UMSL *Physicist*

Department of Physics & Astronomy http://www.umsl.edu/~physics November 2011

Note from Chair

Greetings from the Department of Physics & Astronomy. This has been a year of loss for the Department. Two of our most prominent faculty members passed away, Frank Moss and Dick Schwartz. Both made very significant contributions to our Department and to the scientific community. Both were highly regarded, internationally known scientists whose work has been very influential and frequently cited.

I would like to add a personal note. Frank was my mentor at UMSL. It was always reassuring for me to know that there was always someone in my corner with regard to departmental politics, and for me that was Frank. I will forever be grateful for that assistance. Frank taught me the importance of having a mentor and in turn, the obligation to mentor younger faculty members.

Dick was the quiet strength of the department. When the Department needed leadership, he accepted the chairmanship and provided outstanding leadership. When the Department needed an observatory, he built one. When someone had to oppose the Chancellor by raising the issue of noise abatement for the Performing Arts Center, he was unwavering and investigated that issue thoroughly. He never tooted his own horn; his actions spoke louder than words. Both Dick and Frank were wonderful colleagues as well as irreplaceable friends.

Also, our electronics technician for over 30 year, Wayne Garver, retired. Wayne made numerous lasting contributions to the Department. So much of the electronics in our research and teaching labs was designed and constructed by Wayne. He also did an outstanding job building and teaching our senior level electronics class as well as assisting in the building and teaching of our senior lab. I will miss seeing Wayne's electric car as well as our discussions about automobile engine technology. I wish him and his wife Fran all the very best.

Let me close by thanking so many of you who have contributed so generously to our Alumni Scholarship Fund and the Dick Schwartz and Frank Moss Memorial Funds. Your contributions have made a significant difference in the Department and the Department is most appreciative.

Bernard Feldman

Thanks for 35 Years!

After 35 years of service to the University, Wayne Garver retired in May. Wayne started his UMSL career in 1976 as a Senior Electronics Technician but, recognizing his many talents, the Department reclassified him as a Research Scientist. Wayne became a vital member of several research groups and was an instructor for both the Modern Electronics course and the Advanced Physics Lab. He was author or coauthor on numerous publications in the *Review of Scientific Instruments, Scientific American, The Physics Teacher, Physical Review, and The Journal of Chemical Physics.* He is involved with five patent applications. In 2001, Wayne received the Chancellor's Award for Staff Excellence. He also became an expert and advocate for electronic automobile technology which included his conversion of a 1971 Volkswagen SuperBeetle to electric.

Fran & Wayne Garver

Wayne was honored at the annual Alumni Awards Luncheon on May 6 where he was presented with a plaque detailing his accomplishments and gift. In addition to colleagues from the Department and University, the luncheon was attended by his wife Fran with messages of congratulations sent by his children Paul and Kari.

Tyrone Daulton Honored at Alumni Luncheon

The annual Physics & Astronomy Alumni Awards luncheon was held on May 6, 2011 at the Summit Lounge on the UMSL campus. Tyrone Daulton (B.S. 1986) was the guest of honor. Tyrone received his Ph.D. in Physics from Washington University in 1994 and has held research positions at Arizona State University and NASA's Stennis Space Center. He is currently a research scientist in the Department of Physics and Center for Materials Innovation at Washington University in St. Louis. Following the luncheon, we were treated to an excellent talk by Tyrone entitled "*Did a Comet Kill the Mammoths and Cause Diamonds to Rain from the Sky?*" Analysis of samples helped Tyrone's group debunk a popular theory that a comet impact led to the extinction of megafauna, such as mammoths, mastodons, saber-tooth tigers and giant short-faced bears, 12,900 years ago.

Dr. Tyrone Daulton with tools of the trade.

Also at the luncheon, graduating senior Joshua Mann received the Jeffrey Earl Award and a set of the Feynman Lectures. Timothy Ferguson received the Senior Alumni Award ($500). Kristen Erickson and Zak Jost each received the Outstanding Graduate Teaching Assistant Award which is a $250 prize and a one-year subscription to the American Journal of Physics.

Meet the Scholarship Recipients

We would like you to meet the scholarship recipients who you help support with your generous contributions. Timothy Ferguson, Matthew Freeman, and Stephen Ordway are receiving Physics & Astronomy Alumni Scholarships. These scholarships provide the students with $2000 annually toward their educational expenses.

Timothy Ferguson - Tim was homeschooled in St. Louis. He is in his senior year at UMSL and plans to get both physics and math degrees. Besides his interest in science and math, he enjoys recreational sports with friends. He plans to attend graduate school to study analytic number theory.

Matthew Freeman – Matthew is a returning student with a previous B.A. of Music from Webster University. He came to UMSL to get a degree in physics as he enjoys science and wanted an education that would lead to greater financial stability. Interests in physics are currently plasma physics and astrophysics. He is currently a member of the Dean of Arts and Sciences Student Committee and works as a math tutor for UMSL. Outside of school and work he plays video games and piano, when he has time.

Stephen Ordway – Stephen went to high school at Jefferson City High School in Jefferson City, MO. He is a junior, currently studying abroad at the University of Birmingham in the UK, which has one of the highest ranked physics programs in the country. He has been working in labs on X-Ray powder diffraction and the attenuation of gamma rays. He is also member of the Pierre Laclede Honors College. Most of his interests outside of school include hanging out with friends and family and tinkering with electronics, specifically ones dealing with sound. His hope as of now is to focus on the acoustical part of physics, and then get a masters or Ph.D. in engineering so he can design speakers or whole auditoriums.

Frank Moss: (1934-2011)

Frank Moss, Curators' Professor Emeritus of Physics at the University of Missouri–St. Louis, died at his home January 4 after a five-year battle with lung cancer and emphysema. In 1996, Moss and his UMSL colleagues Lon Wilkens, Professor Emeritus of Biology and Steve Lehmkuhle, then a Professor of Optometry at UMSL and now chancellor of the University of Minnesota, Rochester, founded UMSL's Center for Neurodynamics. Frank was one of the first physicists to perform the groundbreaking research identifying the phenomenon of stochastic resonance, in which a small amount of added noise enhances the transmission of weak, sub-threshold signals. In widely cited papers in the science journal *Nature*, Moss and Wilkens provided the first demonstrations of this phenomenon in a biological context. One of their most dramatic studies showed how small amounts of electrical noise can enhance the feeding behavior of the paddlefish.

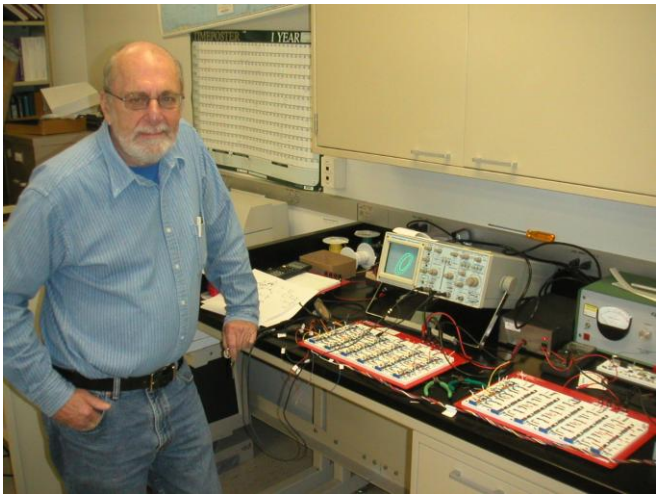
Frank was born in Paris, Ill., and attended the University of Virginia in Charlottesville where he earned a bachelor's degree in electrical engineering, a master's degree in nuclear engineering and a doctorate in physics. He came to UMSL in 1971 as an associate professor, was named a full professor in 1976, and a Curators' Professor in 2000. He received numerous honors for his research including the President's Award for Research and Creativity from the University of Missouri System in 1994, and the Peter H. Raven Lifetime Achievement Award by the Academy of Science of St. Louis in 1999. Also that year he was awarded the Humboldt Prize, an award given to internationally renowned scientists and scholars. He was the author of hundreds of scientific publications, many of which are now classics in his field. He retired from UMSL March 1, 2008.

A gathering to celebrate Frank Moss' life was held January 21 in the J.C. Penney Conference Center lobby and attended by family and colleagues. While mourning Frank's loss, his colleagues and friends throughout the scientific

community are celebrating and honoring his legacy and his immense influence on his field. The Agora for BioSystems in Sigtuna, Sweden, hosted a Workshop on Fluctuations in Biological Systems from July 28-30, 2011 in Frank's honor. Speakers included a wide array of international scientists. A workshop at the 2011 Computational Neuroscience Meeting held in Stockholm was also dedicated to Frank's memory.

The AIP journal *Chaos: An Interdisciplinary Journal of Nonlinear Sciences* has posted a tribute to Frank (http://chaos.aip.org/tribute_to_frank_edward_moss) and is publishing a special issue on "Nonlinear and Stochastic Physics in Biology" in Frank's honor, which should appear in early 2012. Many of Frank's friends and colleagues have come together in order to guest edit the issue, including UMSL's Sonya Bahar, Alexander Neiman of Ohio University (and also an UMSL "alum", who spent a number of years here as a postdoctoral fellow and Research Professor), Ken Showalter of the University of West Virginia, Peter Jung of Ohio University, Jürgen Kurths of the Potsdam Institute for Climate Impact Research, and Lutz Schimansky-Geier of Humboldt University of Berlin. Still more international scientists have contributed their most recent work to this special issue, so that this tribute to Frank will be a powerful survey of the field of nonlinear dynamics in biology – a field which Frank helped to found.

Frank is survived by his wife, Elaine, son Frank and his wife Sara, and two grandchildren. He is also survived by a large extended family of scientists and friends to whom he was a beloved friend and mentor. The family requests that donations be made in memory of Dr. Frank E. Moss to the Elaine and Frank Moss Hospitality Fund at the University of Missouri–St. Louis, and sent to Development Systems and Alumni Records, 103 Woods Hall. The family also has asked for anecdotes, stories and pictures about Frank Moss to be sent to drnoise@nine13tech.com. These stories will be compiled into a book format and posted to the web.



Frank Moss in his lab.

Faculty/Staff News

Dr. Jimmy Liu, Professor of Physics & Chemistry, resigned in October as Director for the Center for Nanoscience. Jimmy has taken a position at Arizona State University in the Physics Department. Dr. George Gokel, Distinguished Professor of Chemistry & Biochemistry and Biology, has assumed the Directorship of the Center and Eric Majzoub, Associate Professor of Physics, has become the Associate Director.

As mentioned in an earlier article, Wayne Garver retired in May. The Electronics Shop, which served the science departments, was closed due to budget constraints.

Alice Canavan was honored in August for her 20 years of service to the University. She has been our Administrative Associate since 1999 and responsible for keeping the faculty in line and the Department running smoothly. Alice received the Chancellor's Award for Staff Excellence in 2008.

Department Pays Tribute to Dr. Richard D. Schwartz (1941-2011)

Richard D. Schwartz, Professor Emeritus of Astronomy, died at his home in Sequim, WA on July 28, 2011 after a 2 ½ year battle with pancreatic cancer. Dick was born in Pretty Prairie, Kansas, to parents Herbert and Elnora Schwartz. He attended elementary and high school there, graduating in 1959. Dick did his undergraduate degree in physics at Kansas State University, followed by a master's degree in Divinity at Union Theological Seminary in NY. He did his doctoral work in astrophysics at the University of Washington, receiving his Ph.D. in 1973. Dick was a professor of astronomy at the University of Missouri-St. Louis from 1975-2003. During this time, he built the astronomy program and initiated the B.S. in physics with an astrophysics option that the majority of physics majors choose. He served as Department Chairperson from 1996-2000 and designed and provided oversight on the construction of the campus observatory which now bears his name. From 1991-2003, he managed the campus program for the NASA/Missouri Space Grant Consortium and mentored over 30 research students in projects at the observatory. Dick compiled a distinguished record of research that gave him an international reputation as an astrophysicist. He pioneered a new research area studying the energetic mass loss in young stars, a field in which there are today hundreds of astronomers and physicists working worldwide. There have been over 2000 citations to his 80 scientific papers. From 1979-1998, he had continuous funding from NASA and the National Science Foundation. For his distinguished research record, he received the Chancellor's Award for Research and Creativity in 1999. Even in his retirement, Dick remained active in astronomy using the Galaxy View Observatory which he constructed adjacent to his home in Sequim.

A celebration of Dick's life was held at the Glen Echo Country Club on September 4. It was attended by Dick's wife Eleanor and his 6 stepchildren and their families, his brother Melvin Schwartz and family, and many of his colleagues and former students. Speaking at the celebration were his wife of 25 years, Eleanor McIntyre, stepchildren Mike McIntyre, Gary McIntyre, Sonny Costin, and Colleen McIntyre Janaszek, and UMSL colleagues Ta-Pei Cheng,

Bernard Feldman, Miles Patterson, John Rigden, and Bruce Wilking.

His family has requested that contributions in his memory be made to the Richard D. Schwartz Undergraduate Scholarship in Physics and Astronomy, Attn: Maura Wuellner, 230 Woods Hall, University of Missouri–St. Louis, One University Blvd. St. Louis, MO 63121.

Dr. Richard Schwartz

NASA/Missouri Space Grant Consortium Holds Annual Meeting at UMSL

UMSL hosted the 20th Annual Meeting of the NASA/Missouri Space Grant Consortium April 8-9, 2011. This is the last time the state-wide group will meet in St. Louis in favor of a more central location at Missouri S&T in Rolla. About 80 students participated including nine undergraduate and graduate students from UMSL and two high school students. After a welcome address by Arts & Sciences Dean Ron Yasbin, students made either oral or poster presentations of their research. Undergraduate John Keller discussed his analysis of the age distribution of young stars in the Ophiuchus molecular cloud (advisor: Bruce Wilking). Emily Sudholt talked about her spectroscopic observations of Comet Lulin (advisor: Dr. Erika Gibb). Molly Salinas presented a poster on the synthesis of tin oxide nanostructures (Advisor: Jimmy Liu). Ashlynn Conner presented the results from her internship with MEMC Electronics on the analysis of defects in semiconductors (advisors: Drs. Phil Fraundorf and Jeff Libbert). Emily Sudholt, Molly Salinas, and Robert Dobynes described the UMSL Planetarium Program conducted for area 5th grade students and teachers.

The banquet was held in the evening of April 8 at the Renaissance Hotel and the banquet speaker was alumnus Dr. Tim Giblin. His talk, "The International Space Station: A National Science Laboratory" was a highlight of the meeting.

Molly Salinas, John Keller, Matt Dennis, Madison Hayes, and Emily Sudholt also made poster presentations at the annual Undergraduate Research Symposium held on the UM-St. Louis campus on April 29 and hosted by the Golden Key International Honour Society and Sigma Xi. Emily Sudholt received the Department prize ($250) for the best physics or astronomy poster. Emily has been selected to present her poster at the Undergraduate Research Day at the State Capitol in Jefferson City in March 2012.

UMSL participants at the 20th Annual meeting of the NASA/Missouri Space Grant Consortium hosted by UMSL. Pictured from left to right in front: Kristen Erickson, Mona Dai, Dr. Erika Gibb, and Ashlynn Conner; Middle Row: Molly Salinas, Bradley Gerling, Zak Jost, and Emily Sudholt; Back row: Dr. Bruce Wilking, John Keller, Robert Dobynes, Matt Dennis, Tim Mason, and David Peaslee.

Physics & Astronomy Club

The Physics and Astronomy Club again collaborated with Chemistry Club in an October Chili Cook-off fund raiser. The Club is designing and printing T-shirts as part of its fund raising activities. Plans for the spring semester include another collaboration with Chemistry Club for Mirthday demonstrations, and a possible trip to Chicago to tour Fermilab and Argonne National Lab. Current officers are Emily Sudholt-President, John Pepper-Vice President, Henry Hamper-Treasurer, and David Proctor-SGA representative.

Graduate Program Update

We awarded four M.S. in Physics degrees and one Ph.D. degree thus far in 2011. Zak Jost, Pat Sheehan, Jason LaCroix, and Adam Crepin completed Master's degrees. Pat is continuing in our doctoral program. Tim Mason successfully defended his doctoral dissertation in the fall. Tim's dissertation was entitled "*First-principles Studies of Complex Hydrides for Li-ion Battery and Hydrogen Storage Applications*". His advisor was Eric Majzoub.

Kristen Erickson, Zak Jost, Tim Mason, and David Peaslee were supported in part by graduate fellowships from the NASA/Missouri Space Grant Consortium. They presented their research at the state-wide annual meeting in April at the UMSL campus. David Peaslee presented a poster on an experimental apparatus he built to measure hydrogen gas desorption, Zak Jost discussed the synthesis

and characterization of nanoporous carbon, and Tim Mason spoke on his research with Li-ion battery anodes (advisor: Eric Majzoub). Kristen Erickson discussed the initial mass function of the young star cluster in Ophiuchus (advisor: Bruce Wilking). These students plus graduate students Nandita Nag, Pat Sheehan, Bob Collins, Kari Wojtkowski, Adam Scott, and Kaushalya Premachandra all presented research posters at UMSL's Graduate Fair in April. Pat and Kari won $200 awards for their posters and David Peaslee received a $350 prize for his poster from the Department and UMSL Chapter of Sigma Xi.

We welcomed seven new full-time students to our graduate program this year: Anamaria Baluyut (U. Notre Dame), Fahd Fahd (UMass-Lowell), Wei Huang (Beijing Institute of Technology), Shane Meyer (UMSL), Ellie Ordway (UMSL), Gang Wang (Fudan University), and Dongxue Zhao (University of Shanghai for Science and Technology).

Recent graduates Shane Meyer and Ellie Ordway. Both students are continuing in our graduate program.

The Missouri Physics Collaboration

Last December, the chairs from all the Bachelor degree offering Physics Departments at public universities in the State of Missouri met and established the Missouri Physics Collaboration. The purpose of this collaboration is to offer physics courses throughout the state over the internet. The first such collaborative course, Nanostructures: An Introduction was offered this fall; about 25 students enrolled in the class from about 5 universities, including 5 UMSL students. The instructor was Dr. A. Yamilov, who is on the physics faculty at Missouri S & T (formerly, UM-Rolla). This course will be counted as a physics elective by all participating schools. Dr. D. Probst of Southeast Missouri State University will teach Optics in the spring over the internet. The plan is to offer two such courses each semester starting next fall.

The driving force behind this collaboration is the Missouri Board of Higher Education who is worried about the inefficiencies of having 10 public Bachelor's degree-offering Physics Departments in the state, some of which only graduate one or two students a year. The goal of the collaboration is to preserve these Bachelor degree programs by reducing their cost. The cost savings will be generated when Physics faculty retire or leave their departments and are not replaced.

Does this collaboration mean the end of the Department of Physics and Astronomy at UMSL? No. First, there will always be faculty needed to offer the general education and introductory physics and astronomy classes. To justify more faculty than the minimum, our department will have to have sufficient undergraduate and graduate students as well as external grants to persuade the Dean and Provost to invest in our department. As long as the State of Missouri is unwilling to make major investments in higher education, this is the new reality we are facing.

Center for Neurodynamics Has New Look

The Center for Neurodynamics has expanded again this year, adding four new members. The Center now includes Drs. Brit Brogaard (Philosophy), Mike Nichols (Chemistry & Biochemistry), Carl Bassi (Optometry) and George Taylor (Psychology). The Center now provides a common meeting-ground for all those on campus with research interests in the interdisciplinary brain sciences. The Center will be hosting a half-day workshop in December, at which members will give informal discussions of their recent work. Center Director Sonya Bahar says that she plans to hold the workshops once a semester, in order to foster collaboration within the Center, and to increase the awareness of UMSL neuroscientists of each other's work. The Center is also planning to host a St. Louis-wide "neurodyn" meeting, including scientists from SLU and Washington University as well; a date has not yet been set for this meeting, but Bahar estimates that it should be held later in the spring. Several interdisciplinary talks at the interface of philosophy and neuroscience will be held next semester as well. On March 2nd, the Center for Neurodynamics and the Department of Physics and Astronomy will host philosopher Jacqueline Sullivan, of the University of Alabama at Birmingham, who will talk about her most recent research. On March 15th, Brit Brogaard will give a talk jointly hosted by Neurodynamics and the Department of Mathematics and Computer Science, and will discuss her neuroimaging studies of a mathematical savant. For questions about locations of upcoming Center events, contact bahars@umsl.edu.

Check Out our Web Page!

You can always look at the Department Web page to find our schedule of colloquia, journal clubs, Observatory Open Houses, and up-to-date news. Check it out at and join us at Department events!

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

Faculty Updates:

Sonya Bahar

My research concerns complex dynamics in biological systems. A major branch of my laboratory's work involves the study of synchronization of neural firing during epileptic seizures. In addition to performing computational studies of neural synchronization, we image seizure onset in the rodent neocortex using voltage sensitive dyes. Work by Dr. Daisuke Takeshita, who received his PhD in 2010 from UMSL, has shown that there is a very significant rise in synchronization during the imaged seizures. This work is now in press in *Chaos*.

In addition to studying synchronization in seizures, my group has studied eye movement synchronization in traumatic brain-injured patients, and uses computational models to investigate patterns of animal search strategies in species ranging from *Daphnia* ("water fleas") to monkeys. Our newest avenue of research involves the use of computer simulations to investigate the role of mutation rate on speciation. Our first venture into this new research area was published in the online journal *PLoS ONE* in 2010. My group was recently awarded a three-year grant from the James S. McDonnell Foundation to continue and expand these studies.

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Bernard J. Feldman

This year, I have one paper in press, "The Elementary Physics of Four Bridge Failures," to be published soon in the US-China Education Review. I have also published two book reviews, "Pursuing Power and Light: Technology and Physics from James Watt to Albert Einstein," in the American Journal of Physics 79, 687 (2011), and "The Quest for a Fusion Energy Reactor," in Physics in Perspective 13, 116 (2011). And I responded to two letters to the editor of Physics Today, "Cold Fusion and Reproducibility," November 2010, p. 11.

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Michael Fix

I was interviewed concerning the "Chronister" dinosaur site in southeast Missouri which was included in a documentary titled "Prehistoric Chicago" that has been aired on the "Discovery Channel" outside the US, and has been aired in the US on the "Discovery Science" and "Planet Green" channels. My segment concerned the Missouri site as evidence that dinosaurs would have roamed Chicago during the Cretaceous period. The Department of Physics & Astronomy was recently the recipient of an extensive collection of mineral specimens donated by Professor Harold Harris of the UMSL Chemistry & Biochemistry Department and his wife Mary. This collection contains a number of outstanding and rare specimens, and portions of it will be displayed on the fourth floor of Benton Hall in the near future. In November 2010 I received the Emerson Outstanding Teaching Award.

Ricardo A. Flores

My research interests are astrophysical cosmology and applications of quantum field theory to the physics of elementary particles. This past year, however, my teaching load was doubled and I have not been able to complete any project. Nonetheless, I remain interested in the expected evolution in maps of the Sunyaev-Zel'dovich effect in clusters, and I may return to the subject of dark matter halo shape using the Bolshoi simulation carried out by my collaborators. Finally, my third student (David Coss) graduated in May and is now back in Tennessee.

Philip B. Fraundorf

My research involves materials, atomic resolution microscopes, computer simulations, and conceptual strategies for doing both nanoscale detective work and curriculum modernization. We've long provided the region with tools not otherwise available for examining the nanostructure of a growing variety of specimen types, including for example aerosol catalysts, integrated circuit silicon, carbon nanotubes, extraterrestrial materials, ferrofluids for drug delivery, and most recently ultrahigh temperature materials for leading-edge surfaces on hypersonic aircraft. This has helped put graduates into applied physics internships and jobs with companies that include MEMC, Seagate, Martin-Marietta, Mitsubishi Silicon-America, Motorola, and Cabot Electronics. Of four recent intellectual challenges, one lies at the intersection between (i) modern-day uses for graphene sheets and (ii) possible roles for carbon droplets in cool stellar atmospheres. Another involves the studies of gigascale integrated circuit silicon, a highly-ordered material tightly connected to future technology. A 3rd involves quantitative detective work on atomic periodicities and energy loss reflected in electron microscope images. A 4th involves the intersection between (a) log-probability measures, (b) the mathematical theory of model selection and (c) the quantitative study of correlations in complex systems with particular focus on the challenge of sustaining niche-network layer-multiplicities in metazoan communities. More on recent developments and on various educational explorations as well, may be accessed through:

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Thomas F. George

I am involved in theoretical research in several areas of laser/materials/nanophysics. One area involves molecular clusters and nanostructures, 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. Nonlinear optical responses are considered, where femtosecond and picosecond degenerate and nondegenerate four-wave mixing and pump-probe techniques are used to investigate ultrafast electron and nuclear dynamics, charge transfer and photoexcitation in fullerenes. Electroluminescence enhancement of polymer light-emitting diodes is being examined. Yet another area involves the analysis of diamondoids as possible materials for nanoelectronic devices. The most recent venture is in nanomedicine, where laser-induced explosion of absorbing gold nanoparticles in selective nanophotothermolysis of cancer is being explored, along with studies of bone cancer therapy by plasmonic nanoparticles.

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Erika Gibb

I am an astrochemist/astrobiologist studying chemistry in star formation regions and comets. One exciting area of astrobiological research is the search for organic molecules and water, important for life as we know it, in planet-forming disks around young stars that are thought to be similar to the young solar system. As primitive solar system objects, comets are also important for understanding how the solar system formed and evolved. I use a technique called infrared spectroscopy to study organic molecules and water in both comets and planet-forming disks. This past year, undergraduate student Matthew Dennis joined me on a Keck II observing run to study comet Hartley 2. Also, postdoctoral research assistant Dr. Matthew Troutman and I went to Keck in January to study water in disks around young stars. With these data, 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" (Q1/fE), *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 was 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 2001-2006. Our progress in nanotechnology and MEMS applications is shown in *.Proc. IEEE* 93, 1784-1814, (2005) and *IEEE Sensors* 8, 1020-1027 (2008). Our progress in state of the art GaN FETs is in IEEE Electron Device Letters Vol. 31, 1041-1043, (September 2010). The most recent application and verification of the Conventional Q1/fE in highest stability quartz resonators is in F. Sthal, et al., Proc. 65th Annual Symposium on Frequency Control, San Francisco 5/2011, (978-1-61284-110-6/11/$26.00 ©2011 IEEE 178), pp. 178-182. See dozens of recent papers on this new field I introduced, in the "Quantum 1/f Bibliography" at my web site www.umsl.edu/~handel/.
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Bob L. Henson

In the Spring Semester 2011, I developed and taught the second graduate level mathematical methods course. Along with this course, my teaching load included a senior level physics course and the Internet elementary meteorology course, which I developed and taught in Fall 2010. We have continued to offer the online meteorology course this Fall and it will be offered again in Spring 2012. It has proved to be a popular course. With my lighter teaching load this Fall, I have returned to working on my mathematical physics research project that had been put on hold.

Jacob J. Leventhal

Foundations of Quantum Physics, a textbook written jointly with Charles E. Burkhardt of St. Louis Community College, was published by Springer in October 2008. While it is a textbook for introductory quantum physics courses, the book is intended to be retained by the student as a reference book long after the course has been completed. The book includes topics that are not normally covered in introductory textbooks, topics that will likely be skipped during a first course in quantum physics. Thus, the student may use the book in future years as a source for these subjects.

Foundations of Quantum Physics is the second textbook that we have published with Springer. The first, *Topics in Atomic Physics*, is a graduate textbook that provides a foundation for students that are beginning research in modern atomic physics. It too is intended as a reference as well as a textbook 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 other books.

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Eric Majzoub

The research focus in our group is on the study and design of new materials for energy storage and conversion, such as hydrogen-storage materials, lithium-ion batteries, and pseudo- and super-capacitors. We employ a combined experimental and computational approach, utilizing first-principles techniques to understand the electronic, mechanical, and thermodynamic properties of the materials we study.

I was promoted to the position of Associate Director of the Center for Nanoscience, and along with the director George Gokel, will be re-organizing the center to more directly utilize the strengths of the CNS members from Chemistry, Physics, and Biochemistry and Biology.

Hydrogen storage research in the Majzoub group remains funded through the Department of Energy, Office of Basic Energy Sciences, with a new grant in collaboration with Washington University involving both Mark Conradi (Physics) and Sophia Hayes (Chemistry). This project currently employs one graduate student. The focus of the research is to identify important structural features of the hydrogen storage compound sodium alanate, or $NaAlH_4$, at temperatures and pressures of hydrogen that cause structural phase changes and coordination changes between Al and H atoms. These structures are important for the understanding of the decomposition mechanisms of $NaAlH_4$, and other similar compounds such as $LiBH_4$, and $Mg(BH_4)_2$, for example.

Recently, with funding from a NASA fellowship for one graduate student, and joint work involving a local technology company, we have begun investigating highly ordered nanoporous hard carbons for use in pseudo- and super-capacitors. These are devices that utilize high surface area electrodes to increase the capacity of energy storage over that of conventional electrolytic capacitors.

The most recent list of publications from the group may be found at: http://www.umsl.edu/~majzoube/

Bruce A. Wilking

Using infrared and optical spectroscopy, I am investigating the ages and masses of young stars in several nearby molecular clouds. We have completed an optical spectroscopic survey of the young cluster in Ophiuchus (Erickson et al. 2011, *Astronomical Journal*, v142, 140), and a comparable survey of the cluster in the Serpens cloud is well underway. The goals of the studies are to gain insight into the star-forming history and construct the distribution of stellar masses for each region. These studies will form the bulk of Kristen Erickson's Ph.D. dissertation. A possible deficit of low mass stars and brown dwarfs is observed in the Ophiuchus region. Spectra were obtained in June 2009 and 2010 using the WIYN 3.5 meter telescope at Kitt Peak and in July 2010 and August 2011 at the MMT 6 meter telescope at Mt. Hopkins. In addition, we collected echelle spectra for the brightest 18 Serpens objects and in July 2009 and 2010 at the 6.5 m Magellan telescope at Las Campanas Observatory in Chile. Using multi-epoch observations from NRAO's Very Long Baseline Array, we followed an outburst in water maser emission from a young binary system and used it to trace a jet from an unresolved companion to the T Tauri star Haro 6-10S. A paper has been submitted to the *Astrophysical Journal*.

http://www.umsl.edu/~wilkingb
bwilking@umsl.edu

Alumni Information

1968

Larry Ramsey (B.S.) visited the Department in February and gave a very informative and enjoyable colloquium entitled "The Pathfinder Testbed: Exploring Techniques for Precision Radial Velocities in the Near-Infrared". Larry is a Professor of Astronomy at Penn State University.

1977

James Malke (B.S.) is a Converged Infrastructure Specialist for Hewlett-Packard Company in St. Louis.

1986

Craig Gulley (B.S.) is a regional manager for Creston Midwest, Inc.

1991

Tim Giblin (B.S., M. S. 1993) was the guest speaker at the banquet for the 20th Annual Meeting of the NASA Missouri Space Grant Consortium held on the UMSL campus. He also served on a panel discussing careers in space science. He was featured in the UMSL Online News in April (http://blogs.umsl.edu/news/2011/04/19/giblin/). Tim works for the United Space Alliance in Houston Texas and is also an adjunct professor at the University of Houston-Clear Lake.

1993

James P. Crowe (B.S.) is a Lt. Commander USN and currently deployed in Afghanistan. He is there as a civil engineer working to train Afghans to maintain the facilities that have been built by the U.S. military for the Afghan Army and the Afghan National Police. Jim also holds a bachelor's degree in civil engineering from Rolla and a Master's degree in civil engineering from the University of Illinois.

1997

Lebeé Meehan (M.S.) and her husband Jim have a baby daughter Lorcan.

1998

Tina Fanetti (B.S., M.S. 2005) successfully defended her doctoral dissertation in UMSL's College of Education entitled "The Effect of Problem-Solving Video Games on

the Science Reasoning Skills of College Students" in November of this year.

1997
Wentao Qin (M.S., Ph.D. 2001) is working for ON Semiconductors in Phoenix, AZ, a "supplier of high performance silicon solutions for energy efficient electronics".

2003
Daisuke Takeshita (M.S., Ph.D. 2010) is now a post-doctoral research associate in the Department of Ophthalmology at the University Medical Center, Göttingen, Germany. He visited the Department in September and gave an excellent colloquium entitled "Imaging and Modeling Synchronization Dynamics in Epileptic Seizures".

2007
Melissa Pastorius (B.S.) is tutoring in science and math in Pasadena, CA.

2008
Zak Jost (B. S., M.2011) is a research scientist at MEMC Electronic Materials in St. Peters, MO.

Tim Maher (B.S.) is in the graduate program at Bard College's Climate Science and Policy Program.

Jinfeng Wang (Ph.D.) is a metrology engineer doing product development for Cabot Microelectronics Corporation. He was married in April.

2009
Roxana Contreras (Ph.D.) accepted a postdoctoral position at the Arctic Centre, University of Lapland, in Rovaniemi, Finland.

Keara Wright (B.S.) received her M.S. degree in mathematics from Missouri S&T. She is currently designing math and physics tutorials for Virtual Nerd.

2010
Chris Bishop (B.S.) is in the physics doctoral program at the University of Tennessee at Knoxville.

2011
Lauren Stephenson (B.S.) is currently a graduate student at the Institute for Astronomy in Honolulu, Hawaii.

Contributors 2010-2011

Thanks to all for your generous contributions! Please contact us if you made a contribution to the Department from July 1, 2010–November 15, 2011 and your name does not appear.

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