-year subscription to the American Journal of Physics. Following the luncheon, we were treated to an excellent talk by Dr. Mlynczak entitled "Adventures with the first law from Earth's surface to the edge of space". It is thanks to your generosity that these awards and scholarships are possible.



Jeffrey Earl Award winner Ryan Cleaver, Dr. Bruce Wilking, and Senior Alumni Award winner Will Lowes

Windows on Physics: Year 2

After a successful launch in 2005, physics majors new to the Department are getting to know the faculty and their fellow students in the course "Windows on Physics". Students meet once a week to learn about the physics curriculum, advising, financial aid, careers, and faculty research interests. This year, the course has been expanded to include presentations on careers in industry. The course

has an enrollment of 12 freshmen and transfer students, is being organized by Drs. Sonya Bahar and Erika Gibb.

Observatory on the Move

The arrival of Express Scripts to the UMSL campus has had a domino effect that will require the Richard D. Schwartz Observatory to find a new campus location. The Observatory was constructed in 1981 on its current south campus site. After reviewing possible sites, site testing was conducted by undergraduate Earl Gadel. A location on the north campus near the Fine Arts Building is the front-runner and we are exploring design modifications that would make the new site ADA accessible and allow for shielding of nearby lights. We would also like to add a concrete pad outside of the Observatory for our portable C-8 telescopes. The move would likely take place in summer 2007.

Undergraduate Josh Tartar and Bruce Wilking were co-authors on a paper by Luisa Ostorero (Landessternwarte, Heidelberg) of monitoring the variability of the blazer S5 0716+71. The data were taken at the Richard D. Schwartz in November 2003. The paper, entitled "Testing the Inverse-Compton Catastrophe Scenario in the Intra-day Variable Blazer S5 0716+71" appeared in the February 2006 issue of *Astronomy & Astrophysics*.

UMSL has Sigma Xi Chapter

In a ceremony held on September 25 in the Millennium Student Center, the UMSL Chapter of Sigma Xi was officially installed. Sigma Xi is a national organization for the advancement of science that offers grants and scholarships for students and publishes the *American Scientist*. The Chapter President is Dr. Patty Parker (Biology), the Vice-President is Dr. Bruce Wilking (Physics & Astronomy), and the Secretary/Treasurer is Dr. Hal Harris (Chemistry & Biochemistry). In attendance from the Department were long-time member Dr. Bob Henson, Chancellor Tom George, Kari van Brunt, and Bruce Wilking, and new student members Dan Blake, David Peaslee, and David Coss. The installation was performed by Sigma Xi president Dr. James Baur who gave an interesting talk "Fish Guts, Mink Fat, and Yak Wool". Members in attendance signed the Chapter Charter.

The UMSL chapter is planning some future events for chapter members and Sigma Xi members in the St. Louis area. If you would like more information or would like to join our chapter, please contact Bruce Wilking.



Kari van Brunt signs the Sigma Xi book of charter members while Dr. Henson and Dr. Harris look on.

Undergraduate Research Symposia

The Department of Physics & Astronomy was again well represented at the annual Undergraduate Research Symposium held on the UM-St. Louis campus on April 28 and hosted by the Golden Key International Honour Society and the College of Arts & Sciences. Poster presentations were made by physics majors Justin Braden, Bob Collins, Dale Downs, Melissa Pastorius, Mitch Pillarick, and Gordon Stangler (advisors Drs. Mary Leopold, Frank Moss, Erika Gibb, and Sonya Bahar, respectively). Tim Volkert made an oral presentation (advisor: Dr. Phil Fraundorf).

On April 4, Dale Downs traveled to Jefferson City to join undergraduate researchers from the University of Missouri-St. Louis at Undergraduate Research Day at the Missouri State Capitol. He presented a poster "Formation of brown dwarfs: A bridge between planets and stars".

UMSL Hosts 15th Annual Meeting of the NASA/Missouri Space Grant Consortium

UMSL was host to the statewide meeting of the NASA/Missouri Space Grant Consortium on April 21-22. Research talks were given by graduate fellows Eric Mandell and Kari van Brunt and by undergraduate research students Earl Gadel and Tim Volkert. Undergraduates David Peaslee and Michelle Brockschmidt gave a summary of our Fifth Grade Astronomy Outreach program at the UMSL planetarium. For the first year, there was a panel discussion with alumni from the program working in industry. UMSL alumni David Dawkins (B.S. 1995, M.S. 1997) and David Findley (B.S. 1996), both employed by AT&T, served on the panel. The banquet was held Friday evening and Dr.

Erika Gibb gave an outstanding review of comet research entitled "Comets in the New Millennium".

Observers and astronomers at Kitt Peak National Observatory.

Graduate Program Update

We welcomed several new students to our graduate program this year. Prabhavim Premachandra is entering the Ph.D. program after receiving a physics degree from the University of Peradeniya in Sri Lanka. Lauren Fallert, Douglas Brumm, and Bob Collins entered the M.S. program after receiving their physics degrees in Dec. 2005 from UMC, UMSL, and UMSL, respectively. We are pleased to welcome another physics student from the University of Stuttgart, Holger Euchner. Holger plans to complete a Master's degree in physics during this academic year. UMSL graduate student Isaac Smith is completing the coursework for his M.S. degree at the University of Stuttgart this year.

Current graduate student Jorge Brea (advisor: Dr. Moss) won an UMSL Graduate School Dissertation Fellowship (\$14,000) for 2006. Eric Mandell is receiving a graduate fellowship (\$15,000) from the NASA/Missouri Space Grant Consortium. Oliver Weihberger (M.S. 2005, advisor: Dr. Bahar) tied for second place in the campus competition for Outstanding Master's Thesis.

Four students, Dan Hopper, Tim Mason, Anthony Giordano, and Martin Rose, completed Masters' degrees. Anthony wrote a Master's thesis entitled "Investigation of a Novel Optoelectronic Oscillator Topology" (advisor: Dr. Handel) and Martin wrote a Master thesis entitled "Spacing Measurements of Lattice Fringes in HRTEM Images Using Digital Darkfield Decomposition" (advisor: Dr. Fraundorf). Ph.D. student Minh Truong successfully defended his dissertation in April. Minh was advised by Dr. Ta-Pei Cheng and his dissertation was entitled "Superfield Calculation of Loop Contribution in Extra Dimensional Theories".

Our third joint meeting with the Physics Department from UM-Rolla is scheduled for Friday, March 2, 2007 on the UMSL campus. There will be oral and poster presentations of research by the graduate students and the Vice Presidents' Lecture will be delivered by astrophysicist Dr. Robert Mathieu from the University of Wisconsin.

Richard D. Schwartz Observatory: West

There is now a second Richard D. Schwartz Observatory. On September 24, Dick dedicated his new observatory in Washington State with the help of friends and astronomers from the University of Washington. Dick also directed the construction of the UMSL observatory in 1981 which now bears his name. His new observatory houses a 16-inch Meade telescope equipped with an SBIG ST-8XME CCD camera. This system, combined with his darker site, is 2.5 to 3 times more sensitive than the UMSL system. Dick has already been involved in acquiring data of NGC 6811 for a campaign by the American Association of Variable Star



Dick Schwartz with his new observatory. (Picture courtesy of Ta-Pei Cheng)

Physics Club News

In 2006, the Physics Club has been very active. In April for Mirthday, the Physics Club had a booth in which we had demonstrations with liquid nitrogen and also centripetal acceleration. This semester we had dinner at Pujols' Restaurant. Physics Club also had a potluck which was very successful with over twenty students, faculty, and alumni in attendance. In December, we are participating in a service project in which we will help out a local food pantry called Operation Food Search. For Halloween, there was a "Halloween Surprise" in which candy was handed out by the Physics Club officers to junior, senior, and graduate level classes. We also plan on going to the City Museum in December along with many other activities planned for next semester.

If you have any questions please contact us by email at UMSL_physics@yahoo.com or our advisor Dr. Mary Leopold (leopoldm@umsl.edu).

Contributors 2005-2006

Mr. Scott D. Alspach and Ms. Susan Altman-Alspach
Dr. and Mrs. Nasser Arshadi
Mr. and Mrs. Timothy J. Bancroft
Dr. Joseph F. Baugh
Dr. Bradley Becker
The Boeing Company
Mr. and Mrs. Mark Bretz
Mr. and Mrs. Todd C. Bryant
Mr. Michael J. Burk and Ms. Lynda E. Busse
Mr. Cory S. Cook
Mr. and Mrs. Daniel M. Doerer
Mr. Deryl L. Earsom and Ms. Frances J. Brown
Dr. Lu Fei and Dr. Lucy Wenzhong He

Dr. and Mrs. Bernard J. Feldman
Mr. and Mrs. Wayne P. Garver
Dr. and Mrs. James A. Guffey
Mr. and Mrs. William B. Harms Sr.
Mr. David J. Harris and Ms. Margaret A. Diekemper
Mr. William P. Hartnett
Hershey Foods Corporation
Mr. Richard W. Heuermann and Ms. Kathleen P. Price
Mr. and Mrs. Charles F. Jones
Mr. David A. Kalin
Mr. and Mrs. Mark E. Kushina
Laclede Gas Charitable Trust
Mr. Joe Lee
Mr. and Mrs. Steven L. Lopata
Maritz Inc.
Mr. Richard J. Melka
Dr. and Mrs. Martin G. Mlynczak
Mr. and Mrs. Christopher M. Morris
Mr. Thomas J. Mroczkowski
The Progressive Insurance Foundation
Mr. James M. Roedder
Dr. Elenore A. Schewe
Dr. and Mrs. Chang Shen
Dr. James C. Simpson
Mr. and Mrs. Edward J. Streit
Mr. and Mrs. Duane A. Theilen
Mr. and Mrs. Howard W. Thoele
Drs. Bruce A. and Janet B. Wilking
Mr. Robert Wilking

Note: Please contact us if you made a contribution to the Department from July 1, 2005–November 10, 2006 and your name does not appear. Many thanks to all of you!

Service Milestones

Several faculty and staff were recognized for their service to the University. At a luncheon at the Performing Arts Center this November, Dr. Bob Henson was honored for his 40th year at the University and Dr. Frank Moss for his 35th year. Hired in 1966, Dr. Henson received the Governor's Award for his outstanding teaching and was UMSL's nominee for the Presidential Award for Teaching Excellence in 2000. At the installation of the UMSL Chapter of Sigma Xi, Dr. Henson transferred his membership from Washington University where he had been a [Sigma Xi](#) member for 45 years. Dr. Moss came to UMSL in 1971. He founded the Center for Neurodynamics in 1996 and served as its Director until this year. Dr. Moss received the Senior Humboldt Prize in 1999 and was named as a Curators' Professor in 2000 in recognition of his distinguished research career.

At the Staff Appreciation reception in April, Wayne Garver was recognized for his 25th year of service, all with the Department of Physics & Astronomy. Alice Canavan was also acknowledged for her 15th year of service (7 with Physics & Astronomy). In addition, Alice was named the UMSL Riverstars Employee of the Month for the month November, 2005 for her "Excellent Teamwork". For their

service accomplishments, Wayne elected to receive a pair of earrings and Alice a men's watch!

Check Out our Web Page!

You can look at the Department Web page to find our schedule of colloquia, journal clubs, and Observatory Open Houses. In addition, you can view the pictures in this Newsletter in color. Check it out at and join us at Department events!

<http://www.umsl.edu/~physics>

The Faculty:

Sonya Bahar

My research concerns neural synchronization in pathological processes and information processing, as well as general problems of collective dynamical behavior in biological systems.

A major current area of study involves synchronization of neural firing during epileptic seizures. The role of synchronization in seizure development can be studied with computational models of coupled neurons or oscillators, and also with experimental imaging of epileptic events. We image seizure onset in the rodent neocortex using a combination of various techniques, including the intrinsic optical signal (a drop in light reflectance that correlates with an increase in electrophysiological activity), calcium sensitive dyes, and voltage sensitive dyes. A central problem is to investigate changes in spatiotemporal synchronization, and other measures of spatial organization, during the course of seizure onset, development, and offset, and to try to understand the underlying dynamics driving this process.

Other projects involve magnetoencephalographic (MEG) imaging of the human brain, in collaboration with Dr. Richard Bucholz and Dr. Jayant Acharya at Saint Louis University Hospital, comparison of EEG and fMRI methodologies (collaboration with Dr. Linda Larson-Prior and colleagues at Washington University), and the study of eye movement synchronization in traumatic brain injured patients (collaboration with Dr. Minah Suh and colleagues at the Brain Trauma Foundation and Weill-Cornell Medical College of Cornell University).

Finally, as part of an NSF CAREER grant, I am running an outreach program to introduce local high school students to interdisciplinary science.

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Ta-Pei Cheng

Officially I will retire at the end of this academic year (9/1/2007). But I will still be around, teaching a course or two in the next few years. I am also writing a new particle physics book, as well as gathering material for a revised edition of my general relativity and cosmology book.

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Bernard J. Feldman

My professional activities in the last four years have been primarily involved in developing new educational materials for introductory physics courses. These include: "What to Say About the Tacoma Narrows Bridge to Your Introductory Physics Class," [The Physics Teacher 41, 92-96 (2003)]; "A Physicist's View of the Automobile Engine," [The Physics Teacher, 42, 543-547 (2004)], "The Nimitz Freeway Collapse," [The Physics Teacher 42, 400-402 (2004)], "Hydrogen Fuel Cell Automobiles" [The Physics Teacher 43, 492-495 (2005)] and "Origin of Bird Flight: A Physics Viewpoint," [The Physics Teacher 44, 351-353 (2006)].

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Michael Fix

My research deals with Missouri's only known dinosaur site – the Chronister Site about 30 miles west of Cape Girardeau. I have been working with a group affiliated with the Bollinger County Museum of Natural History, in Marble Hill, Missouri. This group, called the "Missouri Ozark Dinosaur Project (MODEP)," is conducting the first truly scientific excavation of the site, which was accidentally discovered in the early 1940's. The dig is enclosed within a 20 by 36 foot greenhouse in order to keep water out. Inside there is a 60 square meter hanging grid which is used in conjunction with a portable one meter mapping grid with an XY axis sliding cursor equipped with a laser pointer for precision mapping of fossils. Thus far we have found numerous bones of a hadrosaur (duck-bill dinosaur) called *Hypsiroma missouriense* (our official state dinosaur), including a partial skull of a juvenile, which according to Dr. John Horner is probably the most complete dinosaur cranial material ever found in the eastern U.S. The site has also yielded fossils from a member of the tyrannosaur family, a possible tooth from a relative of velociraptor, as well as numerous fossils of turtle, crocodile, fishes, and amphibians. We are working on a paper about these finds with Dr. David Parris from the New Jersey State Museum and Dr. Barbara Grandstaff at the University of Pennsylvania, which is intended for publication in the "Journal of Vertebrate Paleontology."

Ricardo A. Flores

My research interests are astrophysical cosmology and applications of quantum field theory to the physics of elementary particles. Cosmology is now a well established branch of science thanks in great part to the astounding diversification of Astronomy in the last three decades into observations covering a very broad range of the electromagnetic spectrum. It is also a very exciting field of research due to its inherent intellectual appeal, and the rapid progress allowed by a steady flow of observational data. I am currently working on analyses of large samples of dark matter halos from cosmological simulations to work out

their expected properties in the concordance Cold Dark Matter cosmology with dark energy, which is currently favored by a large body of observational evidence. My most recent work has been on the systematics of the shape of DM halos (<http://xxx.lanl.gov/abs/astro-ph/0508497>), and comparisons to observations to test these predictions (<http://xxx.lanl.gov/abs/astro-ph/0508226>). Other relatively recent work has been on clusters of galaxies (see ApJ 532(2000)206 and ApJ 538(2000)92) and gravitational lensing (see ApJ 533(2000)194 and ApJ 535(2000)555). My work has been funded by the National Science Foundation, the University of Missouri System Research Board, and by Research Awards here at UM - St. Louis. Over the years, I have collaborated on a long-term basis with scientists from around the world to carry out my research. Most recently: Joel Primack @ UCSC (Santa Cruz, USA), and Hernan Quintana @ Universidad Catolica (Santiago, Chile).

Philip B. Fraundorf

My research involves materials, atomic resolution microscopes, computer simulations, and conceptual strategies for doing both nanoscale detective work and curriculum modernization. For over a decade we've been providing for the region tools not otherwise available in state to examine the nanostructure of a growing variety of specimen types, including for example aerosol catalysts, integrated circuit silicon, carbon nanotubes, extraterrestrial materials, and ferrofluids for drug delivery. We've also put graduates into applied physics internships and jobs with companies that include MEMC, Seagate, Martin-Marietta, Mitsubishi Silicon-America, and Motorola. Of three recent intellectual challenges, one lies at the intersection between single-walled carbon nanostructures in the history of our own atoms, and possible roles for carbon droplets in cool stellar atmospheres. Another involves the study of defects in and on gigascale integrated circuit silicon, a highly-ordered material tightly connected to future technology. A third involves the study of atomic-resolution images using wavelet-versions of long-established optical darkfield techniques. More on recent developments, information on the recently established Missouri NanoAlliance, and a variety of web-based nanoworld adventures, may be accessed through:

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Thomas George

I am involved in theoretical research in several areas of laser/materials physics. One area involves molecular clusters, where excitation processes in fullerenes by ultrafast laser pulses are being investigated theoretically by numerically solving the Liouville equation for electron density matrices. Comparisons are then carried out with experiments in regard to the control of vibrational excitations. Another area is nonlinear optical processes, where a theory of quantum control of short-wavelength sum-frequency generation, which employs continuum states, has been developed. Nonlinear interference processes in a

multi-level ladder-type quantum system are being considered, along with the coupling of several strong laser fields with adjacent bound-bound (discrete) and bound-free (continuous) transitions in the continuous wave regime, accounting for relaxation of coherence. Also, quantum switching and amplification without inversion controlled by two optical fields are being examined in connection with (1) solids doped by rare earths and (2) atomic and molecular vapors. A third area involves ultrafast laser-driven materials processing, where femtosecond laser pulses are used in a theoretical analysis of microprocessing of metals, semiconductors and dielectrics. Here, a two-temperature model (energy coupling between electronic and phonon subsystems), the role of Demer effects, and ballistic transport are being considered. Step melting of crystalline and amorphous lead foils due to irradiation by ultraviolet laser pulses are being examined experimentally by optical microscopy-densitometry and atomic force microscopy methods. A fourth very recent area of research deals with laser-induced explosion of gold nanoparticles and their potential role for nanophotothermolysis of cancer. Finally, as a side project just for fun, Newtonian mechanics is being applied to help resolve the controversy of two opposite theories explaining the origin of vertebrate flight: (1) running and leaping into flight ("ground-up theory") and (2) gliding to flight ("tree-down theory").

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Erika Gibb

I am an astrochemist, studying chemistry in star formation regions and comets. One of the most exciting areas of astrobiological research is the search for organic molecules of prebiotic importance in disks and envelopes of gas and dust around low mass young stars that are thought to be similar to the young solar system. I use infrared spectroscopy to detect molecules and infer the quantity, temperature, and location of each molecule. The observations are usually performed at major telescopes like the 10-meter Keck Observatory and the 3-meter Infrared Telescope Facility on Mauna Kea, HI or the 8-meter Gemini South Observatory in Chile. I also collaborate with a research group at NASA Goddard Space Flight center to measure abundances of those same molecules in comets, which are thought to have been a source of much of the early Earth's reserve of organics and water. We recently participated in the worldwide campaign to observe comet Tempel 1 from ground based telescopes during the Deep Impact mission (published in Science, volume 310). In this way, I hope to track the organic chemistry through the star and planet formation process and to be able to infer the role that comets may have played on delivery of organics and water necessary for life on Earth.

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Peter H. Handel

I have found the origin of the fundamental 1/f fluctuations present in most high-tech devices and systems ("Coherent and Conventional Quantum 1/f Effect", Physica Status Solidi b 194, 393 (1996)), including computer chips, infrared detectors, quartz resonators, atomic and laser clocks, submicron electronic devices, FET and HBT transistors, laser gyros, SQUID magnetometers, etc. ("Fundamental Quantum 1/f Noise in Small Semiconductor Devices", IEEE Trans. on Electr. Devices, 41, 2023 (1994)). I am using this new effect to optimize these devices ("Incoherence and Negative Entropy in the Quantum 1/f Effect of BAW and SAW Quartz Resonators", Proc. Frequency Control Symp., Orlando, FL, May 1997, pp. 464-69) for the Department of Defense and for civilian applications, such as ultra-low power computers. This research is supported by the Office of Naval Research and by the Air Force Office of Scientific Research. Having also found the origin of Atmospheric Electricity ("Polarization Catastrophe Theory of Cloud Electricity", J. of Geophys. Research 90, 5857 (1985)), I use the new law for weather modification and protection against lightning and ball lightning (Handel et al. "Development of the Maser-Caviton Ball Lightning Theory", J. of Geophys. Research 99, 10689 (1994)). In nonlinear Plasma Physics with solitonic MASER interactions, I am developing (Zhil'tsov et. al. "Spatially Localized Microwave Discharge in the Atmosphere", Zh. Eksp. Teor. Fiz. 108,1966 (1995) & JETP 81, 1072 (1995)) a new type of electric discharge and artificial ball lightning. Finally, I am applying my quantum 1/f formulas to optimize our chemical and bacteriological sensors. I was included into DoD's Ultra-Low Phase Noise MURI #17, together with the University of California, Caltech and Yale University in May 2001. The goal of this new 5-year grant is a new generation of electronic devices and radars. See my web site at www.umsl.edu/~handel/.
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Bob L. Henson

Currently, my activities in the Department are mostly in the areas of instruction at the graduate and undergraduate levels plus service in the curriculum area. This has been the typical case for me for several years now. However, I am still active in theoretical research, but at a very reduced level of activity. My main scholarly activity now is writing a text at the senior-graduate level on the topic of atmospheric physics. I am approaching this by writing up and expanding my class notes for Physics 4354 (Atmospheric Physics), which I have taught several times over the past thirty years.

Mary Jane Kernan

My primary activities in the Department are related to physics education. I supervise the undergraduate labs, and I've been teaching the undergraduate Quantum Mechanics course for the past two years. I'm also the webmaster for the department. We're currently making substantial revisions to the website, so I would welcome your input with comments or suggestions.

Wayne Garver and I are continuing our collaboration on an internet lab course for Electricity and Magnetism. We've completed the hardware devices and are awaiting word from the NSF on our grant proposal for implementing the course. Several of our undergraduate and graduate students as well as an REU student from SIU-E have contributed to the project, and we're hoping for funding so we can support additional students.

My research area is condensed matter-I use nuclear magnetic resonance (NMR) to characterize the structural, electronic, and optical properties of photovoltaic materials. The various types of hydrogen present in amorphous semiconductors have unique NMR signatures - the NMR signal gives us insight into the fundamental nature of the semiconductors. Thanks to the generosity of Professor Larsen in the Chemistry Department, I now have a 13MHz pulsed NMR spectrometer, which we hope to retrofit for our Advanced Lab course.

Jacob J. Leventhal

With Charlie Burkhardt, I have written a textbook *Topics in Atomic Physics*. The book has been published by Springer in October. *Topics in Atomic Physics* provides a foundation for students to begin research in modern atomic physics. It can also serve as a reference because it contains material that is not easily located in other sources. A distinguishing feature is the thorough exposition of the quantum mechanical hydrogen atom using both the traditional formulation and an alternative treatment not usually found in textbooks. The book is intended for graduate students who have had introductory quantum mechanics, but undergraduates who have had such a course can also benefit from it. There are more than eighty problems at the ends of chapters with all answers given. A detailed solutions manual, in some cases giving more than one solution, is available to instructors.

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Jingyue "Jimmy" Liu

My research focuses on two platforms: 1) nanoparticles and nanoparticle systems and 2) advanced nanocharacterization techniques. Nanoparticles are defined very broadly here: metal and alloy clusters for catalysis, semiconductor quantum dots for bio-labeling or as biomarkers, oxide nanocrystals as sensor components, as well as proteins, viruses and other nanoscale components of biological systems. Nanoparticle systems include catalysts, displays, nanocomposites, nanosensors, etc. Advanced nanocharacterization techniques include high-resolution microscopy, novel X-ray scattering/diffraction techniques, as well as a variety of spectroscopy and in situ techniques for characterization of nanoscale materials and devices; the goal of this research platform is to develop quantitative and statistically meaningful nanostructural characterization techniques, which is one of the grand challenges in nanoscience and nanotechnology research. All the research

activities will have strong component of industrial applications or industry involvement. Our research is conducted in the interdisciplinary Center for Molecular Electronics, which consists of physicists, chemists, materials scientists, biochemists and biologists.

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Frank E. Moss

The overall objective of this research is to study the role of noise, or random processes on the foraging behavior of the zooplankton, *Daphnia*. The emphasis is on certain swimming characteristics that may be constant across several species with different sizes and behaviors. The hypothesis is that if such characteristics exist they are the result of evolution in order to maximize survival. Our studies are both experimental, using two species cultured here and five others in collaboration with a group at the Great Lakes WATER Institute of the University of Michigan - Milwaukee. Theoretical/numerical analyses of this problem are done in collaboration with a group at Humboldt University in Berlin, Germany. Invited lectures on this topic were presented at three conferences held in Europe in the summer of 2005. Our research is carried out within the interdisciplinary Center for Neurodynamics now funded internally. Collaborating in this research is an undergraduate in our department: Ricardo Garcia. Faculty, visitors, and students from the Departments of Physics and Astronomy and Biology carry out research within the Center for Neurodynamics.

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Wilfred H. Sorrell

Main research focus is theoretical astrophysics. Previous research work was focused on models for interstellar solid particles with a special emphasis on the physical and chemical properties of graphitic solid particles producing the interstellar ultraviolet absorption band at wavelength 2175 Angstroms. The research work was published and appears in a peer-review journal as Sorrell (1990, Monthly Notices Royal Astronomical Society, 243, 570). Other research works on the chemical properties of hydrogenated amorphous carbon solids in diffuse interstellar clouds appeared as Sorrell (1991, Monthly Notices Royal Astronomical Society, 248, 439), and on dust grain processing in the Orion Nebula as Sorrell (1992, Monthly Notices Royal Astronomical Society, 255, 594). Research work on the interstellar dust grain alignment problem appeared as Sorrell (1994, Monthly Notices Royal Astronomical Society, 268, 40 and 1995, Monthly Notices Royal Astronomical Society, 273, 169-200). Research work on the issue about a massive black hole at the center of the Milky-Way galaxy appears in the Bad-Honnef Conference on Cosmic Jets, July 3-7, 1995. Recent research focused on the Origin of Life problem appears in Sorrell (2001, Astrophysical Journal Letters, L129-L132). Recent research work on the nature of the T-Tauri binary system appears in Sorrell (2002, Monthly Notices Royal Astronomical Society, 334, 705-712). Current research is focused on cosmological models for the universe that have

nothing to do with the Big Bang. The cosmological models I am now constructing are based upon my idea that says the Big Bang is a cosmic myth.

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Vassiliy Tsytarev

My research concerns interneural integration and information processing in the neocortex of mammals. We are observing neuronal activity in the neocortex using a combination of various techniques, including the intrinsic optical signal (a drop in light reflectance that correlates with an increase in electrophysiological activity), and voltage sensitive dyes. At the central of our project is a problem of spatiotemporal representation of the information in the brain.

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Teaching activity:

4347 - Biophysics of Imaging

Tuesday / Thursday 2:00-3:15

The course included introduction into the main modern methods of the brain imaging – functional magnetic resonance imaging, positron-emission tomography, intrinsic optical imaging, voltage- and calcium sensitive dye.

Selected papers:

Intrinsic optical signals from rat primary auditory cortex in response to sound stimuli presented to contralateral, ipsilateral and bilateral ears. Tsytarev V, Tanaka S. Neuroreport. 2002 Sep 16;13(13):1661-6

Sound frequency representation in cat auditory cortex. Tsytarev V, Yamazaki T, Ribot J, Tanaka S. Neuroimage 2004 Dec; 23 (4):1246-55

Song and speech: brain regions involved with perception and covert production. Neuroimage. Callan DE, Tsytarev V, Hanakawa T, Callan AM, Katsuhara M, Fukuyama H, Turner R. 2006 Jul 1;31(3):1327-42

A new planar multielectrode array: recording from a rat auditory cortex. Vassiliy Tsytarev, Makoto Taketani, Frank Schottler, Shigeru Tanaka and Masahiko Hara. J. Neural Eng. 3 (2006) 293-298

Bruce A. Wilking

Young brown dwarfs continue to be the focus of my research. Using the Hubble Space Telescope, we have built upon our previous study of young brown dwarfs in the NGC 1333 star-forming region. The results of this project, which is in collaboration with graduate students Tina Fanetti and Julia Greissl (U. Arizona) and Dr. Michael Meyer (U. Arizona), include the discovery of four new brown dwarfs but none below 20 Jupiter masses. Our results, scheduled to be published in the *Astronomical Journal*, are suggestive of a cut-off in the lowest mass objects formed in the cloud. I

am continuing a program with graduate student John Robinson and Michael Meyer to characterize the ages and masses of optical stars that lie at the surface of the Rho Ophiuchi star-forming region (see 2005, *Astronomical Journal*, v130, p. 1733-1751 for first results). We are finding evidence for two distinct waves of star formation in the Ophiuchus region. We observed at the 4-meter WIYN Telescope in June 2006 to complete the data collection for this project. I am completing work on a review chapter on star formation in the Ophiuchus cloud for a book entitled "Handbook of Low Mass Star-Forming Regions" in collaboration with Marc Gagné (West Chester University) and Lori Allen (Harvard-Smithsonian Center for Astrophysics). The book should be published in 2007. In October 2006, I attended the *Protostars and Planets V* meeting in October held in Hawaii.

Alumni Information

John L. Africano (1951-2006)

We were saddened to read the following from a Colorado Springs newspaper:

"John Louis Africano, 55, of Colorado Springs, passed away July 27, 2006 in Honolulu, Hawaii. He was a part-time Maui resident. John saw a picture of Saturn in his second grade science book when he was eight years old and knew that he wanted to be an Astronomer. After graduating from Riverview High School in 1969, he pursued his dream, earning a Bachelor of Science in Physics at the University of Missouri-St. Louis, and a Master of Science in Astronomy at Vanderbilt University-Nashville, Tennessee. During his career, he worked at observatories all over the country and the world, including McDonald Observatory, Ft. Davis, Texas; Sunspot Observatory, Cloudcroft, New Mexico; Kitt Peak National Observatory, Tucson, Arizona; Haleakala Observatory, Maui, Hawaii; and Cerro Tololo, Chile. He also worked at NASA in support of programs monitoring orbital debris. John married his high school sweetheart, Linda, on February 12, 1972 in St. Sabina Church, Florissant, Missouri. They shared almost 35 years of marriage and raised three children, James, Brian and Monica."

1981

Marty Mylnczak (B.S.) is a Senior Research Scientist at NASA Langley Research Center. He visited the department in April and gave a colloquium on his research in atmospheric science entitled "Adventures with the first law from Earth's surface to the edge of space".

1985

Maurice R. Pierce (M.S.) is currently working for Transindustrial Corporation doing internet related programming with neural network applications.

1986

Tyrone Daulton (B.S.) is back at Washington University where he received his Ph.D. He is a Research Scientist at

their Center for Material Innovation. He recently got funding on an NSF instrumentation grant, and has been working to get the new FEG-TEM system up and running for the joint A&S/Engineering Center located in Crowe Hall.

1989

Todd Shepherd (B.S. Economics, M.S. Economics 1991), who many of us remember as a physics and astronomy student in the 1980s, is the Department Chair of Social Science at Cowley College in Kansas. In addition to teaching economics, he also teaches algebra and introductory astronomy.

1990

K. Michael Malolepsky (B.S.) is currently working at the Washington University Department of Biology as a computer support specialist/system administrator. He is also the current president of the St. Louis Astronomical Society and does planetarium shows at the St. Louis Science Center's McDonnell Planetarium on a part-time basis. In October of last year, he became one of only about 10 people to visually observe 2003 UB313 / Xena /Eris which was briefly the 10th planet before it, along with Pluto, was demoted to a dwarf planet. The viewing was well publicized at the time, but as Mike comments "I guess my 15 minutes of fame is even more fleeting that I thought..."

1991

Tim Giblin (B.S., M.S. 1993) is an assistant professor at the College of Charleston. He visited the department this November and gave a colloquium entitled "Gamma-Ray Bursts, Shocks, and Relativistic Jets".

Michael R. Meyer (M.S.) is a tenured associate professor of astronomy at the University of Arizona. He continues his studies of the formation of stars and planetary systems as the Principal Investigator (PI) on research grants with NASA's Spitzer Space Telescope and as a member of the Science Team for an infrared camera being developed for the James Webb Space Telescope. He is also a Deputy PI for the astrobiology team at the University of Arizona which is part of the NASA Astrobiology Institute.

1994

Mark Kushina (B.S.) is a Senior Laser Engineer for Cutting Edge Optronics which is owned by Northrop-Grumman. Mark visited the Windows on Physics class this November to talk about careers for physicists in industry.

1996

Kevin Dolan (B.S., M.S. 1998, Ph.D. 2000) is a Senior Scientist - Biomedical Sensor Systems at Philips Research in Eindhoven, Netherlands. Kevin just completed a successful postdoctoral position at Research Center Juelich, Germany.

1999

Gábor Balázsi (M.S., Ph.D. 2001) has accepted a tenure-track research position in the Department of Molecular Therapeutics at the University of Texas, M. D. Anderson Cancer Center in Houston Texas. Gabor just completed a

successful postdoctoral position at Center for Biodynamics, Boston University.

Minh Q. Truong (B.S. 1999, M.S. 2001) successfully defended his Ph.D. dissertation in April entitled "Superfield Calculation of Loop Contribution in Extra Dimensional Theories". Minh and Amanda Hall (M.S. 2002) were married this fall.

2000

Adam Tournier (B.S., M.S. 2002, Ph.D. 2005) is an assistant professor of physics at Lewis and Clark College in Godfrey, IL.

2001

Richard Schuler (M.S.) has moved to Iowa where he is employed as the "Offsite and Community Programs Coordinator" at the Science Center of Iowa in Des Moines. His current responsibilities include developing programs for outreach (at the local and state levels) and distance learning, as well as cultivating community partnerships with both science and non-science organizations. He is also involved in exhibit design, and is enjoying the blend of education, physics and engineering.

2002

Bo He (Ph.D.) has moved to the University of Illinois Champaign-Urbana to take a postdoctoral position in Electrical Engineering. He will be doing research in inverse scattering with one of the top groups in the country.

2003

Michelle Kirchoff (B.S.) recently completed her Ph.D. in Earth and Planetary Sciences at Washington University. The title of her dissertation was "Mountain Building on Io: An Unsteady Relationship Between Volcanism and Tectonism". She has a postdoctoral position at the Lunar and Planetary Institute in Houston, Texas studying cratering statistics on the Saturnian satellites. She reports that Tim is currently a stay at home dad with Lyle, but looking for work. Lyle is now 16 months and learning to walk.

2004

Stephen Brown (B.S.) recently moved to Indianapolis from Georgia where he had been a full-time math tutor at Georgia Highlands College. He wants to pursue a M.S. in Physics at Indiana University-Purdue University at Indianapolis and eventually teach physics and astronomy at a community college.

Wesley Mossinghoff (B.S.) has just become a new father this past Halloween and is getting his Masters degree in Mechanical Engineering from Washington University.

2006

Ryan Cleaver (B.S.) received an internship for the summer 2006 at the Jet Propulsion Lab in Pasadena, CA through the NASA/Missouri Space Grant Consortium. He worked with

Dr. Robert West on images of Saturn from the Cassini spacecraft.

Dan Hopper (M.S.) has accepted a position teaching physics at DeSmet Jesuit High School in Creve Coeur, MO.

Enclosed is my contribution of \$ _____. _____ Yes, I work for a matching gift corporation.

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St. Louis, MO 63121-4499

Alumni Information Form:

Keep in touch! Please let us know what's new with you, both personally and professionally.

Name: _____

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City, State, Zip: _____

Company Name: _____

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e-mail
address: _____

News (to include in our newsletter):

When are you available for campus events? _____

Thank you.

Comments or Questions: canavan@umsl.edu.

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