

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

Jentschura Scales New Heights

Ulrich Jentschura joined the Physics faculty in 2009. "I left the proverbial students' kisses of the beautiful German city of Heidelberg for the even more beautiful Academic purity of Rolla," says Ulrich. "Having been to the beer festivals of Hermann, Missouri, with the statue of 'Germania's Liberator' overseeing the banks of the Missouri River, I felt right at home from the start."

Ulrich's research has been connected with quantum electrodynamics (QED) since 1995. He did his diploma thesis with **Ted Häensch** in Munich, working on the theory to describe the most accurate measurements of transitions in atomic hydrogen, deuterium, and other simple atoms. This work earned a number of international prizes. The thesis was supervised by Professor **Krzysztof Pachucki**, from Warsaw, Poland. Ulrich's subsequent PhD thesis was conducted in the US primarily under the guidance of Professor **Peter J. Mohr**, at the National Institute of Standards and Technology (NIST). Peter had been a student of **Eyvind Wichmann**, who once said that "you should work on a paper until you cannot see it any more," and this diligent approach to science has influenced Ulrich's work ever since.

Ulrich began his career in Germany, where he pursued laser physics problems and advanced the QED theory of atomic transition frequencies. He is known for the first successful nonperturbative calculation of the one-photon self-energy correction in the binding field of a proton, and for the treatment of the two-photon self-energy in terms of two-loop Bethe logarithms. He also developed the expressions necessary for treating the quantum motion of an electron in a strong laser field, and used them for Feynman diagram calculations.

Ulrich has scaled new creative heights since he came to S&T. He was recognized in 2009 with an Outstanding Referee Certificate from the American Physical Society and a term on the Editorial Board of Physical Review A. He was featured on the front page of January 7, 2011 issue of Physical Review Letters with an article about novel states of the light field known as "twisted photons." His research is supported by the NSF, the Missouri Research Board, and by a Precision Measurement Grant from NIST.

In 2010, Ulrich wrote two papers about the discrepancy of quantum electrodynamic theory and very recent measurements of atomic transitions in a heavy analogue of hydrogen, termed "muonic hydrogen," in which the electron is exchanged for a muon. Ulrich was interviewed by Scientific American and the UK popular science magazine "New Scientist" about these papers. The two papers



Ulrich Jentschura (left) at the summit of Mont Blanc

are currently in press and will appear in the Annals of Physics.

One of Ulrich's hobbies is mountaineering. In 1986, as a young boy, he performed the first ascent of the route "Berliner Luft" in the West Face of Kleine Halt, along with a long-time mountain guide and his father. The climb is a nice exercise: it is a UIAA climb of the fifth degree and a Yosemite Decimal System climb of degree 5.6. The photo was taken in 2010 on the top of Mont Blanc, which is the highest mountain in the Alps at 15,782 feet.

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Memo from the Chair

This year promises many changes at Missouri S&T. After taking an extended leave in December 2010 to care for his wife, **Sherry**, who was diagnosed with cancer, University of Missouri President **Gary Forsee** announced his immediate resignation in January 2011. Later in January, at his State of the University address Chancellor **John F. Carney III** announced that he will step down in August 2011 in order to spend more time with his children and grandchildren. In his six years at Missouri S&T Chancellor Carney oversaw tremendous changes in the university including a name change, administrative restructuring, dramatic enrollment increases, and increasing emphasis on private financial support in times of diminishing state support for higher education. You may recall that in last year's memo from the chair the discussion was dominated by the uncertain economic climate and shrinking state support for higher education. We are indebted to these gentlemen for their leadership in difficult times, and their departure leaves us with many challenges.

As I have had to inform you each of the last two years, this year's economic news for the University is not positive. The governor has targeted a reduction of 7% in state support for higher education for FY2012. The only silver lining here is that the reduction was anticipated to be 10-15%, with some estimates as high as 25%. Nonetheless, we will continue to face declining resources in the face of increasing enrollment. Enrollment has increased approximately 30% over the last 6 years, and the total enrollment now exceeds 7,000. While this increase has softened the impact of reductions in state appropriations, it has also put significant strain on the departments to accommodate more students while providing the same high quality educational experience Missouri S&T is known for. The University is now very close to, or perhaps exceeding, enrollment capacity. This is particularly true for the engineering disciplines. Any additional enrollment growth will be in smaller departments and in the graduate programs.

In the spirit of never letting a crisis go to waste, I believe this presents our department with an opportunity to grow both our undergraduate and graduate physics programs. This year the combined enrollment in our B.S., M.S., and Ph.D. programs exceeds 100. Our incoming freshman class last fall was a robust 19 with an average ACT score of better than 30, and the incoming class for Fall 2011 promises to be as large and as strong. We are delighted to be able to attract these talented students, and we look forward to the challenges they present and the bright future they represent. Your generous donations to the department are largely responsible for our ability to attract students of such high quality, and our ability to continue to grow and maintain the quality of our program depends on your continued generosity.

In addition to a growing student population, we are happy to welcome Prof. **Yew San Hor** to the department. Prof. Hor is a condensed matter experimentalist specializing in the growth and characterization of exotic new materials. He and his wife, **Phaik**

Kean (P.K.) and two children, **Visakha** (Veve) and **Sudatta** (Tata), joined us in August 2010 from Princeton University. Read more about Prof. Hor elsewhere in this edition of Matter 'n Motion.

In the fall, we dedicated the **Jon T. Schneeberger** and **Fred C. Schneeberger** laboratories in recognition of a gift made by the estate of Jon T. Schneeberger in memory of his father Fred C. Schneeberger (General Science '25). This gift allowed us to make much needed replacements and upgrades of our undergraduate laboratories. Support for laboratory equipment continues to be a major need in the department since the University does not provide any money for upgrades or repairs.

Even in difficult times, our students and faculty continue to excel. Profs. **Ulrich Jentschura** and **Thomas Vojta** were two of only ten faculty members to receive the 2010 Missouri S&T Faculty Research Award. In addition, Prof. **Greg Story** received a 2010 Committee for Effective Teaching Outstanding Teaching Award, and Profs. **Paul Parris** and **Dan Waddill** received Outstanding Teaching Commendations. Approximately two-thirds of our graduating seniors graduated with honors, and **Thomas Schmit** graduated with a perfect 4.0. Our graduates continue to be accepted into first rate graduate programs, and those who choose to seek employment rather than graduate school admission have been overwhelmingly successful. The same can be said for our graduate students. These and more stories of student and faculty accomplishments can be found elsewhere in this newsletter.

I will close as I did last year. 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



Physics Department Awards 2010-2011 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 **Kenneth Smith**, of Florissant, Missouri, **Jesse Hoemann**, of Washington, Missouri, and **Adam Farquhar**, of St. Louis, 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 **David Dotson**, of Florissant, Missouri. This \$1000 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.

Amanda McBee of Kansas City, Missouri, **Kurt Konyalioglu**, of Overland Park, Kansas, and **Aaron Viets**, of Excelsior 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.

Thomas Schmit, of Naperville, Illinois, and **Christopher Svoboda**, of Kansas City, Missouri 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. **Thomas White**, of St. Louis, Missouri received the \$1000 Hannum Scholarship for 2010-2011.

The *Richard Anderson Scholarship Fund* is an endowment established in memory of Dr. **Richard Anderson**. **Dan Franklin**, of St. Louis, Missouri received the \$1000 Anderson Scholarship for 2010-2011.

The department also awards *Physics Scholarships for Academic Access*, funded by a group of alumni and faculty donors. These are need-based awards to Missouri resident students in physics. Last year this \$1000 scholarship was awarded to **Sarah Wiese**, of St. Louis, Missouri.

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 of \$1000 were awarded to **Matthew Callaway**, of Jefferson City, Missouri, **Patrick Chipman**, of Steelville, Missouri, **Carolyn Renee Johnson**, of Lees Summit, Missouri, **Benjamin Knapp**, of Columbia, Missouri, **Jonathan Mulcahy-Stanislawczyk**, of Wildwood, Missouri, **Thanh Nguyen**, of Webb City, Missouri, **Nicholas Parmley**, of Springfield, Missouri, **Scott Richardt**, of Farmington, Missouri, **Laura Sisken**, of West Lafayette, Indiana, **Sam Stephens**, of Richland, Missouri, and **Spencer Templeton**, of Wildwood, 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 estates of **Richard Anderson** and **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 e-mail giving@mst.edu.

Report from the SPS

The Missouri S&T chapter of the Society of Physics Students was busier than ever in 2010. At the beginning of the Fall semester we elected new officers: president **Tom Schmit**, vice president **Jesse (Halo) Hoemann**, secretary **Laura Sisken**, and treasurer **Adam Farquhar**. Thanks to Laura, our web site (<http://web.mst.edu/~sps>) now has some content more recent than 2006!

Tom's first act as president was to appoint **Erin Davis** to a new position as Event Coordinator, with **Trevor Knoblauch** assisting to plan speakers for meetings. Our first speaker for the fall was S&T's Dr. **David Rogers**, who described "The race to build the atomic bomb." You can see Dr. Rogers' talk notes on his web site <http://web.mst.edu/~rogersda/>. Following that, Tom Schmit previewed the December SPS trip to Fermilab with an educational talk on "The Higgs mechanism, supersymmetry and the ATLAS detector." In November, S&T physics professor **Bob DuBois** spoke on "I've got my physics degree, now what?" In December, physics professors **Gerry Wilemski** and **Ulrich Jentschura** gave talks on their research.

The Argonne Undergraduate Research Symposium was not held this year, so Tom Schmit arranged for a private SPS tour of Fermilab. Twelve SPS members drove to Fermilab for the tour on Sunday, December 5. The tour was given by Dr. **Eric Prebys**, leader of the US LHC Accelerator Research Program, who generously donated his time. The tour included the Collider Detector building, which is rarely included in public tours, and a lecture on neutrinos followed by an ask-a-scientist session. **Dan Franklin**, **John Igo**, **Scott Ketcherside**, **Ian King**, **Trevor Knoblauch**, **Paul Leykamp**, **Mike Luning**, **Ian Ramsey**, **Alec Robinson**, **Nelson Shreve**, and **Sam Stephens** went on the Fermilab tour. The annual SPS trip to Argonne/Fermilab is funded by alumni donations during the department's annual Phonathon, and alumni support is deeply appreciated.

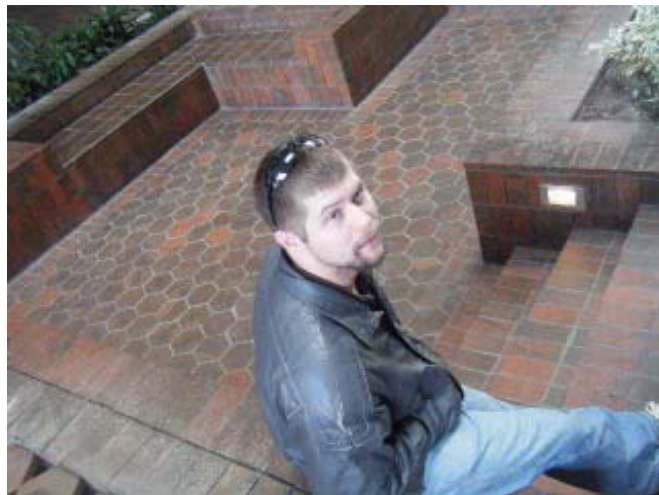
Other fall activities included irregular but nearly semi-weekly "unofficial" meetings at world-famous Diana's Diner in St. James, Missouri. SPS members acted as tour guides during two campus open houses, taking prospective students and their families around the physics building. Ever-popular audience participation movie nights included showings of Young Frankenstein and selected Mystery Science Theater 3000 episodes.

In January 2011 we elected our officers for the Spring semester. **Ian King** replaced graduated Tom Schmit as president, freshman **Trevor Knoblauch** was elected vice president position to replace **Jesse (Halo) Hoemann**, nuclear engineering student **Ethan Barth-Taber** took over for **Adam Farquhar** as treasurer (see how trusting we are!), and **Laura Sisken** remained as secretary. **Maddie Weston** took over the unofficial Event Coordinator position.

upper right: Ian King at Fermilab

middle: James Robinson (left), Scott Ketcherside, Dan Franklin (right)

lower right: Paul Leykamp, Trevor Knoblauch



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>.

Outstanding GTA's



Uttam Chowdhury, Dan Waddill, Adam Upshaw, Sachin Sharma

This past year we again presented graduate teaching awards to honor the outstanding accomplishments of our graduate teaching assistants. These awards were first initiated for the Fall 2009 semester. This year's awards were for the Spring 2010 and Fall 2010 semesters, and they were determined by a combination of student evaluations and teaching performance assessed by the faculty overseeing the teaching laboratories where most of our graduate teaching assistants teach. The winners for the Spring 2010 semester were **Uttam Chowdhury**, **Sachin Sharma**, and **Adam Upshaw**. For the Fall 2010 semester the winners were **Thusitha Arthanayaka**, **Jonathan Noble**, and Adam Upshaw. Adam is now a three time winner. Congratulations to all the winners for helping to advance the department's commitment to excellence in teaching.



Dan Waddill with Thusitha Arthanayaka (left) and Jon Noble (right)

Congratulations to S&T's 2010 Physics Degree Recipients!

May 2010

Bachelor of Science

Benjamin Roland Bethge
Nathan Webster Elo

Master of Science

Elizabeth Ann Black

Doctor of Philosophy

Ola Ali Al-Hagan
David Raymond Cross
Aaron Laforge
Daisuke Takeshita
Amanda Marie Truong

December 2010

Bachelor of Science

Winston Dylan Carr
Tyler Fears
Emily Marie Holden
Alexander Noah
Gena Clare Robertson
Thomas Michael Schmit

Master of Science

Neda Paziresh (August)

Doctor of Philosophy

Tina Dhekial-Phukan (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.

Vojta Visits Kavli Institute for Theoretical Physics

In July 2010 Professor **Thomas Vojta** spent four weeks at the Kavli Institute for Theoretical Physics (KITP). He participated in the “Electron Glasses” program which focused on the out-of-equilibrium properties of strongly disordered interacting quantum systems.

The KITP was launched in 1979 as a national center for theoretical physics under the auspices of the National Science Foundation. Located on the campus of the University of California Santa Barbara and generously supported by the Kavli Foundation, the KITP has become a model for facilitating scientific collaborations that has been widely imitated both by other disciplines and by other countries. Each year, hundreds of theoretical physicists and other scientists come from all over the world for varying periods of time to work on site, to meet with other experts, and to participate in the programs and conferences.

During his visit, Thomas gave a talk on “Ultraslow dynamics in disordered superconducting nanowires” which summarized recent work with graduate student **Chetan Kotabage** and postdoc **Jose Hoyos**. Information on this research can be found in the article “Don't be too thin if you want to be superconducting!” in last year's Matter 'n Motion. As a result of the stimulating discussions with other scientists, Thomas also started working on a new research project dealing with the response of a quantum many-particle system to sudden parameter quenches.

In addition to the scientific activities, the schedule left some time for hiking and rock climbing in the mountains near Santa Barbara, as well as for teaching the resident cat some algebra.



Progress at the National Ignition Facility

David Crandall's presentation about the National Ignition Facility at the Frontiers in Physics Colloquium Series in September drew a large audience of both faculty and students from our campus and beyond.

Beginning in the 1960's, a concept called inertial confinement fusion (ICF) has evolved for rapid compression of a small capsule of deuterium and tritium, creating a miniature nuclear explosion in the laboratory as a method of controlled release of fusion nuclear energy. The required physical conditions are both extreme and delicate and have been studied, attempted, and simulated for 50 years. Expectation is high that the first such laboratory, pure fusion ignition event (more fusion energy out of the target than compression energy into it) may be achieved within a year at the 192-laser-beam National Ignition Facility at Livermore, CA.

The physical conditions for “hot spot” ignition inside the “hohlraum” of a fusion target driven “indirectly” by the megajoule laser system were described by Dr. Crandall in his talk. Called

both “a star in the laboratory” and “the internal combustion engine of the 21st century,” the advent of ignition opens ways to do science and provide industrial energy that are new. In his talk, Dr. Crandall described the progress in adapting this new capability to astrophysical experiments and commercial fusion energy.

Dr. Crandall is Chief Scientist at the National Nuclear Security Administration, U.S. Department of Energy. He advises the Administrator and develops NNSA's “Science and Technology for National Security.” His experience spans 16 years of physics research, including research in atomic collisions while a visiting professor at the Physics Department at Missouri S&T (then UMR), and 28 years of science program management. Before becoming Chief Scientist, he served as Director of the Offices of the National Ignition Facility, Inertial Fusion, and Defense Sciences and then as the Assistant Deputy Administrator for Research Development and Simulation. His honors include the Presidential Award of Meritorious Executive within the Senior Executive Service.

New Faculty Yew San Hor

Yew San's passion for Physics began when he was a child. Fascinated by a magnet shown by his elementary school teacher, he used all his savings to buy the magnet so he could learn how it worked. His curiosity about the little piece of material eventually led him into experimental condensed matter physics.

Yew San earned his MS in Physics from the University of Malaya and his PhD in 2004 from Rutgers. His PhD research was on magnetic phase transitions in chalcogenides, supervised by **Sang-Wook Cheong**. After graduation, he did a postdoc at Argonne National Lab, working with **John Mitchell** on high pressure, high temperature synthesis and nanomaterial studies. In 2006, he joined **Robert Cava** at Princeton University to work on thermoelectric materials and topological insulators. He joined Missouri S&T as an assistant professor in August 2010.

At Princeton, Yew San managed to grow high quality crystals of bismuth-antimony and bismuth chalcogenides. These crystals are important in the search for topological Hall states and massless Dirac particles, and are predicted to have a spin Hall phase of matter known as a topological insulator. They are also predicted to exhibit three-dimensional Dirac particles, a topic of heightened interest following the Nobel Prize-winning findings in two-dimensional graphene. Ideally, a topological insulator can conduct electricity only on its surface, but not through its interior. A topological insulator with Dirac-like behavior could lead to an interesting phenomenon called the quantum spin Hall effect. Yew San was the first to convert a topological insulator into a superconductor, $\text{Cu}_x\text{Bi}_2\text{Se}_3$, which could be a candidate for topological superconductors.

Since the discovery of topological insulators, which may be useful in spintronic devices and quantum computing applications, the field has become one of the hottest in condensed matter physics. Due to material synthesis difficulties, existing topological insulators are bulk conductors, which prevents the detection of the surface Dirac electrons by electrical transport measurements. At S&T, Yew San plans to learn how to grow perfect topological insulator crystals.

Yew San also carried out nanoscience research during his stay at Argonne, where he developed a one-step approach to growing air-stable charge density wave NbSe_3 nanowires and nanoribbons, and successfully synthesized nanoscale superconductors for the study of vortex physics in low-dimensional structures by converting NbSe_3 into NbSe_2 nanowires and nanoribbons. NbSe_2 is a low-temperature superconductor and is a model system for understanding vortex physics. Investigating its properties in confined geometries will be an extremely interesting research area. Yew San developed a new technique to grow an array of standalone nanowires between two conducting plates for thermoelectric applications. Thermal conductivity, thermopower, and electron transport properties of this nanowire array can be easily measured, and it can be used for industrial thermoelectric applications. Electric-field guided nanowire solar cell fabrication, semiconducting nanowires for optoelectronics, and quantum dot array fabrications will be Yew San's long term projects at S&T.

Alumni Notes

Mark Thomason (MS '06) and his wife **Mary** became proud parents of **Samantha Thomason** on November 24, 2010. She weighed 3 pounds, 11 ounces.

Dan (BS '94) and **Kathi Arbin** informed us after receiving the newsletter last year that they have a grandson, **Braedon James Mullane**, born June 2, 2009.

Caleb Klapp (MS '08) works for FlightSafety International in Hazelwood, Missouri.

Jagat Lamsal (MS '03) recently completed his PhD at Mizzou and is currently a postdoc at Iowa State.

Sam (PhD '93) and **Debbie Bross** became proud parents in December 2010. Daughter **Marcianna Bross** weighed in at 7 pounds, 5 ounces and was 18 inches long. She joins brother **Atticus** and sister **Livia** in the Bross family.



Atticus (top), Livia (lower left) and Marcianna (lower right) Bross

Tina Dhekial Phukan (PhD '10) works as a Process Engineer at Intel in Hillsboro, Oregon.

Aaron LaForge (PhD '10) is a postdoc at Max Planck Institute for Nuclear Physics in Heidelberg, Germany.

Elizabeth Black (PhD '10) has been appointed Science Education Project Director for the Department of Natural and Applied Sciences at Missouri State University in Springfield, Missouri

Allison Harris (PhD '09) has accepted a position as Assistant Professor of Physics at Henderson State University in Arkadelphia, Arkansas.

Jose Hoyos, who was a postdoc for **Thomas Vojta** in 2006-2007 started a faculty job at the Institute of Physics of São Carlos, which is part of the University of São Paulo at São Carlos.

Jentschura and Vojta Receive Faculty Research Awards

Ulrich Jentschura and **Thomas Vojta** were two of only ten Missouri S&T Faculty members to receive a 2010 Faculty Research Award.

This new award was established in 2009 to recognize faculty who have demonstrated excellence in research and scholarship. Awards are given based on the significance of the contributions of the individual in the preceding two years, as well as the long term impact of the individual's research.

Ulrich's work is highlighted on the cover of this edition of Matter 'n Motion, and some of Thomas' work is described in the article on page 6.



Ulrich Jentschura



Thomas Vojta

A Visit from the Elves

Last December the Christmas Elves visited our chairman, **Dan Waddill**, leaving his office a wrapped wonderland.



The images of the two elves have been slightly blurred to protect the "innocent."

Congratulations to 2010 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 2010

Ian Denaro, David Dotson, Adam Farquhar, Dan Franklin, Jonathan Gigax, Jesse (Halo) Hoemann, Benjamin Knapp, Kurt Konyalioglu, Amanda Mcbee, Nicholas Parmley, Laura

Sisken, Kenneth Smith, Christopher Svoboda, Aaron Viets, and Adam Yount.

Fall Semester 2010

Derek Anderson, Katherine Brinker, Winston Carr, Andrew Cudd, David Dotson, Christian Dzurny, Adam Farquhar, Dan Franklin, Ryan Gibbs, Jonathan Gigax, Jesse (Halo) Hoemann, Nicholas Hugenberg, John Igo, Micah Johnston, Stephen Kraus, Amanda Mcbee, Nathan Morris, Rebecca Racer, Ian Ramsey, Gena Robertson, Thomas Schmit, Nelson Shreve, Laura Sisken, Sam Stephens, Dimitar Stoyanov, Jason Summers, Christopher Svoboda, Spencer Templeton, Aaron Viets, Thomas White.

Supercomputing in Sicily and Chile

Graduate student **Ben Payne** attended two conferences on supercomputing last year. Both trips were awarded through National Science Foundation competitions. The first trip was to Sicily to discuss US and European programs for future supercomputers. The challenge in the next few years will be to find a means to increase the size of the largest computers. Current supercomputers are composed of 300,000 normal computers in one building. As this number grows, the amount of electrical power they consume will soon exceed that required by New York City. Also, because computers are not getting faster, memory and communication between components are limiting factors.

The second conference Ben attended was in Valparaiso, Chile. It addressed a new development in supercomputing, the use of video cards (GPUs) in addition to the usual central processor (CPU) for some scientific computation. Using the GPU is complex because CPUs and GPUs normally serve different purposes and are designed differently. Solving a problem by using both a CPU and a GPU with a single program is more difficult, but the time-to-solution is lower.

Ben found both conferences valuable because they gave him an opportunity to hear presentations by experts in the field of supercomputing and to ask questions. Other students from computer science, biology, math, and physics also attended. Their shared interest in scientific computation gave them much to



discuss. The conferences also allowed some time for extracurricular activities (see photo).

From Alumnus Mark Herrera

Greetings from Maryland! In 2008, I closed the undergraduate chapter of my life at Missouri S&T and ran off to graduate school at the University of Maryland (UMD). After spending time in the trenches as a teaching assistant and surviving the qualifier, I joined the nonlinear dynamics and chaos group at the UMD.

Last April, I was awarded a National Defense Science and Engineering Graduate (NDSEG) Fellowship. The NDSEG Fellowship is a three-year, portable fellowship awarded to students pursuing doctoral degrees in areas of interest to the DoD. The fellowship was a nice surprise, and it's given me the freedom to work on the projects of my choice.

Currently, I'm working on two projects in nonlinear dynamics. In one project, I work closely with experimentalists to study the dynamics of granular materials under strain. Using tools from complex networks and percolation theory, we quantify the intermediate time and length scales of granular flows. I've recently started a new project where I study quantum systems that have chaotic classical analogs. I'm interested in how the inclusion of atom-atom interactions changes the dynamics of these systems.

Life in Maryland is always interesting. The physics department has diverse research interests, there are a number of national labs and research institutes to suit anyone's palate, and DC is a lively place. My wife, **Camille** (a 2009 S&T alumna), and I are always finding new sites to see!



Mark Herrera at the Maryland Renaissance Festival

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

Donations over \$100:

Harro Ackermann
 Mary Alice Anderson
 Daniel J Arbini
 Kenneth E Arnett
 Mark Jeffery Barnhart
 Kul Bhasin
 Lewis K Cappellari
 James H Carlson
 Ross O Carnes
 Carmen Maria Carney
 Daniel Brian Chitwood
 Stephen D Christiansen
 Charles H Church
 George Martin Dover
 Kenneth L Dufner
 Courtney Ryan Feeler
 Robert G Fuller
 Thomas K Gaylord
 Betsy Graef
 Daryl C Hatfield
 Jon Mark Holdman
 Thomas K Holley
 Robert E Hufft
 Dennis C Johnson
 Thomas M Jordan
 Shella Dawn Keilholz
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 Gary D Bickel
 John S Bosnak
 Laura L Bosnak
 Mack A Breazeale
 David K Bross
 Charles E Byvik
 Robert E Caldwell
 James P Canner
 Christopher Paul Carney
 John C Carstens
 Patrick L Cole
 Vibhakar R Dave
 Richard H Duncan
 Kevin B Edwards
 Suzanna Jo Edwards
 Alissha Gayle Feeler
 Robert M Flick

Roger Keith Foehrweiser
 Matthew Christopher Fritts
 Julie Anne Gamble
 Glen R Gettemeyer
 Harvey C Guinn
 Stanley S Hansen
 William E Haymes
 Carol E Henderson-Kuhn
 John A Hocken
 Wayne E Holland
 Theodore C Huff
 William M Hughes
 Jerry G Johnson
 Harris C Jones
 John Daniel Jones
 Mark A Jones
 Jessica Joy Kerr
 John V Knopp
 Terrence A Leigh
 David R Lewis
 DeAnn Lewis
 Patricia Lindgren
 William A Lindgren
 Hulen H Luetjen
 Lina Madison
 Daniel B Marsh
 John L McDaniels
 John W McGuire
 William Vernon Meyer
 Steven A Mezines
 Elizabeth A S Munson
 William F Munson
 Charles J Neumann

Lawrence A Newquist
 Terry Ann Newquist
 Frank L Ollinger
 G Suzanne Olson
 Larry D Oppliger
 Larry J Peery
 Matthew Nathan Pritzker
 Kathy A Rages
 Rodney O Randall
 Donald G Rathbun
 Emmett R Redd
 Arthur J Reetz
 Gary S Sammelmann
 Richard S Schwentker
 David Gene Seely
 Richard H Shields
 Morgan P Slusher
 James G Smith
 Gary E Staats
 Kenneth B Steinbruegge
 Kenneth M Stephens
 Robert M Stovall
 Bobbie J Thompson
 John L Thompson
 Robert E Thurman
 Terry R Tucker
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 James T Willcutt
 David J Wolters
 Gary K Woodward
 Gary G Wooley
 Wei Zhao

Physics Department Acknowledges Corporate Support

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3M Foundation
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 Boeing Foundation
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 General Electric
 Oracle Corporation
 Raytheon Company
 Shell Oil Company Foundation
 Sun Microsystems

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.

- “*Scaled vapor-to-liquid nucleation in a Lennard-Jones system*,” Barbara N. Hale and Mark Thomason,³ Phys. Rev. Lett. **105**, 046101 (2010).
- “*Low-energy symmetric coplanar and symmetric non-coplanar ($e,2e$) studies from the $3a_1$ state of H_2O* ,” Kate L Nixon, Andrew James Murray, Ola Al-Hagan,³ Don H Madison, and Chuangang Ning, J. Phys. B. **43**, 035201 (2010).
- “*Electron impact ionization cross sections of H_2 for low energy outgoing electrons from 1 eV to 10 eV*,” Ola Al-Hagan,³ A.J. Murray, C. Kaiser, J. Colgan, and D.H. Madison, Phys. Rev A **81**, 030701(R) (2010).
- “*The distorted wave Born approach for calculating electron-impact ionization of molecules*,” D.H. Madison and O. Al-Hagan,³ Journal of Atomic, Molecular, and Optical Physics **2010**, 367180 (2010).
- “*Search for interference effects in electron impact ionization of aligned hydrogen molecules*,” Arne Senftleben, Thomas Pflueger, Xueguang Ren, Ola Al-Hagan,³ Bennaceur Najjari, Don Madison, Alexander Dorn and Joachim Ullrich, J. Phys. B **43** FT C, 081002 (2010). An IOP select paper and selected by the editors to be included in J. Phys. B highlights from 2010.
- “*Three-dimensional cross sections for electron impact ionization of atoms and molecules*,” X. Ren, A. Senftleben, T. Pflüger, M. Holzwarth, A. Dorn, K. Bartschat, I. Bray, V.D. Fursa, J. Colgan, M.S. Pindzola, O. Al-Hagan,³ D. H. Madison, J. Ullrich, J. Phys.: Conf. Ser. **212**, 012003 (2010).
- “*Recent theoretical progress in treating electron impact ionization of molecules*,” Ola Al-Hagan,³ Chuangang Ning, Kate Nixon, Andrew Murray, Christopher Colyer, Mark Stevenson, Birgit Lohmann and Don Madison, J. Phys.: Conf. Ser. **212** 012004 (2010).
- “*Five-fold differential cross sections for ground-state ionization of aligned H_2 by electron impact*,” Arne Senftleben, Ola Al-Hagan,³ Thomas Pflueger, Xueguang Ren, Don Madison, Alexander Dorn and Joachim Ullrich, J. Chem. Phys. **133**, 044302 (2010).
- “*Theoretical fully differential cross sections for double charge transfer collisions*,” A.L. Harris,³ J.L. Peacher, and D.H. Madison, Phys. Rev. A **82**, 022714 (2010).
- “*Tracing multiple scattering patterns in absolute ($e,2e$) cross sections for H_2 and He over 4π solid angle*,” X. Ren, A. Senftleben, T. Pflüger, A. Dorn, J. Colgan, M.S. Pindzola, O. Al-Hagan,³ D.H. Madison, I. Bray, D.V. Fursa, and J. Ullrich, Phys. Rev. A **82**, 032712 (2010).
- “*Dynamical ($e, 2e$) studies using tetrahydrofuran as a DNA analogue*,” C J Colyer, S M Bellm, B Lohmann, G F Hanne, O Al-Hagan,³ D H Madison and C G Ning, Journal of Chemical Physics **133**, 124302 (2010).
- “*Phase transitions of the generalized contact process with two absorbing states*,” M.Y. Lee² and T. Vojta, Phys. Rev. E **81**, 061128 (2010).
- “*Investigations of mode coupling in optical fibers with controlled volume disorder*,” N. P. Puente, E.I. Chaikina, S. Herath² and A. Yamilov, SPIE Proceedings: Specialty Optical Fibers and Their Applications **7839**, 78391O-1 (2010).
- “*Classification of regimes of wave transport in quasi-one-dimensional non-conservative random media*,” A. Yamilov and B. Payne,² J. Mod. Opt. **57**, 1916 (2010).
- “*Relation between transmission and energy stored in random media with gain*,” B. Payne,² J. Andreasen, H. Cao, and A. Yamilov, Phys. Rev. B **82**, 104204 (2010).
- “*Anderson localization as position-dependent diffusion in disordered waveguides*,” B. Payne,² A. Yamilov, S. E. Skipetrov, Phys. Rev. B **82**, 024205 (2010).
- “*Dual-periodic photonic crystal structures*,” A. Yamilov and M. Herrera,³ in *Recent Optical and Photonic Technologies*, edited by Ki Young Kim, INTEH, (2010) ISBN 978-953-7619-71-8.
- “*Double differential spectra of scattered protons in ionization of atomic hydrogen*,” M. Schulz, A.C. Laforge,² K.N. Egodapitiya,² J.S. Alexander,³ A. Hasan, M.F. Ciappina, A.C. Roy, R. Dey, A. Samolov, and A.L. Godunov, Phys. Rev. A **81**, 052705 (2010).
- “*Scattering angle dependence of double differential cross sections for fragmentation of H_2 by proton impact*,” K.N. Egodapitiya,² S. Sharma,² A.C. Laforge,² and M. Schulz, Phys. Rev. A **83**, 012709 (2011).
- “*Kinematically complete experiment on ionization of atomic hydrogen by proton impact*,” A. Laforge,² invited conference talk, 63rd Annual Gaseous Electronics Conference, Paris, France (2010).
- “*Three-body dynamics in ionization of atomic hydrogen by proton impact*” (Ph.D. project of K.N. Egodapitiya²), M. Schulz, invited conference talk, International Conference on Many Particle Spectroscopy of Atoms, Molecules, Clusters, and Surfaces, Sendai, Japan, 2010.
- “*Nucleation rates of methanol using the SAFT-0 equation of state*,” A. Obeidat,³ M. Gharaibeh, H. Ghanem, F. Hrahsheh,² N. Al-Zoubi, and G. Wilemski, Chem. Phys. Chem., **11**, 3987 (2010). Invited paper for special atmospheric chemistry issue.
- “*Structural and magnetic Properties of $La_{0.7}Sr_{0.3}Mn_{1-x}Cr_xO_3$ ($x < 0.5$)*,” T. F. Creel,² J.B. Yang, M. Kahveci, J. Lamsal,³ S. K. Malik, S.A. Quezado, O. A. Pringle, W. B. Yelon, and W. J. James, IEEE Trans. Magn. **46**, 1832 (2010).

DuBois Spends Sabbatical Year in Germany

My saga began in August of 2009 when I boarded a plane to Frankfurt, Germany. For the next year, my wife and I lived in Darmstadt, a university city of about 150,000 located a half hour south of Frankfurt, and I worked at the GSI Helmholtzzentrum für Schwerionenforschung, located in a forest just north of Darmstadt. GSI, one of the largest German national research laboratories, is a “large accelerator laboratory.” Accelerators and storage rings are used to accelerate heavy ions up to almost the speed of light. The ion beams, anything from protons to bare uranium, are then used to study atomic, nuclear, plasma, and biological processes. During my sabbatical, I was a guest professor at the Extreme Matter Institute, EMMI, and in the Atomic Physics section at GSI plus was a Fulbright Professor at the University of Heidelberg.

The group I worked with uses few-electron heavy ions (typically uranium where all but 1,2 or 3 electrons have been removed) to study atomic structure and dynamics. In such ions, the remaining electrons are subject to extremely intense electric fields that are thousands of times larger than those produced by the most powerful lasers that exist. By measuring the x-rays which are emitted when K-shell electrons are excited or ionized, information about how the atomic structure and dynamics are influenced by these high fields is obtained. The experiments employ unique techniques such as storage rings where the beam circulates and is “reused” as it passes through the target a million times a second, gas jet targets where the gas comes out as liquid droplets, position sensitive diamond detectors for the ion beams plus position sensitive x-ray detectors capable of providing polarization information. An upcoming experiment, which I designed during the year, will combine these techniques to measure K-shell excitation when the ion is extremely close as it passes the target nucleus. For this experiment we will use 3-electron gold ions traveling at about 40% the speed of light.

Sabbatical leaves are not just work; they also provide many learning and travel opportunities. During the year, my wife and I

were in Berlin, where I helped in the Fulbright selection process for German graduate students coming to the USA, and we viewed some of the special exhibits celebrating the 20th anniversary of German reunion. A visit to a lab located near the eastern end of Hungary let us experience the Christmas market and sights of Budapest. A visit to a lab just north of Rome gave us the opportunity to see some of the city and spend a few days enjoying the artwork of Florence. A trip to Aarhus, Denmark, where we lived for 1+ years in the late 70’s, let us relive memories plus visit some friends we had not seen for a long time. These trips, plus meetings/workshops in Austria and Eisenach, Germany, a vacation to Istanbul, plus exploring Germany with family and friends provided many more insights into European culture, food, and politics. Other fun times included bike tours along the Danube and Rhine rivers, watching the World Cup games on large viewing screens set up in the market square of Darmstadt, and standing in the cold watching the Carnival parades. Another lasting memory is a year without a car and using bicycles and trains for transportation. This taught us that 15 km isn’t too far to go on bike for cake and that neither rain, cold weather, or snow on the ground is a valid reason for staying home.

In August, we returned home full of many enjoyable memories plus a long list of new friends.



Bob and Kay DuBois

Phonathon 2011

Mark your calendars! On April 6, 7, 10, 11, and 12 this year a dedicated group of our students will be calling to ask for your assistance. With new scholarships made possible by past phonathon donations the department has been able to grow the combined undergraduate and graduate enrollment to nearly 100. 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.

A total of 168 alumni and other donors committed \$30,119 in donations to the MSM-UMR-Missouri S&T Physics Department last year. Last year’s fundraising Phonathon raised \$14,949 with an average gift of \$114 from 131 donors. The department greatly appreciates your generosity, which helps to support scholarships and student activities like the Society of Physics Students.

Frontiers in Physics Colloquium Series

The 2010 *Frontiers in Physics Colloquium Series* began in January with our own **Thomas Vojta** describing “*Cluster computing in the Missouri S&T Physics Department*” and the official opening of the Pegasus II and Gryphon clusters. The Gryphon Cluster was made available to all students at the department, as described in the cover article of the 2010 Physics Newsletter. The series continued with **Joshua Rovey** from the S&T department of Aerospace Engineering speaking about the future direction of advanced space propulsion research in “*Missouri S&T deep space propulsion systems.*”

In February, **Ralf Wessel** from Washington University at St. Louis presented results from cutting-edge research on visual pathways in reptiles and birds with a talk “*Vision with neural microcircuits.*” The rest of February and March saw five presentations by the prospective candidates as a part of the faculty search in experimental condensed matter physics conducted by the department. Our newest faculty member, **Yew San Hor**, is pictured to the right and profiled in an article on page 7.



In April, **James Vary** from Iowa State University outlined recent theoretical and computational progress in nuclear theory with “*Building bridges from quarks to the cosmos.*” **Timothy Kaiser**, a 1981 graduate of our department who is now at Colorado School of Mines gave an inspirational talk “*Consider an ojive cow...*,” in which he described how his physics degree helped him throughout his career. Tim obtained his BS in Physics while working for Dr. **Ed Hale**. Also in April, the department held the Thirty-Ninth Annual **Harold Q Fuller** Prize Colloquium, This year the competitors gave talks instead of posters. Details of the Fuller competition appear in a separate article on page 15. Our spring series concluded in May with a presentation by **Alexander Godunov** from Old Dominion University on “*Correlated electron motion in helium and the collective effects of plutonium sputtering.*”

The colloquium series resumed in the fall with twelve colloquia in a variety of subfields of physics. First up in September was **David Crandall** from National Nuclear Security Administration who discussed “*Progress at the National Ignition Facility.*” David’s talk is described in the article on page 6 of this newsletter. **Jonathan Sapirstein** from the University of Notre Dame talked about a recent controversy “*What is the size of the proton?*” Next, our own **Bob DuBois** made a presentation “*Scientific and personal benefits and experiences associated with a sabbatical leave,*” in which he detailed his experiences during his recent sabbatical to Germany where he was a Fulbright Fellow at the Ruprecht-Karls-Universität Heidelberg and a guest professor at the Extreme Matter Institute at the GSI Helmholtzzentrum für

Schwerionforschung in Darmstadt. Bob’s sabbatical is described in a separate article on page 12. Also in September, **Haeyeon Yang** from Utah State University presented “*Guided assembly of nanodots through selective heating.*” Our 2010 homecoming speaker was **Junfang Gao**, who received his PhD in atomic and molecular physics from our department in 2006. Now at the Central Care Cancer Center, he spoke about “*Radiation therapy for cancer treatment and the potential use of nanoparticles.*”

In October, **Richard Dawes**, a new faculty member from S&T’s chemistry department, described “*Automated construction of ab initio potential energy surfaces for spectroscopy and dynamics applications.*” Continuing a tradition, the department celebrated the awarding of the 2010 Nobel Prizes with lectures by our own Thomas Vojta and Yew San Hor with “*Flat carbon: the 2010 Nobel Prize in physics.*” Next up was **John F. Mitchell** from Argonne National Laboratory who talked on “*Crystal synthesis of complex oxides, or how to help out your friendly neighborhood physicist.*”

November began with S&T’s chemistry professor **Nicholas Leventis** describing “*Assemblies of nanoparticles as 3D scaffolds for new materials.*” **Mark Havey** from Old Dominion University made a presentation on how ultracold atomic gases are presently being used to study a wide range of condensed matter phenomena with “*Disorderly conduct in ultracold atomic gases.*” The third talk in November, “*When the good old superconductors go nano,*” was given by **Nayana Shah** from University of Cincinnati. In December our colloquium series concluded with the Seventeenth Annual **Laird D. Schearer** Prize Colloquium, which saw four presentations by the finalists. Details are in the article on page 14 of this newsletter.



David Crandall

17th Annual Schearer Prize Competition

The Seventeenth 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 2, 2010. Four students submitted applications for the competition. The applications consisted 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 **Barbara Hale**, **Yew San Hor**, and committee chair **Bob DuBois**, selected four finalists who gave oral presentations of their work in a departmental colloquium.

The 2010 finalists were **Uttam Chowdhury**, advised by Professors **Don Madison** and **Jerry Peacher**, **Benedikt Wundt**, advised by Professor **Ulrich Jentschura**, **Kisra Egodapitiya**, advised by Professor **Michael Schulz**, and **Ben Payne**, advised by Professor **Alexey Yamilov**. During the colloquium on December 2, Mr. Chowdhury spoke about “*Fully differential and double differential cross sections for single ionization of H_2 by 75 keV proton impact*,” Mr. Wundt discussed “*Quantum Electrodynamics and Fundamental Constants*,” Mr. Egodapitiya talked on “*Manipulating atomic fragmentation processes by controlling the projectile coherence*,” and Mr. Payne presented “*Mapping aperiodic Thue-Morse media onto the Anderson tight-binding model*.” All students gave excellent talks. First place and a \$500 prize was awarded to Mr. Wundt, while the other three candidates were each recognized with a second place award and a \$200 prize.

Come Back for Homecoming

The Missouri S&T Physics Department warmly invites you to return to Rolla for **S&T Homecoming 2011 on October 7-8, 2011**. On Friday afternoon, October 7, 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 2011 Physics Colloquium at 4 PM. on Friday, October 7. 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!

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 Benedikt Wundt

I am very honored to be awarded the 17th Annual Schearer Prize and thankful for this opportunity for the graduate students in the Physics department to present their research. Foremost, I want to thank my advisor Dr. **Ulrich Jentschura** for all his help and insight in my research and in many other things. I would like to thank the members of this year’s Schearer Prize committee, Drs. **Robert DuBois**, **Barbara Hale** and **Yew San Hor** for awarding me this honor. I also would like to thank my friends and fellow finalists **Uttam Chowdhury**, **Ben Payne** and **Kisra Egodapitiya** for their help in our practice sessions and for their excellent and intriguing talks.

After I came to Rolla following my advisor in July of 2009, I have come to like the Department and I have met many friends here. This and my advisor are the reasons that after I defended my thesis in December of 2010, I will be staying in the Department as a Postdoc until the end of this year and continue working with Dr. Ulrich Jentschura on new projects.

My presentation was about my research in bound states in Quantum Electrodynamics (QED). With calculation of the effects from QED on highly excited bound states, which we carried out, it becomes possible to make very precise theoretical predictions for transition frequency between highly-excited states in one-electron ions. A comparison of these predictions with experimental measurements, which are currently being pursued at NIST, can allow to improve the accuracy of the Rydberg constant.

Benedikt
Wundt



39th Annual Fuller Research Seminar

The 39th annual **Harold Q Fuller** Undergraduate Research Seminar was held on April 29, 2010. This competition promotes participation of undergraduates in research both in the department and in summer intern projects. This year's participants were **Thomas Schmit**, "Determining missing transverse energy in the ATLAS detector," advised by Drs. **Vivek Jain** and **Daria**



Tom Schmit

Zieminske, carried out at Indiana University-Bloomington; and **Winston Carr** and **Laura Sisken**, "Simulations of wave-front shaping in light propagation through disordered medium," advised by Dr. **Alexey Yamilov**, performed at Missouri University of Science and Technology.



Right: Winston Carr
(at the 2010
Christmas party)



Left: John Schmitt
and Laura Sisken

Faculty Notes

Michael Schulz and **Bob DuBois** received a major new National Science Foundation grant "*Few-body dynamics of ionization process induced by particles and anti-particles.*"

Don Madison's article "*Search for interference effects in electron impact ionization of aligned hydrogen molecules*" has been chosen by J. Phys. B as one of the 2010 Highlights that showcase some of the most exciting research published in Journal of Physics B: Atomic, Molecular and Optical Physics that year.

Ulrich Jentschura's article "*Generation of high-energy photons with large orbital angular momentum by Compton backscattering*" was chosen for the cover of Physical Review Letters Volume 106, Issue 1. His research is being supported by the NSF, the Missouri Research Board, and the National Institute of Standards and Technology. Read more about Ulrich's accomplishments in the cover story on page 1.

Don Hagen and CASL (Cloud and Aerosol Sciences Laboratory) received a \$670K award from the FAA to do experiments to define the measurement techniques that will be written into the Aerospace Recommended Practice document that specifies how emissions measurements are done during new jet engine certification. This study involves both laboratory and field measurement work, and is being closely watched by jet engine manufacturing companies, NASA, FAA, and EPA.

Gerry Wilemski received a major new National Science Foundation Award for "*Collaborative research: fundamental studies of water-hydrocarbon condensation.*" The grant was awarded under the Grant Opportunities for Academic Liaison with Industry initiative and represents a collaboration between Missouri S&T, the Ohio State University, and a Dutch company called Twister BV.

In early 2010, Gerry ruptured his quadriceps tendon while on his daily run. Despite the fact that the injury left the lower part of his leg uncontrollably dangling like a floppy noodle, Gerry is proud to report that he didn't miss a single class!

Bob DuBois received a Fulbright award last year. Read more about it in the article on his sabbatical, on page 12.

Ron Bieniek and **Allan Pringle** are co-PI's on "*Science education and quantitative literacy: an integrated, inquiry-based approach,*" which was funded in 2010 for the eighth year in a row by the Missouri Department of Higher Education.

Don Hagen received a NASA award for playing a major role in a jet engine emissions measurement campaign, project AAFEX (Alternative Aviation Fuel Experiment). The award was for "*outstanding achievement in establishing the impact of synthetic fuels on commercial aircraft engine and auxiliary power unit performance and pollutant emissions.*" A follow-up campaign is planned for March 2011 at Palmdale, CA. Emissions will be measured on CFM56 engines on a DC-8 aircraft, with a focus on emissions from synthetic fuels.

Greg Story won a 2010 Outstanding Teaching Award, and **Dan Waddill** and **Paul Parris** received 2010 Letters of Commendation for their excellence in teaching.

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.

Name: _____ Phone: _____ E-mail: _____

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