

For alumni, friends, faculty, and staff of the MSM-UMR-Missouri S&T Physics Department

Hagen Wins a Piece of the Nobel Peace Prize

A team of researchers from Missouri University of Science and Technology played an integral role in the research that led to the 2007 Nobel Peace Prize, which was shared by former Vice President **Al Gore** and the Intergovernmental Panel on Climate Change (IPCC). Last spring the Missouri S&T group received official recognition from the Nobel Committee.

The award was presented for “efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change.” The IPCC was recognized for its research connecting human activities and global warming. Missouri S&T researchers from the Center of Excellence for Aerospace Particulate Research contributed their work with studies of aircraft emissions in the atmosphere.

The Missouri S&T team is led by **Dr. Donald Hagen**, professor of physics, and **Dr. Phil Whitefield**, professor and chair of chemistry. Their research into the role of aircraft emissions on climate change was featured in a chapter of “Aviation and the Global Atmosphere,” one of the scientific reports from the IPCC that contributed to the Nobel Prize. Hagen and Whitefield were two of the chapter’s lead authors. The report summarized the role of aircraft emissions in climate change and made predictions based on that information.

In the mid-1990s, Hagen and Whitefield were invited to join the IPCC and contribute their research to the panel. For more than a decade, the pair has been studying particulate emissions produced by aerospace activities, such as aircraft operations and rocket launches. Their work has led to the development of an internationally accepted approach to characterize the nature of particulate matter, or soot, in jet engine and rocket exhaust.

Soot is the most complex of the emittants of a jet engine and the least understood, Hagen says. “Much is still unknown about its environmental and health impacts,” Whitefield adds. The Missouri S&T researchers are examining soot, as well as other aircraft emittants.

They’re examining how airplanes affect the natural balance the earth uses to deal with the sun’s radiation, Whitefield explains. “That is the energy driving the whole global climate change issue. We’re dumping all these greenhouse gases into the atmosphere and they’re upsetting that natural balance.” “And that’s becoming increasingly interesting to the population as a whole,” Hagen adds.



Don Hagen and Phil Whitefield

Hagen and Whitefield credit their colleagues at Missouri S&T for much of their recognition. “One reason we were able to do so much work in this area is because we are at a university that is a mix of science and engineering,” Hagen says.

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“We were able to represent the university on the IPCC, but we drew on phenomenal support from our colleagues who work with us in this interdisciplinary center. Missouri S&T is a unique entity to foster that kind of work.”

In addition to Hagen and Whitefield, **Dr. Darryl Alofs**, professor of mechanical and aerospace engineering, **Dr. Nuran Ercal**, professor of biochemistry, and **Dr. Gary Gadbury**, assistant professor of mathematics and statistics, also work on the project, as well as graduate and undergraduate students. *Adapted from a Missouri S&T News Release, June 10, 2008.*

Memo from the Chair

The climate at Missouri University of Science & Technology this year has been dominated by recent events in the global economy, just as I am sure those events have had major impacts on the lives of all of you reading this. The uncertainty generated by the economic problems, particularly as they impact the state budget and its appropriations for higher education, have us all rather anxious. The likely budgetary shortfalls will tax the creative talents of the campus to find new ways to provide a quality educational experience with a dwindling budget. While no one knows what the exact budget scenario will be, it is unfortunate that this comes at a time when state appropriations as a source of revenue for the campus has dropped from 42% in 2000 to 28% in 2007. The university has partially compensated for this reduction through increased enrollment, but we are now bursting at the seams and will no longer be able to compensate with additional enrollment growth. Clearly challenging times lie ahead, but I am confident that the resourcefulness and resilience of the faculty, staff, and students together with the continued generous support of our alumni will allow us to weather these difficult times and emerge from them stronger and better suited to face the future.

Considering the times, the department has fared remarkably well this year. A new physics scholarship was established thanks to the generosity of **John R.** (Ph.D. 1969) and **Patty Rogers** in endowing the John R. and Patty Rogers Scholarship in physics. Also, the hard work of the university development office in generating contributions from alumni anchored by a major gift from the estate of **Jon T. Schneeberger** in memory of his father **Fred C. Schneeberger** (General Science 1925) will allow us to make much needed replacements and upgrades of equipment in the undergraduate laboratories. Finally, we have completed Phase I of a three phase plan to upgrade the facilities in the department's large lecture hall. This year's upgrades include a new computer, new projector and screen, new flat panel monitors, and a new sound system to meet the audio/video needs of current educational technology.

The department also grew this past year. We are happy to welcome Dr. **Ulrich Jentschura**, an atomic, molecular, and optical physics theorist specializing in quantum electrodynamics. Dr. Jentschura joined us from Heidelberg University in January 2009. He is busy acclimating to life in the midwest, and tending to the many duties of a new faculty member. We look forward to reporting more about his research and teaching in future editions of Matter 'n Motion. Also, in September, 2008, Dr. **Alexey Yamilov**, who joined the department as a Research Assistant Professor in Fall 2005, was appointed to a tenure track Assistant Professor position. Some of Dr. Yamilov's accomplishments have been detailed in past editions of Matter 'n Motion, and we expect to bring you more details of his exploits in coming years.

This December it was my pleasure to meet **Charles E. Byvik** who

was awarded a professional degree from the physics department at the December 2008 commencement. Chuck received his M.S. from UMR in 1964 and is currently Associate Director for Electronics (Science and Technology) in the Office of the Secretary of Defense. He and his wife **Terry** attended commencement which coincided with their 44th wedding anniversary! Their visit is detailed elsewhere in this edition of Matter 'n Motion.

Contrasting the pleasure of meeting new friends and members of the department is the sorrow at the passing of old friends and colleagues. The department was saddened to learn of the death of **Robert H. McFarland** last September in Neosho, MO at the age of 90. He and his wife **Twilah** moved there from Rolla to be closer to their son and family. Bob served the university as Dean of the Graduate School, and his efforts in that office helped to establish the quality of the graduate programs and the stature of a graduate degree from UMR. 'Mac' regularly attended the departmental colloquia well into his retirement years, and I was constantly amazed by the breadth of his knowledge, and his dedication to the department, the university, and the community. He will be missed by all.

In closing, I would like to thank all of you for your continued support. The department remains a vital and thriving unit despite difficult times. This is primarily due to the quality and dedication of our faculty, students, staff, and alumni. I hope that in these troubled financial times we can continue to count on the generous support of our alumni. It is clear that the department's ability to provide a quality education to our students would be hampered without your dedication and support.

– Dan Waddill



What happens when the department chair refuses to allow Pam and Ellen to decorate the inside of his office for Christmas? See page 4 for the answer.

Physics Department Awards 2008-2009 Scholarships and Fellowships

The following scholarships have been endowed through the generous gifts of the friends of the Missouri S&T Physics Department. Please contact the Physics Department if you would like to add to the endowment fund of these scholarships or would like to establish a new one.

Recipients of the *Harold Q Fuller Scholarship-Loan* were **Lane Martin**, of Rogersville, Missouri and **David Kimzey**, of Arnold, Missouri. The \$1,300 scholarship-loan was endowed by the late Dr. **Harold Q Fuller**, chair of the Physics Department from 1948 to 1970 and former Dean of the College of Arts and Sciences, to recognize outstanding achievements among juniors and seniors in physics. One quarter of the scholarship is an interest-free loan that students begin to repay when they start their first jobs.

The recipient of the *Burke H. Miller Memorial Scholarship* was **Thomas White**, of St. Louis, Missouri. This \$500 endowed scholarship was established by the Miller family to commemorate the academic achievements of their son, Burke, who graduated with a bachelor's degree in physics in 1969 and later died during the Vietnam War. The award is for promising and dedicated students in physics.

Ciaran Ryan-Anderson of Ellsinore, Missouri, **Tara Biggers**, of Marshfield, Missouri, **Jake Walker**, of Kansas City, Missouri, and **Joshua Cardenzana**, of Reeds Springs, Missouri, were awarded the \$1000 *Ed and Mary Sue Sickafus Endowed Scholarship/Fellowship*, established by **Ed** (BS '55, MS '56) and **Mary Sue Sickafus** in conjunction with the Ford Motor Company and awarded to physics students on the basis of their performance at Missouri S&T.

Lauren Rich, of St. Joseph, Missouri and **Elizabeth Fiechtner**, of Sioux Falls, South Dakota received the *Leon E. Woodman Memorial Scholarship*. This \$1000 scholarship was established by the Woodman family in honor of Dr. **L. E. Woodman**, Chair of the Physics Department from 1919 to 1948. It is offered to students in physics who are of good moral character, maintain a satisfactory grade point average, and are in financial need.

The *Richard W. Hannum Endowed Development Fund* was established through a bequest by **Richard Hannum** (PhD '66). The fund is currently used to provide scholarships for outstanding students in Physics. **Jonathan Gigax**, of Marshfield, Missouri received the \$1000 Hannum Scholarship for 2008-2009.

The *Stephen P. Reed Scholarship Fund*, an endowment, provides scholarships to US citizens enrolled in mathematics or physics who are sensitive to a peaceful and humane search for knowledge and solutions to technical problems of mankind. **Thomas White**, of St. Louis, Missouri received the \$500 Reed Scholarship for 2008-2009.

The *Richard Anderson Scholarship Fund* is an endowment established in memory of Dr. **Richard Anderson**. **Jason Mast**, of Kansas City, Missouri received the \$1000 Anderson Scholarship for 2008-2009.

In addition to endowed scholarships, which are usually awarded to juniors and seniors, the department awards special *Physics Department Scholarships*, funded from the annual phonathon, to students who earn a grade point average of 3.5 or higher. This past year, department scholarships ranging from \$500 to \$1000 were awarded to **Nicholas Brackley**, of Memphis, Tennessee, **Matthew Callaway**, of Jefferson City, Missouri, **Joshua Cardenzana** of Reeds Springs, Missouri, **Brian Derickson** of Farmington, Missouri, **Adam Farquhar**, of St. Louis, Missouri, **Jonathan Gigax**, of Marshfield, Missouri, **Christopher Immele**, of Kansas City, Missouri, **Nathan Kelly**, of Blue Springs, Missouri, **Ian King**, of Rolla, Missouri, **Benjamin Knapp**, of Columbia, Missouri, **Kurt Konyalioglu**, of Overland Park, Kansas, **Josiah Perisho**, of Conway, Missouri, **Thomas Schmit**, of Naperville, Illinois, **Kenneth Smith**, of Florissant, Missouri, and **Christopher Svoboda** of Kansas City, Missouri.

Endowments: Gifts that Continue to Give

Many generous donors have found that creating an endowment, a fund established with cash, securities or other assets which provides income in perpetuity, offers a significant, long-term impact on Missouri S&T. Endowments can be unrestricted or restricted for a specific purpose such as scholarships, department programs, faculty support, etc. Endowments can be started with as little as \$15,000 and additional funds can be added at any time in the future.

The Missouri S&T Physics Department has several donors that have been adding to their endowment for several years, including endowments established by **Ed** and **Mary Sue Sickafus**, and by the estate of **Richard Hannum**.

The ongoing nature of an endowment provides a way to support your alma mater and give them the financial strength to do things that might not otherwise be possible. If you want to learn more about the Missouri S&T endowment program and how you can participate, please call 1-800-392-4112, or email giving@mst.edu.

Report from the SPS

This year was marked by several changes in SPS. As our upperclassmen graduated, the reins were passed to a new generation of SPS members. We were sorry to say goodbye to some of our long standing members and their traditions, but we were able to welcome in a new year with some new “traditions.”

In the past, SPS members were able to visit Argonne National Laboratory for the National Undergraduate Symposium. This year, however, we chose to attend the SPS Quadrennial Congress, held on the same weekend as the Symposium. Held at Fermilab, the congress was an opportunity to network with other physicists and tour the facility. With some 600 members present, it was one of the largest congresses in this history of the SPS. Some of the topics that were discussed included the need for outreach programs. It is estimated that nearly 80% of Americans are “science illiterate”, a statistic that SPS is actively trying to change. In this time of economic uncertainty, increasing knowledge of and enthusiasm for the sciences is more important than ever. Our special thanks go to our chairman, Dr. **Waddill**, and those who support the department for making this opportunity available to us.

Other changes include a new communal refrigerator policy, aimed at reducing biohazards in the SPS room. We recently spent a weekend cleaning up the SPS room and are happy to report it is, once again, spick and span. We also have some ambitious plans for the room that involve a rich shade of green. Aside from modifying our SPS room, we have also been able to take our liquid nitrogen ice-cream demonstrations to some other organizations on campus. Somehow, the SPS is becoming synonymous with delicious ice cream. Some goals for the future include setting up some leisure activities for SPS members, such as a billiards tournament.

--Tom Schmit, President of SPS



Jason Mast. "Cleaning" really means cleaning.



What happens when the department chair refuses to allow Pam and Ellen to decorate the inside of his office for Christmas?



Tom Schmit. No, your set does not need adjustment, but the camera lens now needs cleaning.



Grinched!

Al-Hagan Awarded GEC Research Prize



At the 61st Annual Gaseous Electronics Conference, held in October in Dallas, Texas, Physics Department graduate student **Ola Al-Hagan** was selected by the GEC Executive Committee as winner of the GEC Student Award for Excellence.

The \$1000 prize was given to the student who gave the best paper presentation at the conference. Ola was one of seven students from around the world who competed. Ola's prize-winning talk was "Atomic and molecular signatures for charged particle ionization." Ola's research was carried out under the supervision of professor **Don Madison**.

Congratulations to S&T's 2008 Physics Degree Recipients!

May 2008

Bachelor of Science

- Paul Webster Gholson
- Mark Richard Herrera
- Michael Dean Hoffman
- Shellie Linn Huether
- Ryan Craig Hupe
- Samantha Glen Matthews
- Paul Michael Robinette
- Dustin Wayne Spieker
- Bradley David Towery
- Christopher James Van de Riet

December 2008

Bachelor of Science

- Phillip Grant Holloway (August)
- Thomas Eric Mahler
- Lane Adam Martin
- Lauren Elizabeth Rich
- Michael J. Scheetz

Master of Science

- Caleb Kern Klapp
- Benjamin Henry Payne

Doctor of Philosophy

- Jin Feng Wang (August)

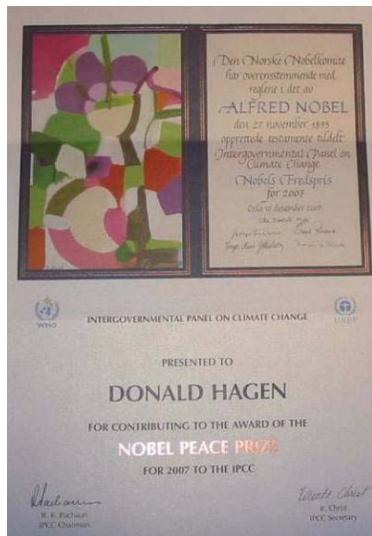
Planned Giving:

Leaving a Legacy to Missouri S&T

Many alumni and friends have realized that a future gift – one arranged through their will or trust – allows them to give back to their alma mater more than they ever thought possible. With careful planning, charitable estate giving can reduce your estate tax liability or transfer assets to your family at a lower gift tax cost.

Making a planned gift shows your loyalty to Missouri S&T, an institution that played a significant role in shaping your future. For more information about giving a current or planned gift, contact the Office of Development at 1-800-392-4112 or e-mail giving@mst.edu.

Don Hagen's award certificate and a copy of the 2008 Nobel Peace Prize presented to the IPCC (see story on page 1).



Vojta Chairs International Conference

One of the most fruitful ideas in today's physics is the concept of emerging phenomena, which can be summarized by the phrase "more is different!" It is based on the observation that systems with a large number of degrees of freedom, such as solids, show complex behavior that does not exist at the level of their constituents (electrons and nuclei). Strongly-correlated electron systems are a prominent example of this concept.

Strongly-correlated electron systems are materials in which electrons interact more strongly than is usual in solids. As a result of these interactions, the materials display many exotic and unconventional properties, such as novel kinds of superconductivity and complex magnetic patterns.

Missouri S&T Physics faculty member **Thomas Vojta**, together with **Andrey Chubokov** of the University of Wisconsin and **Matthias Vojta** of the University of Cologne in Germany, chaired an international workshop and conference on "Unconventional Phases and Phase Transitions in Strongly Correlated Electron Systems" in June 2008. The month-long workshop was generously supported by the German Max-Planck Society and hosted at the Max-Planck Institute for Physics of Complex Systems in Dresden, the capital of the German state of Saxony. It brought together 126 researchers from 22 countries and 4 continents. The scientific program started with a four-day conference during which leading experimentalists presented their newest results. In the following weeks, the program featured a series of informal talks by theorists as well as ample time for research and spontaneous but intensive and occasionally heated discussions which were used for exchanging ideas and starting new collaborations.

In addition to the scientific program, the participants enjoyed a city tour featuring Dresden's famous baroque architecture and a ride on a historic paddle-wheel steamer on the river Elbe.



Thomas Vojta, daughter Sophia, and son Philipp, in front of Castle Moritzburg, near Dresden



Historic steamer on the river Elbe

Physics Department Acknowledges

Corporate Support

The Physics Department gratefully acknowledges the support of the following corporations:

3M Foundation
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 General Electric
 General Mills Foundation
 Lockheed Martin Corporation
 Oracle Corporation
 Shell Oil Company Foundation
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 Vikings USA Bootheel MO #190

Student Notes

Mike Hoffman won the Natural Sciences poster competition in the S&T Undergraduate Research Conference held on April 9, 2008. His poster was "Linear and nonlinear study of trapped electron mode turbulence," supervised by professor **Ralph Alexander**.

Graduate student **Elizabeth Black** received a \$10,000 Graduate Research Award for 2008-2009. The award was given by the Transportation Research Board of the National Academies, sponsored by the Federal Aviation Administration, and is administered by the Airport Cooperative Research Program. Her award-winning proposal was entitled "Lung deposition of jet engine exhaust particulates."

Robert McFarland Remembered

Robert Harold McFarland was born on January 10, 1918, near Severy, Kansas, four days after the family farm house was destroyed by fire. He attended Kansas State Teacher's College (KSTC) in Emporia, Kansas, and in 1940 was awarded both a B.A. in Physics and Mathematics and a B.A. in Education. While at KSTC, he played football, taught physics laboratories, was president of the junior class, and valedictorian. Shortly after graduating from college, Bob married **Twilah Mae Seefeld**, whom he met two years before in his calculus class.

Bob went to graduate school at the University of Wisconsin, Madison. He obtained his masters degree in Physics in 1943 and for a year he was a full-time instructor at the university. He then took a job in war time research with Sylvania Electric Corporation, where three patents resulted from his work on the erratic starting of fluorescent lamps. This work ultimately led to the development and commercialization of rapid starting ballasts and lamps. In 1946 he returned to the University of Wisconsin and used his work at Sylvania to complete his Ph.D. in Physics one year later.

From 1947 until 1960 he rose through the ranks of faculty positions at Kansas State University (KSU), where he became Professor of Physics and Director of the Nuclear Laboratory, which he founded and which ultimately involved forty-five people from various campus departments. While at KSU, he was supported by eight research grants awarded by government agencies including the Atomic Energy Commission, Office of Army Research, and the National Science Foundation. These grants totaled more than one-half a million dollars. The first Ph.D. student in physics at KSU was his student.

In the spring of 1960, he was recruited by **Edward Teller** to the Lawrence Radiation Laboratory, Livermore, California. He spent nine years at the Radiation Laboratory where he served as head of an atomic physics group working on atomic phenomena of importance to controlled fusion. His work included a paper which explained a long standing problem on the puzzling aspects of polarization of electron-induced radiation from helium.

In March, 1969, Bob became the Dean of the Graduate School at UMR, a position he held for ten years. He improved the academic quality of beginning graduate students, as well as the quality of graduate student dissertations. His efforts increased the stature of a graduate degree from UMR. While serving as Dean, he was also a member of the Council of Graduate Schools and in 1972 was appointed by the council for four years to the Graduate Record Examination Board. His activities gave UMR needed national exposure. During 1974-75 he served as Interim Vice-President for Academic Affairs for the four campus University of Missouri system. From 1979 to 1983 he was Director of Institutional Analysis and Planning at UMR.



During 1980-81, "Mac" was a Visiting Professor at the Lawrence Berkeley National Laboratory where at the request of the Office of Fusion Energy he supervised six graduate students on an atomic physics fusion project involving negative ion beams. His research also involved resonant electron transfer and excitation. From 1982 to 1984, he took leave from UMR and was appointed Program Manager for Atomic Physics Research at the Office of Fusion Energy, Department of Energy, Germantown, Maryland, where he reviewed proposals for high energy physics research grants. Shortly after his return to UMR, he retired on January 1, 1985.

The McFarlands lived in Rolla for many years after retirement, but about five years

ago they moved to Neosho, Missouri, to be with their son and his family. Dr. Robert McFarland died there on September 14, 2008, at the age of 90.

During his forty-seven year career in science, Bob published more than 110 publications and was awarded six patents. He was a Fellow of both the American Association for the Advancement of Science and the American Physical Society.

Bob contributed greatly to the local community. He was a long time member of Kiwanis and held many club and division offices. He received Kiwanis International's greatest award - the Tablet of Honor, and founded the Rolla Kiwanis Breakfast Club. He actively supported the Boy Scouts, and both his sons were Eagle Scouts. He and his wife, Twilah, started the University of Missouri-Rolla Retirees Association (now known as The Miner Retirees Association). He was President of this group for two years and served on the U-Wide retirees council. He was a board member of the United Way and the ABLE Commission.

Bob and Twilah have been blessed with two sons, **Alan** and **Rodney**, four granddaughters, and a grandson. Alan McFarland lives with wife **Birgitt** in Spokane, Washington, and Dr. Rodney McFarland and wife **Kathy** live in Neosho, Missouri.

This Memorial Resolution was incorporated into the official minutes of the Missouri S&T General Faculty Meeting of 2 December 2008, and copies were sent to Robert's widow, Twilah, and to his sons Alan and Rodney and their families.

Adapted from a memorial resolution by Edward B. Hale, John T. Park, and Joseph H. Senne.

To Contact S&T Physics

If you would like to contact us for any reason, you can reach us by phone at (573) 341-4781 and by e-mail at physics@mst.edu. You might also be interested in checking out our web page, <http://physics.mst.edu>.

DuBois Organizes International Workshop

Missouri S&T Professor **Robert DuBois** co-organized a Pan American Advanced Studies Institute (PASI), titled “Ultrafast and Ultrasmall; New Frontiers and AMO Physics.” The workshop was held in Buzios, Brazil, between March 30 and April 11, 2008, and was co-organized by colleagues from the Advanced Light Source at the Lawrence Berkeley Laboratory in California, the Universidad Nacional Autónoma de México in Mexico, the Universidade Federal do Rio de Janeiro, the Pontifícia Universidade Católica do Rio de Janeiro, and the Laboratório Nacional de Luz Síncrotron, in Brazil.



Bob's Fine Diner, Buzios, Brazil

Primary funding of the PASI was through a grant Dr. DuBois received from the National Science Foundation; supplementary funding was provided by the Conselho Nacional de Desenvolvimento Científico e Tecnológico, (Brazil), the Missouri University of Science and Technology, and the Centro latinoamericano de Física (Latin America).

For two weeks, 14 invited lecturers, 6 local lecturers, and 34 graduate students and postdocs from the USA, México, and South America discussed two exciting new areas relevant to the fields of Atomic, Molecular and Optical (AMO) physics, chemistry, and material science. These areas are concerned with using ultrafast techniques, i.e., timeframes ranging from femtoseconds to attoseconds, to investigate processes occurring within and/or properties associated with ultrasmall volumes, i.e., lengths ranging from a few to many tens of nanometers.

These two areas are relatively new but are already impacting and pushing back the borders of physics, chemistry, and material science into uncharted territories and dramatically expanding our understanding of physical and chemical processes. For more information and some pictures of Búzios, where the meeting was held, go to <http://campus.mst.edu/physics/courses/conf/dubois/Pasi/index.html#Program>.



Planning an international workshop is hard work

Congratulations to 2008 Physics Academic Scholars

Students who maintain at least a 3.50 GPA for twelve hours or more of coursework are honored for their outstanding accomplishment by being named Academic Scholars.

Spring Semester 2008

Tara Biggers, Brian Derickson, Adam Farquhar, Elizabeth Fiechtner, Jonathan Gigax, Mark Herrera, Shellie Huether, David Kimzey, Lane Martin, Jason Mast, Dustin Powell, Lauren Rich, Gena Robertson, Ciaran Ryan-Anderson,

Thomas Schmit, Kenneth Smith, Dustin Spieker, Bradley Towery, Christopher Van de Riet, and Jake Walker.

Fall Semester 2008

Tara Biggers, Matthew Callaway, Joshua Cardenzana, Brian Derickson, David Dotson, Adam Farquhar, Elizabeth Fiechtner, Jonathan Gigax, Jesse Hoemann, Micah Johnston, Lori Kennedy, David Kimzey, Benjamin Knapp, Kurt Konyalioglu, Stephen Lee, Lane Martin, Jason Mast, Andrea Mcbee, Melissa Ray, Lauren Rich, Ciaran Ryan-Anderson, Thomas Schmit, Christopher Svoboda, Jake Walker, Thomas White, and Stephen Yeo.

Fourth Annual S&T-UMSL Joint Meeting

On October 24, 2008 Missouri S&T hosted the Fourth Annual S&T/UMSL Joint Physics Department Meeting. These meetings are intended to foster closer ties between the departments, and to strengthen the cooperative Ph.D. program.

About twenty five students and faculty from UMSL made the trip to Rolla for the meeting. Graduate student research from both departments was featured in a large number of impressive poster presentations, and a lively discussion of the research took place over lunch and during the early afternoon.

Cash prizes and certificates were awarded for the top three posters with UMSL student **David Coss** awarded \$500 for first prize, S&T student **Altynbek Murat** awarded \$300 for second, and S&T student **Jason Alexander** awarded \$200 for third. The awards were presented prior to a keystone colloquium given that afternoon by Dr. Fred Schlachter from the Lawrence Berkeley National Laboratory and the American Physical Society entitled “*Over a Barrel: America’s Energy Crisis.*”



David Coss

New Faculty Member Ulrich Jentschura

Ulrich Jentschura toured the world before ending up in the middle of everywhere, also known as Rolla Missouri. He was born in West Berlin, studied in Munich, did his PhD in Dresden, and after postdocs in Freiburg and Heidelberg was appointed Assistant Professor in the Physics Department at Missouri S&T. In between, his journeys took him to postdocs in Paris, and at the National Institute of Standards and Technology in Gaithersburg, and on extended visits at Cambridge University and Oxford in the UK. His scientific collaborations have taken him to St. Petersburg in Russia as well as to Bologna in Italy.

Ulrich has published more than 60 papers in scientific journals and served as a group leader at the Max-Planck-Institute for Nuclear Physics in Heidelberg for four years. He has supervised students at both graduate and undergraduate levels and published a paper on the “*physics of skiing*” in the Canadian Journal of Physics.

Ulrich's research involves one of the more challenging areas of theoretical physics: bound-state quantum electrodynamics. A bound electron does not necessarily emit light during an optical transition; the bound particle might undergo a virtual transition, immediately hopping back to the ground state where it came from. This is made possible by the quantization of the electromagnetic field, where photons do not come continuously but in packets carrying a quantum of energy.

From quantum electrodynamics emerge theoretical predictions about everything that you wanted to know about physics, from relativistic theory to the quantization of the light field. Ulrich's work complements the department's activities in atomic physics.

Ulrich has also worked on high-field laser-related radiation phenomena: what happens when the light field is so strong that even the strong electric field of an atomic nucleus merely constitutes a perturbation of the trajectory of the electron? What happens when matter perturbs light, and not the other way around?

Here, it becomes crucial to know at the quantum level how the electron moves in the periodic light field, and what relativistic effects come into play. Computer simulations are required to show how the electron moves, which radiation gets emitted, and which particle-antiparticle pairs get produced in the light field. This is currently an important field of research because many laser laboratories are currently being built up both on the national as well as international level.

At S&T, Ulrich is building a computer cluster using his start-up support and hopes to resume his research activities soon after sorting out the inevitable friction effects due to his relocation and jetlag. His hobbies include a little bit of sports, such as skiing, tennis, long-distance running, and climbing in the Swiss and Austrian Alps.



Ulrich Jentschura

The Physics Department gratefully acknowledges the support of the following alumni and friends.

Donations over \$100:

Leroy H. Alt
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Phonathon 2009

A total of 170 alumni and other donors pledged \$35,455 in donations to the MSM-UMR-Missouri S&T Physics Department last year. Last year's fundraising Phonathon raised \$15,880, with an average gift of \$174 from 91 donors. The department greatly appreciates your generosity, which helps to support scholarships and student activities like the Society of Physics Students.

"With new scholarships made possible by past phonathon donations the department has been able to more than double undergraduate enrollment since Spring 2005," says Dr. **Dan Waddill**, Chair of Physics. "This year we continue to work towards our goal of 100 undergraduate and graduate majors. Every dollar you can give for scholarships and graduate fellowships will greatly assist the department in its aggressive recruitment plan, and will be greatly appreciated. In addition, in this time of shrinking state support for higher education our department, along with all academic units, are more reliant than ever upon the generosity of our alumni to continue to provide the outstanding education we are known for. Your continued support will also allow us to maintain instructional supplies and resources in our classes, and support the efforts of our outstanding faculty and students."

This year, we will be calling our alumni April 9 and April 13-16. When the phone rings, please take a moment to share some of your Rolla experiences with a current Missouri S&T student, and say, "Yes," when asked for a pledge.

Taxpayer support accounts for less than one-third of the university's revenue, so your contribution makes up an important part of the department's total income.

Madison Sabbatical

On his recent sabbatical, **Don Madison** visited Australia National University (Canberra), Swinburne University of Technology (Melbourne), the University of Adelaide (Adelaide), Flinders University (Adelaide), and the University of Western Australia (Perth). He also gave an invited talk at the 8th Asian International Seminar on Atomic and Molecular Physics. As you can see from the photo below, working with your colleagues while on sabbatical is truly hard work.



Missouri University of Science and Technology Students & Alumni: In Press

The following journal articles which appeared over the last year feature work by Missouri S&T undergraduate students,¹ graduate students,² or alumni³ under the supervision of Missouri S&T faculty.

"*Infinite-randomness critical point in the two-dimensional disordered contact process*," T. Vojta, A. Farquhar,¹ and J. Mast,¹ Phys. Rev. E **79**, 011111 (2009).

"*Infinite-randomness quantum critical points induced by dissipation*," T. Vojta, C. Kotabage,² and J.A. Hoyos, Phys. Rev. B **79**, 024401 (2009).

"*(e,2e) ionisation of helium and hydrogen molecule : evidence for two-center interference effects*," E M Staicu Casagrande, A Naja, F Mezdari, A Lahmam-Bennani, P Bolognesi, B Joulakian, O Chuluunbaatar, O Al-Hagan, D H Madison, D V Fursa and I Bray, J. Phys. B: **41** 025204 (2008).

"*Higher-order contributions observed in three-dimensional (e,2e) cross section measurements at 1 keV impact energy*," M. Dürr, C. Dimopoulou, B. Najjari, A. Dorn, K. Bartschat, I Bray, D. V. Fursa, Zhangjin Chen, D. H. Madison, and J. Ullrich, Phys. Rev. A **77**, 032717 (2008)

"*Investigating many-electron exchange effects in electron-heavy-atom scattering*," S. Bellm, J. Lower, Z. Stegen,³ D. H. Madison, and H. P. Saha,² Phys. Rev. A **77**, 032722 (2008)

"*Projectile interactions in theoretical triple differential cross sections for simultaneous excitation ionization of helium*," A. L. Harris,² M. Foster,³ J. L. Peacher, and D. H. Madison, J. Phys. B. **41** 135203 (2008).

"*Absolute cross sections for the ionization-excitation of helium by electron impact*," S. Bellm, J. Lower, E. Weigold, I. Bray, D. V. Fursa, K. Bartschat, A. L. Harris,² and D. H. Madison, Phys. Rev. A **78**, 032710 (2008).

"*Interference effects due to projectile target nucleus scattering in single ionization of H₂ by 75-keV proton impact*," J.S. Alexander,² A.C. LaForge,² A. Hasan, Z.S. Machavariani, M.F. Ciappina, R.D. Rivarola, D.H. Madison and M. Schulz, Phys. Rev. A **78**, 060701(R) (2008).

"*Spin- and fine-structure-resolved ionization of krypton*," S. Bellm, J. Lower, R.P. McEachran, E. Weigold, C. Ryan-Anderson,¹ and D.H. Madison, Phys. Rev. A **78**, 062707 (2008).

"*Atomic and molecular signatures for charged particle ionization*," Ola Al-Hagan,² Christian Kaiser, Don Madison, and Andrew Murray, Nature Physics **5**, 59 (2009).

Chuck Byvik Awarded Professional Degree

Charles E Byvik (MS '64) was awarded a Professional Degree in Physics at the December 2008 commencement. Chuck received his B.S. in physics from the Illinois Institute of Technology, his M.S. in physics from UMR in 1964, and his Ph.D. in physics from Virginia Polytechnic and State University.

Chuck began his professional career doing bench-level R&D at NASA Langley Research Center in a broad range of science and technology areas, including wide bandgap electronics, electromagnetic radiation interactions with semiconductors, high temperature superconductor electronics, photo-electrochemistry, semiconductor and solid state lasers, and radiation hardened electronics for space applications. He then changed positions and provided contract support for program management, development and oversight of advanced materials, structures, power, and electronics technologies for the Missile Defense Agency.

Chuck is currently Associate Director for Electronics (Science and Technology) in the Office of the Secretary of Defense. He is responsible for formulating guidance, developing strategic plans and providing the technical leadership for the DoD electronics science and technology portfolio.

Chuck is a member of the Science Advisory Board of the Government-Semiconductor Industry Focus Center Research Program that funds 38 university activities and 200 research to advance semiconductor electronics technologies. He has served as a non-voting member of the proposal evaluation Team of the Semiconductor Industry Association's Nano-electronics Research Initiative focused on the 'post Moore's Law' replacement of Silicon-based digital technology. He is the representative of the Office of the Director of Defense Research and Engineering to the Joint Advisory Committee overseeing the R&D activities of the MIT/Lincoln Laboratory. He is the Subject Matter Expert for ad hoc Technology Teams evaluating challenges of and options for on-going space-based defense satellite systems including GPS, Space RADARS, space infra-red sensor systems, and communications satellites.

Chuck has participated in assessments of international technical capabilities with site visits to Russia, Japan, and Europe, and he has authored two reports to Congress on defense electronics technology. Chuck was accompanied on his visit to Rolla by his wife **Terry**. They were gracious enough to attend a commencement that coincided with their 44th wedding anniversary!



Chuck and Terry Byvik

Alumni Notes

H. H. "Luge" Luetjen (BS '50) spoke to the Windsor Missouri Senior Center in March 2008 about the history of rocket propulsion.

Paul H. Blackmon (BS '53, MS '55) says "I reached my level of incompetence early in my career, so in 1982 I retired to Hawaii to pursue my interest in world travel. On a recent trip to Antarctica and Peter 1 Island, I achieved a major goal of visiting all seven continents."

John Mastin (BS '62) reports his son, **J. Douglas Mastin**, began work on a PhD in linguistics research at the University of Edinburgh in Scotland. The university sent the 2004 Dartmouth graduate to present a white paper at an international linguistics conference in Barcelona, Spain. Mastin and his wife, **Betty**, live in Cherry Hill, NJ, where he is president of M-Cubed Technology, an IT consulting firm.

Osman Ozturk (PhD '02) tells us "I moved to Turkey. I work in a university as an Assistant Professor."

John Weirich (BS '01) writes "Working on PhD in Planetary Science. I have passed all prelims, and am 1-2 years from finishing."

Haresh Siriwardane (PhD '93) is currently Director of Research and Development for the Data Storage Division of Cabot Microelectronics, located in Singapore.

Sanjay Mishra (PhD '96) was just appointed Professor of Physics at the University of Memphis. His children are 4 and 10 years old, and his wife is an emergency room physician in Memphis.

If you wish to get in touch with any of these alumni, or any others, please contact the Physics Department at (573) 341-4781 or at physics@mst.edu. We can generally give you current phone numbers, along with postal and e-mail addresses. We would be grateful if you would take the time to fill out and return the alumni information on both sides of the last page of this newsletter.

Spacebook:

Magnus in Space Again

S&T alumna Sandra Magnus (BS '86, MS EE '90) is off in space again, this time on a four-month stay aboard the International Space Station.

Magnus, a NASA astronaut, is blogging from space. Her blog, numerous photos, and updates about her stay on the ISS are available at <http://spacebook.mst.edu>. It's fascinating reading; be sure to check it out.

Frontiers in Physics Colloquium Series

The 2008 *Frontiers in Physics Colloquium Series* began in February with Dr. **Daniel Vrinceanu** of the Los Alamos National Laboratory, who spoke on “*Matter under control at extreme conditions.*” He was followed by Dr. **Agapi Emmanouilidou** of the University of Oregon, whose talk was titled “*Attosecond time-scale collisions: A tool for exploring how electrons escape during the photoionization of three- and four-electron atoms.*” Next up was Dr. **Ulrich Jentschura** of the Max Planck Institute of Nuclear Physics & Institute of Physics, Heidelberg University, Germany who outlined the application of quantum electrodynamics to “*Lasers, electrons, quantum dynamics and all that.*” February culminated with Dr. **Tom Kirchner** of the Institute of Theoretical Physics, Clausthal University of Technology, Germany who gave an overview on “*Atomic systems in time-dependent fields: persistent challenges, recent ideas, and new insights.*”

In March, we hosted Dr. **Alicia Palacios** of the Lawrence Berkeley Laboratory, who spoke about “*The role of nuclear motion in ionization of molecules by ultrashort laser pulses.*” She was followed by Dr. **Dieter Bauer** of the Max Planck Institute fuer Kernphysik, Heidelberg, Germany, who covered the topic, “*Atoms and molecules in intense laser fields: from the single active electron via correlation to collectivity.*”

April brought three visitors to our department, starting with Prof. **Eric Majzoub** of the University of Missouri-St. Louis, who discussed “*State of the art hydrogen storage materials.*” Our next visitor was physics alumnus Mr. **Steven R. Frey**, Director, Applied Research-Sensor Systems, Lockheed Martin Corporation. Besides speaking on “*Nonlinear propagation – From UMR physics to the aerospace industry to laser directed energy,*” he provided our students with additional perspective on an industrial career during an informal luncheon meeting. Prof. Maikel C. Rheinstadter of the University of Missouri-Columbia finished the month with his talk, “*The impact of collective molecular dynamics on physiological and biological functionalities of artificial and biological membranes.*”

The spring series concluded early in May with the Thirty Seventh Annual Harold Q Fuller Prize Colloquium, which was run again as a poster competition. Details of the Fuller competition appear in a separate article on page 15.

The colloquium series resumed in the fall with 13 colloquia in a variety of subfields of physics. First up was Dr. **Antonio Carlos Fontes dos Santos**, Universidade Federal do Rio de Janeiro, Brasil with a talk titled “*Ionization and fragmentation of molecules by ion and photon impact.*” Dr. **Gary Yao** from the Bio-Engineering department at University of Missouri-Columbia showed in his talk “*Optical diffuse reflectance in skeletal muscle*” how different optical techniques could be used in the growing field of biophysics.

September began with a lecture by Dr. **Maksim Skorobogatii** from Ecole Polytechnique de Montréal whose research topic “*Color-on-demand photonic textiles using plastic photonic bandgap fibers*” promises to bring the photonics closer to every-day-life applications. Also in September Missouri S&T professors **Don Hagen, Alexey Yamilov, Thomas Vojta, Ulrich Jentschura, Bob DuBois, Paul Parris, Julia Medvedeva,** and **Michael Schulz** showcased their work and outlined the research opportunities in their groups. Next, Dr. **William Klein** from Boston University gave a lecture entitled “*A physicist's view of earthquakes,*” in which he presented several approaches to the predictive modeling of the earthquakes.

During a busy month of October, Dr. **Zaal Machavariani** from Tbilisi State University, Georgia, who was awarded a prestigious Fulbright Scholar travel award to work at our department with with Dr. Schulz, reported the outcome of the collaboration with the lecture “*Single and double ionization of two electron atomic and molecular systems by charged particles impact.*” Dr. **Christian Butth**, Louisiana State University, overviewed a long list of future applications of X-ray lasers which are coming online throughout the world; his talk was titled “*Atoms and molecules interacting with ultrafast x-ray lasers.*” Alumnus Dr. **Ray Vandiver** (PhD '94), who is currently vice president of exhibits for the Oregon Museum of Science and Industry, talked about his career during an invited homecoming colloquium “*Presenting cutting edge topics in an informal science setting.*” During the 4th joint Missouri S&T - UMSL meeting (see page 9) Dr. **Fred Schlachter**, Lawrence Berkeley National Laboratory & American Physical Society, delivered a motivational key-note lecture “*Over a barrel: America's energy crisis.*” October concluded with a colloquium by Dr. **Renat Sabirianov**, University of Nebraska, Omaha, who reviewed “*Novel effects in spin-dependent transport.*”

The November schedule included three visitors. Dr. **Michel Gingras**, University of Waterloo, Canada, lectured on an excited topic in condensed matter physics, “*Geometric frustration in magnetic pyrochlore oxides.*” Optical properties of small dielectric spheres was the topic of the talk “*Whispering gallery modes in microspherical resonators: coupling and scattering*” by Dr. **Lev Deych** from the City University of New York. Continuing a new tradition, the department celebrated the 2008 Nobel Prize in physics with a lecture by our own Thomas Vojta, on “*2008 Nobel prize in physics: spontaneous broken symmetry.*”

In December there were two presentations. The Fifteenth Annual **Laird D. Schearer** Prize Colloquium (see page 14) saw three presentations by the finalists. We concluded the year with yet another interesting biophysics lecture “*Physics of emerging biomedical optical imaging*” by **Dr. Ping Yu** from the University of Missouri-Columbia.

15th Annual Schearer Prize Competition

The Fifteenth Annual *Laird D. Schearer Competition for Graduate Research*, established by the family of Dr. **Laird D. Schearer** to recognize research performed by a graduate student, was held on December 4, 2008. Seven students submitted applications for the competition, consisting of a short description of their research, copies and lists of any publications and presentations they have made, plus a résumé. Based on these applications, the judges, professors **Greg Story**, **Gerry Wilemski**, and committee chair **Paul Parris**, selected the finalists who gave oral presentations of their work in departmental colloquium.

The 2008 finalists were **Jason Alexander**, advised by professor **Michael Schulz**, **Chetan Kotabage**, advised by professor **Thomas Vojta**, and **Altynbek Murat**, advised by professor **Julia Medvedeva**. During the colloquium on December 4, Mr. Alexander

spoke about “*Interference effects due to projectile - target nucleus scattering in single ionization of H₂ by 75 keV proton impact*,” Mr. Kotabage discussed “*Quantum phase transition with dissipation and disorder*,” and Mr. Murat presented “*Structural, optical and electronic properties of multicomponent oxides: a combinatorial approach*.” All students gave excellent talks. First place and a \$500 prize was awarded to Mr. Alexander, while Mr. Kotabage took second place and a \$200 prize, and Mr. Murat received third place and a \$100 prize.

The cash awards were made possible by the generous donations of the Schearer family. Following the presentations, the finalists and numerous faculty members had a relaxing dinner at a local restaurant.

From Schearer Prize Winner Jason Alexander

I am honored to be included among past and future winners of the Schearer Prize Competition. I would like to thank my advisor, Dr. **Michael Schulz**, for giving me the opportunity to work with him here in Rolla and continue to learn experimental atomic physics from the elite of the field. I also want to thank Dr. **Don Madison**, as the head of the Graduate Studies Committee, for allowing me to interview for a graduate assistantship in the Department. Also, I would like to thank my family and friends for their help and support.

I am beginning my final semester here at Missouri S&T and preparing for my dissertation defense, and, as indicated above, my research area is experimental atomic, molecular, and optical physics. My Schearer Prize talk discussed interference effects due to projectile-target nucleus interaction in single ionization of molecular hydrogen by 75 keV proton impact.

The two most important conclusions to be drawn for this work are: 1) interference structures due to the interaction between the projectile and the target nuclei were directly observed in the double differential ionization cross-section as a function of the projectile scattering angle and ejected electron energy. and 2) the ionization amplitude, contrary to previous assumptions, appears to depend strongly on the molecular orientation, with respect to the initial projectile direction, with a transverse (90°) orientation being preferred for small scattering angles and a longitudinal orientation (0°) is preferred for large scattering angles. This work was also recently published as a Rapid Communication in *Physical Review A* (see the “*In Press*” article on page 11).

Finally, I would like to give a special thanks to **Pam Crabtree** and **Ellen Kindle**, who make everything run smoothly, to my colleagues in the competition, **Chetan Kotabage** and **Altynbek Murat**, who gave excellent talks and the Prize Committee for

their patience and the opportunity to participate in this important outlet for graduate students in the Department and talk about our research.



Jason Alexander

Come Back for Homecoming

The Missouri S&T Physics Department warmly invites you to return to Rolla for **S&T Homecoming 2009** on **October 23-24, 2009**. On Friday afternoon, October 23, the department will hold an open house and special programs for its alumni and friends. Tours of laboratories and educational facilities will be offered and there will be opportunities for interaction with current Missouri S&T physics students. Come see what we have done since you received your degree.

In keeping with a long-standing tradition, an S&T alum will deliver the Homecoming 2009 Physics Colloquium at 4 PM. on Friday, October 23. Later that evening, professors **Ed** and **Barbara Hale** will host a homecoming reception in their lovely home. Contact us at physics@mst.edu for specific information about physics department activities, or alumni@mst.edu for general homecoming information. Come home to your college roots, and help us celebrate our past as UMR, even as we work to shape our future as Missouri S&T!

37th Annual Fuller Research Seminar

The 37th annual **Harold Q Fuller** Undergraduate Research Seminar was held on May 1, 2008. This competition promotes participation of undergraduates in research both in the department and in summer intern projects. This year's participants were **Lauren Rich**, "Z-scan by white light continuum," **Ryan Hupe**, "Electron transitions of C_2 in the ultraviolet: a survey with the hubble space telescope," **Mark Herrera**, "Complex networks and scientific ideas: the road to revolution," and **Michael Hoffman**, "Linear and nonlinear studies of trapped electron mode turbulence."



Mike Hoffman

The four participants presented posters of their work to the entire department. The posters were judged by Dr. **Greg Story** (competition chairman), Dr. **Jerry Peacher**, and Dr. **Don Madison**. The results of the competition was a tie for 1st place between Michael Hoffman and Ryan Hupe, who each received \$200, and a tie for 2nd between Mark Herrera and Lauren Rich, who each received \$100.



Ryan Hupe

Faculty Notes

Thomas Vojta gave a series of four lectures on "Disordered quantum phase transitions" during the Summer School of the Asia-Pacific Center for Theoretical Physics in Seoul, South Korea in July 2008. He also gave invited talks at the following three international conferences: The International Conference on Frontiers of Quantum and Mesoscopic Thermodynamics, in Prague; The International Conference on Low-Temperature Physics LT25, in Amsterdam; and the ICAM Workshop on Quantum Phase Transitions: Statics and Dynamics, in Toronto.

Don Hagen is co-PI on a new award from the Department of Transportation entitled "Emissions characteristics of alternative aviation fuels."

Julia Medvedeva has contributed a book chapter "Combining optical transparency with electrical conductivity: challenges and prospects," in **Transparent Electronics: From Synthesis to Applications**, to be published by John Wiley & Sons. She also gave two invited talks last year: "Light-metal TCO: challenges and prospects," at the 2nd International Symposium on Transparent Conducting Oxides, Hersonissos, Crete, Greece, and "Conventional TCO and Beyond: Band Engineering Approach," at the Materials Research Society Fall Meeting in Boston.

Don Madison has received notification of a new 3 year award from the National Science Foundation for "Theoretical Study of Few-Body Processes."

Alexey Yamilov and **Julia Medvedeva** are the proud parents of a baby girl, **Amy Elizabeth**, born March 18, 2008. She weighed 7 lbs. 2 oz., and was 21" long. Congratulations to the new parents!

Ron Bieniek was been promoted to professor effective Sept. 1, 2008. Congratulations Ron!

Julia Medvedeva was selected to receive a well-deserved 2008 Faculty Excellence Award.

Alexey Yamilov was appointed Assistant Professor in 2008, and received a Missouri Research Board grant for studies of "Electromagnetic wave transport through disordered amplifying optical fibers."

Don Madison's research is currently featured on the NSF website: http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=112918&org=NSF.

Thomas Vojta's Physical Review B article "Infinite-randomness quantum critical points induced by dissipation" has been featured in the Viewpoint section of the journal Physics. This is an American Physical Society journal dedicated to "spotlighting exceptional research to help physicists and physics students learn about exciting new developments outside of their own sub-fields." The article is featured on the web at <http://physics.aps.org/articles/v2/1?referer=rss>.

So What's News with You?

We hope you enjoyed this year's edition of **Matter 'n Motion**. We enjoy keeping you informed about what is going on at Missouri S&T, but we'd also like to know what's new with you, both personally and professionally. Any information you send will be circulated in the department and, if appropriate, inserted in the next physics newsletter unless you request otherwise.

Please print or type your information, and include your mailing address so that we can update our records. Mail to: **Physics Department, Missouri University of Science and Technology, 1315 N. Pine St., Rolla MO 65409-0640**. Or, if you would prefer, you can e-mail us your comments at **physics@mst.edu**. Thanks for keeping in touch. It's always good to hear from old friends.

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