

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

## SPS Sends Their Banner into Space

Mission Specialist **Sandra Magnus** (BS '86, MS EE '90) presented the Missouri S&T chapter of the Society of Physics Students with a banner that was flown to space on the final mission of space shuttle Atlantis.

SPS came together to create this great banner after receiving a request from Dr. Magnus for something she could fly on the final space shuttle flight, which took place July 8-21, 2011. The banner, along with a certificate of authenticity from the National Aeronautics and Space Administration, was given to SPS in a special presentation on Friday, November 11, 2011. It was a great honor for our students!

The final shuttle mission STS-135 had a total duration of 12 days, 18 hours, 27 minutes, 56 seconds, making 200 orbits around our planet. The banner traveled over 5.2 million miles through space to get to SPS. When Atlantis rolled to a stop she ended 30 years of space shuttle flights for NASA.

The flight crew included Capt. **Christopher J. Ferguson** (Commander), **Col. Douglas G. Hurley** (Pilot), Dr. Sandra H. Magnus (Mission Specialist I), and Col. **Rex J. Walheim** (Missions Specialist 2). All four of the crew signed a certificate of authenticity for the banner. The banner and certificate are shown on page 4 of this newsletter.



### In this issue:

Memo from the Chair .....	2
Physics Department Scholarships .....	3
Report from the SPS .....	4
Outstanding GTAs .....	5
Pegasus Grows .....	5
2011 Physics Degree Recipients .....	5
Medvedeva Joins CEMRI .....	6
From Alumnus Matt Krems .....	6
Holy Cow, Pam! .....	6
A Visit from the Elves .....	7
Alumni Notes .....	7
Jentschura Receives Award .....	8
Charlie Celebrates 35 <sup>th</sup> .....	8
Dustin Powell Remembered .....	8

2011 Physics Academic Scholars .....	8
Chowdhury Wins Award .....	9
Alloys: an (im)Perfect Mixture .....	9
Your Support Acknowledged .....	10
Corporate Support Acknowledged .....	10
S&T Students & Alumni: in Press .....	11
Vojta Lectures in Korea .....	12
Phonathon 2012 .....	12
Frontiers in Physics .....	13
Eighteenth Annual Scheerer Prize .....	14
Prize Winner Ben Payne .....	14
Homecoming 2012 .....	14
40 <sup>th</sup> Annual Fuller Research Seminar .....	15
Ken Smith Honored .....	15
Faculty Notes .....	15

Pictured above are undergraduate students who attended the banner presentation and a special students-only question-and-answer hour with Dr. Magnus. Front row, left to right: **Jonathan Mulcahy-Stanislowczyk, Madalyn Weston, Erin Davis, Derek Anderson, Laura Sisken, Ian King** (banner designer), **Trevor Cessna**. Back row: **Dimitar Stoyanov, Andrew Clum, Ethan Barth-Taber, Michael Luning, Andrew Cudd, John Igo, Sandra Magnus, Dr. Allan Pringle** (SPS Advisor), **James Kelly, Joseph Lynch**.

## Memo from the Chair

This year promises many changes at Missouri S&T. At the time of last year's memo University of Missouri President **Gary Forsee** had just resigned, and Missouri S&T Chancellor **John F. Carney III** had announced that he would step down in Aug. 2011.

On Dec. 13, 2011 the University of Missouri Board of Curators announced the appointment of **Timothy M. Wolfe** as the 23<sup>rd</sup> system president. The University of Missouri business school alumnus will assume responsibilities presently held by Interim President **Stephen J. Owens**, effective Feb. 15, 2012. Shortly afterwards, on Jan. 19, 2012, University of Missouri System officials announced that Dr. **Cheryl B. Schrader** had been selected to be the next Chancellor at Missouri S&T. Dr. Schrader will take over for Interim Chancellor **Warren K. Wray** on April 2, 2012.

Dr. Schrader is associate vice president for strategic research initiatives and former engineering dean at Boise State University. She is past president of the Institute of Electrical and Electronics Engineers (IEEE) Control Systems Society, and plans to continue the STEM education research that involves developing and assessing innovative teaching approaches that promote learning across the "K through gray" educational spectrum and help students succeed in science, technology, engineering and math. She has been active in this area for the past decade. We are excited to have Dr. Schrader join the University and look forward to what her leadership, vision, and energy can bring to Missouri S&T.

As I have had to inform you each of the last three years, this year's economic news for the University is not positive. The governor has targeted a reduction of 8% in state support for higher education for FY2013. This is less than the original target of 12.5%, but still represents a cut that would dramatically impact the ability of Missouri S&T to offer the quality education in an atmosphere of cutting-edge research that makes the educational experience here so valuable. On the brighter side, last year's cuts were anticipated to be about 7%, but were significantly lower. Nonetheless, continued erosion of state support for higher education in the state of Missouri is presenting tremendous challenges to this University.

Despite the difficult financial times at the University, the Physics Department continues to do well. Our combined BS, MS, and PhD enrollment remains high, and the number of admitted freshmen for Fall 2012 is at its highest level in a decade. The overall quality of the students is as high as it has ever been, and we are delighted to be able to attract so many talented students. 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 is dependent on your continued generosity.

This past year has seen success for our students and faculty. Nearly  $\frac{3}{4}$  of our graduating majors did so with honors, and **Chris Svoboda** graduated with a perfect 4.0. **Uttam Chowdhury**, one of our graduate students working with Prof. **Don Madison**, won the Gaseous Electronics Conference (GEC) Student Award for Excellence at the 64th annual GEC conference in November 2011. Prof. **Ulrich Jentschura** was one of only five recipients of the Faculty Excellence Award for 2011, and Prof. **Greg Story** won yet another Outstanding Teaching Award. In addition, Profs. Don Madison, **Paul Parris**, **Thomas Vojta**, and **Dan Waddill** all received Outstanding Teaching Commendations. Finally, Prof. **Julia Medvedeva** was promoted to Associate Professor of Physics with tenure, and Prof. Thomas Vojta was promoted to Professor of Physics. These and more stories of student and faculty accomplishments can be found elsewhere in this newsletter.

I will close as I did the past several years. 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



## 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](mailto:physics@mst.edu). You might also be interested in checking out our web page, <http://physics.mst.edu>.

## 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 **Aaron Viets**, of Excelsior Springs, Missouri, and **Stephen Kraus**, of Jefferson City, 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 **Sam Stephens**, of Garfield, Arkansas. 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.

**Derek Anderson** of Blue Springs, Missouri, **Philip Markarian**, of Windsor, Missouri, **Christian Dzurny**, of Sikeston, Missouri, and **Ian Ramsey**, of Rolla, 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.

**Andrew Cudd**, of Overland Park, Kansas, and **Ryan Gibbs**, 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. **Carolyn Johnson**, of Lees Summit, Missouri received the \$1000 Hannum Scholarship for 2010-2011.

**Laura Siskin**, of West Lafayette, Indiana, and **Jason Summers**, of Rolla, Missouri, shared the *Frank and Ellen Schowengerdt Scholarship*. This \$1200 scholarship was made possible by a donation from **Frank Schowengerdt** (BS '66, MS '67, PhD '69).

The *Richard Anderson Scholarship Fund* is an endowment established in memory of Dr. **Richard Anderson**. **Christopher Svoboda**, of Kansas City, Missouri, and **Amanda McBee**, of Kansas City, Missouri received the \$1000 Anderson Scholarship for 2010-2011.

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. **Sam Stephen**, of Garfield, Arkansas received the \$500 Reed Scholarship for 2011-2012.

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 **Jason Summers**, of Rolla, 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 **Sam Stephens**, of Garfield, Arkansas, **Ryan Gibbs**, of Kansas City, Missouri, **Katherine Brinker**, of Chesterfield, Missouri, **Brock Hinton**, of Parkville, Missouri, **Nelson Shreve**, of Waynesville, Missouri, **Nicholas Hugenberg**, of Springfield, Missouri, **Spencer Templeton**, of Springfield, Missouri, and **Jonathan Mulcahy-Stanislawczyk**, 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](mailto:giving@mst.edu).



## Report from the SPS

The Missouri S&T chapter of the Society of Physics Students had a great year in 2011. One of the highlights of the spring semester was a visit from **Lea (Cozort) Loeffler** (BS '02), who has been with Boeing since 2004, and was one of Boeing's representatives at S&T's fall 2009 career fair. Lea was SPS president for the 2001-2002 academic year, and secretary the semester she graduated. Lea gave a special undergraduates-only presentation on what a physics major can do at Boeing, how to apply for a position at Boeing, and continuing education benefits at Boeing.

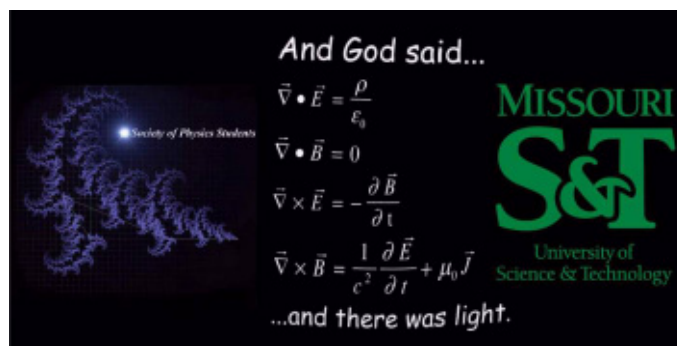
The picture at the top right shows SPS members during Lea's term as president. Lea is in red, in the middle of the upper row. If you are in the picture, send us a brief note about your recent activities for inclusion in next year's newsletter, and we'll send you a free SPS T-shirt.

SPS met weekly during the fall semester. At the beginning of the semester **Ethan Barth-Taber** was elected president, replacing **Ian King**. **Laura Sisken** took over from **Trevor Knoblauch** as vice president, **Cassi Coley** assumed Laura's old position of secretary, and **Andrew Clum** replaced Ethan Barth-Taber as treasurer.

Fall meetings included frequent movie nights and a liquid nitrogen social with Alpha Epsilon Pi. SPS heard a talk by physics graduate student **Ben Payne** on "Undergraduate research activities." Four S&T Professors from outside the Physics department gave talks on their research specialties. Professor **Chen Hou** of Biological Sciences talked about the Hou Animal Physiology Lab, "Where simple math meets real biology;" History Professor **Diane Ahmad** spoke on "Getting to the Pacific: animals, people and the trails 1840-1869;" Professor **Xiaodong Yang** of Mechanical and Aerospace Engineering presented "Nanoscale optics and photonics;" and Professor **Josh Rovey**, also of Mechanical and Aerospace Engineering talked about his plasma physics lab.

The highlight of the fall semester was a visit by Dr. **Sandra Magnus** (BS '86, MS EE '90), who presented SPS with their banner which had flown on the last space shuttle mission. Details are in the front-page article.

The fall semester concluded with election of officers for spring 2012. **John Igo** was elected president, Laura Sisken continued as vice president, **Dimitar Stoyanov** was elected treasurer, and **Madalyn Weston** became secretary.



top: SPS 2001-2002

top middle: SPS banner certificate of authenticity

bottom middle: Erin Davis presenting certificate of appreciation to Sandra Magnus

bottom: SPS banner

## Outstanding GTA's



*Dan Waddill, James Keehn, Adam Upshaw, Nilanka Gurusinghe*

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 2011 semester, and they were determined by a combination of student evaluations and teaching performance assessed by the faculty overseeing the teaching laboratories. In the past the awards were presented every semester, but we have restructured them to an annual award based on two-semester excellence. The winners for the Spring 2011 semester were **Nilanka Gurusinghe**, **James Keehn**, and **Adam Upshaw**. Congratulations to all the winners for helping to advance the department's commitment to excellence in teaching.

## Pegasus Grows

**Thomas Vojta's** Pegasus Linux Cluster, described in detail in our March, 2010 newsletter, has been expanded by the addition of sixteen new quad processor nodes funded by **Gerry Wilemski's** NSF grant and four new quad processor nodes funded by **Barbara Hale's** personal contribution. Gerry's nodes are mainly being used to perform large scale molecular dynamics simulations of two and three component nanodroplets containing thousands of water, butanol, and nonane molecules. Barbara's nodes will be used in her Monte Carlo simulations of molecular clusters containing up to several hundred molecules.



## Congratulations to S&T's 2011 Physics Degree Recipients!

### May 2011

#### *Bachelor of Science*

David Lee Dotson  
Adam Jeffrey Farquhar  
Daniel Edward Franklin  
Jonathan Gregory Gigax  
Jesse Ryan Hoemann  
Micah Lyn Johnston  
Thanh Joseph Nguyen  
Scott Mark Richardt  
Kenneth Paul Smith  
Thomas Gregory White  
Kyle Edward Williams

#### *Master of Science*

Ciaran Ryan-Anderson  
Premitha Wijayinie Pansalawatte

#### *Doctor of Philosophy*

Chetan Vyankatesh Kotabage  
Man Young Lee  
Benedikt Johannes Wilhelm Wundt

### December 2011

#### *Bachelor of Science*

Alexander James Balducci  
Michael Warren Luning  
Christopher Killeen Svoboda

#### *Master of Science*

Yaou Song

#### *Doctor of Philosophy*

Kisra Nayomal Egodapitiya  
Timothy Hudson Mason

## 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](mailto:giving@mst.edu).



## Medvedeva Joins CEMRI

**Julia Medvedeva** is now part of the research team at the Center of Excellence for Materials Research and Innovation (CEMRI) at Northwestern University.

CERMI is a new NSF Materials Center program restructured from the prior Materials Research Science and Engineering Centers (MRSEC) program. In 2011, eight US universities were chosen for the NSF CEMRI award.

The Northwestern University CEMRI proposal received NSF support totaling \$16,200,000 over a six-year period. Within the center, there are three interdisciplinary research groups (IRGs). Medvedeva is co-PI of the IRG studying Fundamentals of Amorphous Oxide Semiconductors (AOS). She is the only theorist and the only physicist working within this collaborative project.

Medvedeva will focus on the systematic quantum-chemical modeling of several AOS materials which are of considerable interest. The short- and long-range structural peculiarities responsible for the macroscopic properties of AOS need to be clearly identified. To do this, Medvedeva will perform density functional calculations of the properties of several experimental AOS materials using the structural data provided by measurements.

In addition, Julia will model a few “prototype” AOS materials using first-principles molecular dynamics simulations, in which the initial crystalline structures are heated and quenched to remove structure memory effects. She will also study the role of structural distortions in the electronic and optical properties of AOS materials.

## From Alumnus Matt Krems

Hello all from San Diego! On March 3, 2011, I successfully completed my goal of defending my thesis entitled “Particle Dynamics in Nanopore Systems” by the age of 26.

Looking back at my years at UCSD, I feel that my undergraduate training from Rolla has served me very well. I want to say hi to Dr. **Dan Waddill**, Dr. **Bob DuBois**, Dr. **Jerry Peacher**, and Dr. **Ron Bieniek**. Their guidance and encouragement helped me get to where I am today. The physics department felt like one big family.

I will be leaving academia, at least for a while. While in San Diego, I discovered many interests in addition to physics. I fell in love with snowboarding, hiking and photography, and have taken a serious interest in other academic disciplines such as economics and computer science. Most of all, I fell in love with travel.

In the past few years, I have been to Japan twice, Hong Kong, Egypt, and Vietnam, and have snowboarded in numerous areas in the western United States and Canada. Starting in July, I will be embarking on a long-term trip, beginning in China. I plan to travel for at least a year all over Asia, working on projects which can hopefully lead to a business. I feel like I am about to enter the most exciting and challenging period of my life, where I will learn and experience more than ever. I will be documenting my experiences over the next year on my personal website, [mattkrems.com](http://mattkrems.com).

I am not sure if I am really done with physics forever. Nonetheless, my physics training at Rolla has and will continue to serve me in more ways than I can probably imagine. Thanks to all of the great people in the physics department! Hopefully I can come visit sooner rather than later!

## Holy Cow, Pam Turns 50, Celebrates 20<sup>th</sup>!

**Pam Crabtree** marked her 50<sup>th</sup> birthday in 2011, and celebrated her 20<sup>th</sup> anniversary of service at Missouri S&T.



Pam joined the Physics Department in 1991 as a secretary. Her entire time at S&T has been with Physics. She is currently senior secretary and is without a doubt one of the department's most valuable people.

In 2011, Pam also celebrated the arrival of her third grandson, **Kameron**, who joined brothers **Kaleb** (5) and **Kolton** (3) in June. She is shown receiving her 20<sup>th</sup> anniversary clock during her 50<sup>th</sup> birthday party. For the detail-minded among our readership, don't worry, the clock came with a pendulum.



*Pam Crabtree*

## A Visit from the Elves

The Christmas Elves must really love our chairman, **Dan Waddill**, because they visited his office once again last December! No other member of the department can claim that distinction.



Finally!  
A useful  
present.



The elves left evidence this year. Handprints. Will they be caught?

## Alumni Notes

**Chris Lloyd** (BS '03) writes "my undergraduate education at UMR prepared me well for graduate work at Washington University in St. Louis (AM '05, PhD '10). I'm now working at MIT Lincoln Laboratory, where my ultrasound research aids me with studying current sonar issues. Unfortunately, I'm not aware of any other UMR graduate working at the laboratory."

**Adam Tournier** (PhD '05) has a new teaching position as Assistant Professor of Physics at McKendree University.

**Vibhakar Dave** (MS '65) informed us "my darling wife Mrs. **Indu V. Dave** passed away on September 28, 2010."

**Thomas McMahon** (PhD '69) reports that he is happily retired and working one day a week as consultant for Prime Star Solar, a wholly owned subsidiary of General Electric.

**Mathew Fritts** (BS '89) tells us "I spent a decade or so out of academia, then decided to go back to school. In February I completed my PhD in Physics at the University of Minnesota. My thesis work was with the Cryogenic Dark Matter Search (CDMS). At the moment I'm still working for CDMS on a short-term postdoc, but I'm starting to look for what's next. Possibly a longer postdoc position in Germany, where my significant other **Monica** is currently living and working as an artist."

**Dr. Michael Anthony Vietti** (PhD '72) passed away on December 7, 2010. He was born March 27, 1941, in Pittsburg, Kansas. He received his BS and MS degrees in physics from Pittsburg State University, and his PhD from the University of Missouri-Rolla in 1972. He was an associate professor of physics at the University of Maine, Orono, for 16 years, then became vice president of engineering for Rainwise, Inc. for the last 23 years. He is survived by his wife, **Celia Kay Somers Vietti**, three brothers, two daughters, four sons, and three grandsons.



*Matt Krems  
(BS '05) in  
Vietnam. See  
his story on  
page 6.*



## Jentschura Receives Faculty Excellence Award

**U**lrich Jentschura was one of only five Missouri S&T Faculty members to receive a 2011 Faculty Excellence Award.

This award was established in 2009 to recognize faculty who have demonstrated sustained excellence in all three categories of teaching, research and service. The Faculty Excellence Award is the most prestigious campus-wide award, and is given based on the contributions of the individual over a five year period.

In a letter of recommendation for the award, 2005 Physics Nobel Prize winner **Theodor W. Hänsch** had this to say about Ulrich's accomplishments: "...he has become one of the world leaders in the field of theoretical quantum electrodynamics of bound systems... he has invented powerful new numerical integration algorithms, which has given new momentum to the entire field of research...I do not know of any other theorist who combines ideas and insights from QED, atomic theory, laser physics, and numerical mathematics in a comparable way."



Ulrich Jentschura

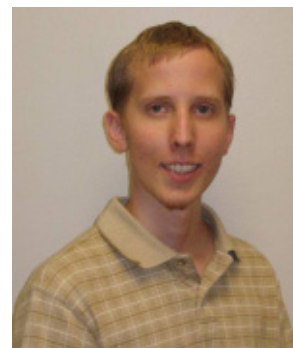
## Charlie Celebrates 35<sup>th</sup>

Last year Charlie McWhorter celebrated his 35<sup>th</sup> anniversary of service at Missouri S&T. Charlie has been with the Physics Department the entire time. Congratulations, Charlie!



## Dustin Powell Remembered

**F**ormer S&T undergraduate student **Dustin Powell** passed away on April 14, 2011, at the age of 22. Dustin was from Troy Missouri, and was a junior studying physics when last enrolled at S&T during the Spring 2009 term.



## Congratulations to 2011 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 2011

Derek Anderson, Katherine Brinker, Andrew Cudd, Ian Denaro, David Dotson, Christian Dzurny, Ryan Gibbs, Jonathan Gigax, Brock Hinton, Nicholas Hugenberg, Carolyn Johnson, Stephen Kraus, Stephen Lee, Amanda

McBee, Nathan Morris, Ian Ramsey, Nelson Shreve, Laura Sisken, Dimitar Stoyanov, Christopher Svoboda, Spencer Templeton, Aaron Viets, Sarah Wiese, and Stephen Yeo.

### Fall Semester 2011

Katherine Brinker, Patrick Chipman, Clayton Craig, Andrew Cudd, Christian Dzurny, Bradley Farley, Nicholas Few, Ryan Gibbs, Timofey Golubev, Nicholas Hilbert, Brock Hinton, Nicholas Hugenberg, Carolyn Johnson, Stephen Kraus, Michael Luning, Nathan Morris, Nelson Shreve, Laura Sisken, Alyson Smith, Paul Somers, Dimitar Stoyanov, Christopher Svoboda, Spencer Templeton, Aaron Viets, and Andrew Wilkening.



## Chowdhury Wins Student Excellence Award

**Uttam Chowdhury** won the Student Award for Excellence at the 64th Annual Gaseous Electronics Conference (GEC) in Salt Lake City, Utah, 14-18 November 2011. The title of Uttam's winning presentation was "*Fully differential cross sections for four-body charge exchange processes.*"

Students are nominated by their advisors to participate in the competition, and the GEC Executive Committee selects the finalists from the nominations. The finalists present a 15 minute talk about their research, and the GEC Executive Committee selects the winning presentation. This year the six finalists for the competition were from Drexel University, Missouri S&T, Texas Tech University, the University of Michigan, the University of Southern California, and Korea's Hanyang University.

Uttam was nominated by his advisor, **Don Madison**, Curators' Professor of Physics at Missouri S&T. His theoretical work examined proton-helium collisions in which one of the helium electrons is captured by the proton and the other helium electron is left in an excited state of the helium ion. Uttam compared his theoretical results with experimental measurements made by **Michael Schulz's** group at Missouri S&T and **Reinhard Dörner's** group at Frankfurt, Germany. Uttam wrote a research paper on the same topic, which was accepted for publication in



the Journal of Physics B: Atomic, Molecular & Optical Physics in early December 2011.

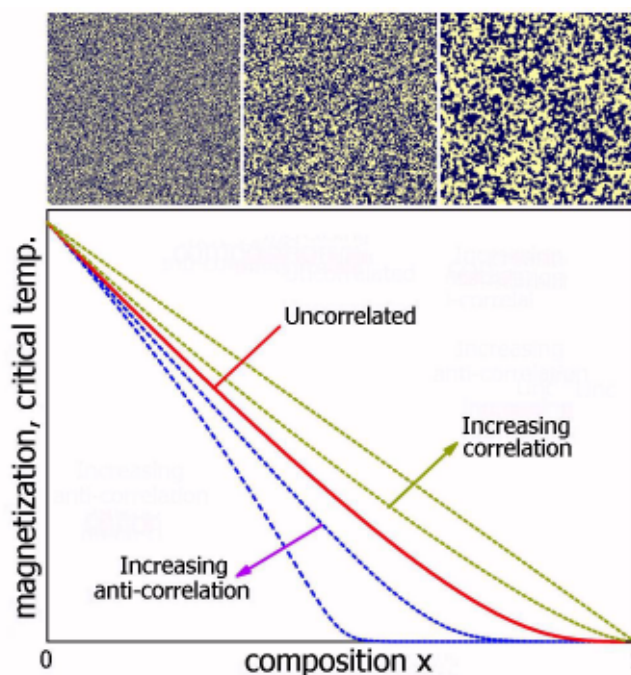
This is the second time a Missouri S&T student has won the GEC Student Award for Excellence. **Ola Al-Hagan** (PhD '10), also advised by Don Madison, won the award in 2008.

## Alloys: an (im)Perfect Mixture

In the study of binary alloys, it is usually assumed that the lattice sites are occupied by atoms of the two constituent substances in a completely random fashion, independent of each other. It is clear, however, that attractive or repulsive interactions between the different atom types will lead to correlations or anti-correlations between neighboring sites. In the former case, like atoms tend to form clusters while they stay apart from each other in the latter case. To understand the properties of realistic alloys, it is therefore important to study the effects of such correlated randomness on their properties.

Working with Prof. **Thomas Vojta**, undergraduate student **Chris Svoboda** attacked this problem by means of computer simulations. He first numerically generated samples of several ferromagnetic alloys with different degrees of correlations between like atoms (see figure for examples). He then computed the magnetic properties of these alloys. Surprisingly, even correlations extending over only one or two lattice constants significantly change the alloy behavior. In particular, positive correlations greatly promote the appearance of ferromagnetism while anti-correlations suppress it (see figure).

This work formed the basis of "*Disorder correlations at smeared phase transitions*," coauthored by Chris, graduate students **David Nozadze** and **Fawaz Hrahsheh**, as well as Thomas Vojta. The paper has just been accepted for publication in *Europhysics Letters*.



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

## Donations over \$100:

Harro Ackermann  
 Fred Keith Baganoff  
 Mark Jeffery Barnhart  
 John S Bosnak  
 Laura L Bosnak  
 Lewis K Cappellari  
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 Carmen Maria Carney  
 Stephen D Christiansen  
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 Terrence R Ward  
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 Clayton Joseph Weidinger  
 Gerald Wilemski  
 James T Willcutt

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 John S Bosnak  
 Laura L Bosnak  
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 Bradley A Brown  
 Charles E Byvik  
 Robert E Caldwell  
 James P Canner  
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John C Carstens  
 Charles H Church  
 Vibhakar R Dave  
 Kevin B Edwards  
 Suzanna Jo Edwards  
 Marsha S Evans  
 Alissha Gayle Feeler  
 Jean W Fletcher  
 Robert A Fletcher  
 Roger Keith Foehrweiser  
 Patrick Joseph Garey  
 Edward B Hale  
 Carol E Henderson-Kuhn  
 George Robert Hessler  
 John A Hocken  
 William M Hughes  
 Jerry G Johnson  
 Harris C Jones  
 John Daniel Jones  
 Franklin W Kone  
 Martha A Kos  
 Terrence A Leigh  
 Patricia Lindgren  
 William A Lindgren  
 Hulen H Luetjen  
 Lina Madison  
 Havva Malone  
 Daniel B Marsh  
 John W McGuire  
 William Vernon Meyer  
 Steven A Mezines  
 Mark W Morris  
 Casey Patrick Morriss  
 Elizabeth A S Munson

William F Munson  
 Norman Eric J  
 Larry D Oppliger  
 Raymond E Paul  
 Larry J Peery  
 Keith Alan Pimmel  
 Matthew NathaPritzker  
 Kathy A Rages  
 Rodney O Randall  
 Donald G Rathbun  
 Emmett R Redd  
 Michael R Ruhland  
 Carrie Lynn Rule  
 Ryan Major Rule  
 Gary S Sammelmann  
 Richard S Schwentker  
 Richard H Shields  
 James Shiells  
 Morgan P Slusher  
 James G Smith  
 Robert M Stovall  
 Curtis Steven Stratman  
 James J Strohmeier  
 John Lester Tappmeyer  
 Richard D Thom  
 Bobbie J Thompson  
 John L Thompson  
 Kenneth Wayne Trantham  
 Terry R Tucker  
 Thomas Vojta  
 Zu-En Wang  
 Charles Gerald Williams  
 Gary K Woodward  
 Gary G Wooley

## Physics Department Acknowledges Corporate Support

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

Anadarko Petroleum Corporation  
 Boeing Foundation  
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 Lockheed Martin Corporation  
 Oracle Corporation  
 Shell Oil Company Foundation



## 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,<sup>1</sup> graduate students,<sup>2</sup> or alumni<sup>3</sup> under the supervision of Missouri S&T faculty.

*"Differential cross sections for single ionization of  $H_2$  by 75-keV proton impact,"* U. Chowdhury,<sup>2</sup> M. Schulz, and D. H. Madison, Phys. Rev. A **83**, 032712 (2011).

*"Calibration of distorted wave Born approximation for electron impact excitation of Ne and Ar at incident energies below 100 eV,"* Yaqui Liang, Zhangjin Chen, D. H. Madison and C. D. Lin, J. Phys. B: At. Mol. Opt. Phys. **44** 085201 (2011).

*"Manipulating atomic fragmentation processes by controlling the projectile coherence,"* K. N. Egodapitiya,<sup>2</sup> S. Sharma,<sup>2</sup> A. Hasan, A. C. Laforge,<sup>3</sup> D. H. Madison, R. Moshhammer, and M. Schulz, Phys. Rev. Lett. **106**, 153202 (2011).

*"Low energy ( $e,2e$ ) studies from  $CH_4$ : Results from symmetric coplanar experiments and molecular three-body distorted wave theory,"* K. L. Nixon, Andrew J. Murray, Hari Chaluvadi,<sup>2</sup> Chuangang Ning, and D. H. Madison, J. Chem. Phys. **134**, 174304 (2011).

*"Strong-field nonsequential double ionization of Ar and Ne,"* Zhangjin Chen, Yaqui Liang, D. H. Madison, and C. D. Lin, Phys. Rev. A **84**, 023414 (2011).

*"Indistinguishability in electron impact excitation-ionization of helium,"* A. L. Harris,<sup>3</sup> B. Milum, and D.H. Madison, Phys. Rev. A **84**, 052718 (2011).

*"Experimental and theoretical investigation of the triple differential cross section for electron impact ionization of pyrimidine molecules,"* J. D. Builth-Williams, S. M. Bellm, D. B. Jones, Hari Chaluvadi,<sup>2</sup> D. H. Madison, C. G. Ning, B. Lohmann, and M. J. Brunger, J. Chem. Phys. **136**, 024304 (2012).

*"Four-body charge transfer processes in proton-helium collisions,"* U. Chowdhury,<sup>2</sup> A. L. Harris,<sup>3</sup> J. L. Peacher and D. H. Madison, J. Phys. B. **45** 035203 (2012).

*"Quantum phase transition of the sub-Ohmic rotor model,"* M. Al-Ali<sup>2</sup> and T. Vojta, Phys. Rev. B **84**, 195136 (2011).

*"Infinite randomness criticality in a randomly layered Heisenberg magnet,"* F. Hrahsheh,<sup>2</sup> H. Barghathi and T. Vojta, Phys. Rev. B **84**, 184202 (2011).

*"Transport properties in antiferromagnetic quantum Griffiths phases,"* D. Nozadze<sup>2</sup> and T. Vojta, Europhys. Lett. **95**, 57010 (2011).

*"Composition-tuned smeared quantum phase transitions,"* F. Hrahsheh,<sup>2</sup> D. Nozadze<sup>2</sup> and T. Vojta, Phys. Rev. B **83**, 224402 (2011).

*"Generalized contact process with two symmetric absorbing states in two dimensions,"* M.Y. Lee<sup>3</sup> and T. Vojta, Phys. Rev. E **83**, 011114 (2011).

*"Evidence for power-law Griffiths singularities in a layered Heisenberg magnet,"* F. Hrahsheh,<sup>2</sup> H. Barghathi, P. Mohan, R. Narayanan and T. Vojta, J. Phys. Conf. Series, **273**, 012004 (2011).

*"Structural and magnetic properties of  $La_{0.7}Sr_{0.3}Mn_{1-x}Ni_xO_3$  ( $x=0.4$ ),"* T. F. Creel,<sup>2</sup> J. B. Yang, M. Kahveci, J. Lamsal, S. K. Malik, S. Quezado, B. W. Benapfl, H. Blackstead, O. A. Pringle, W. B. Yelon, W. J. James, MRS Proc. **1327**, mrss11-1327-g8-02 (2011).

*"Self-energy correction to the hyperfine splitting for excited states,"* B. J. Wundt<sup>3</sup> and U. D. Jentschura, Phys. Rev. A **83**, 052501 (2011).

*"Fabrication, characterization and theoretical analysis of controlled disorder in the core of the optical fibers,"* N. P. Puente, E. I. Chaikina, S. Herath<sup>2</sup> and A. Yamilov, Appl. Opt. **50**, 802 (2011).

This paper was highlighted in <http://www.opticsinfobase.org/spotlight/summary.cfm?uri=ao-50-6-802>, where it was said that "the results presented in this paper open up new and important possibilities in the design of coherent and incoherent random fiber lasers and can be expected to have a significant impact in the community." It was among the top 10 most downloaded papers in Applied Optics for two months in 2011.

## Vojta Lectures in Korea

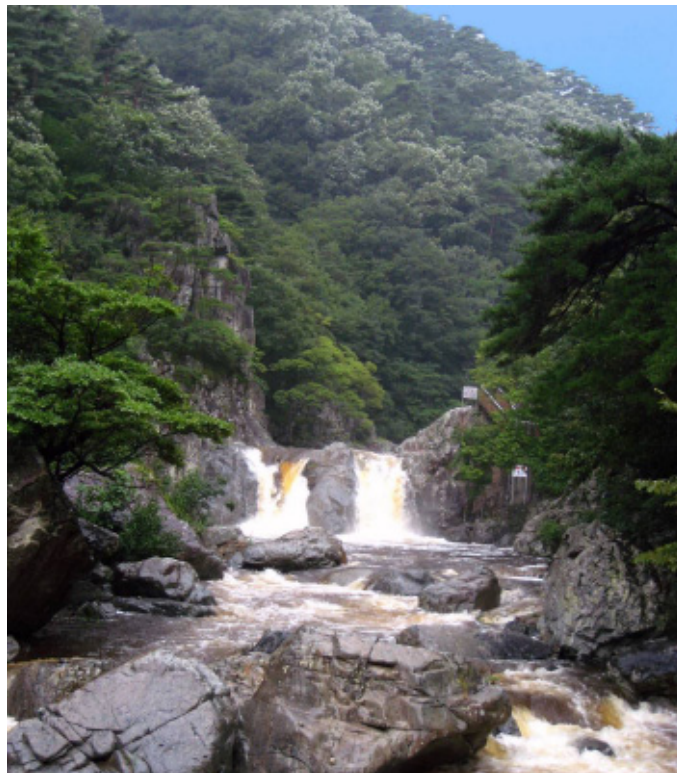
Professor **Thomas Vojta** returned to Korea in August 2011 to give an invited talk at the international conference Localization 2011. The conference was hosted by the Asia-Pacific Center for Theoretical Physics, an international research center in theoretical physics supported by ten member countries from the Asia-Pacific region. It is located in the city of Pohang on the campus of Pohang University of Science and Technology, one of the top science and technology universities in Asia.

Localization 2011 was the eighth of a series of conferences that started in Braunschweig, Germany in 1984 and has been held in Tokyo, London, Eugene, Jasowiec, Hamburg, Tokyo and now in Pohang. Its main topic was quantum transport phenomena in disordered systems. Thomas gave a talk on “*Transport properties in magnetic quantum Griffiths phases*,” which summarized recent work with S&T graduate student **David Nozadze**.



*Bulguksa Temple  
(inset: two guardian statues)*

In addition to the lectures and scientific discussions, the schedule left some time for sightseeing in the region around Pohang which is the homeland of the famous Silla dynasty (57 BC to 935 AD). The conference participants visited Bulguksa Temple which dates back to the year 751. After the conference, Thomas spent a day hiking in Mount Naeyeonsan Park, exploring a chain of fabulous waterfalls.



*Naeyeonsan Waterfalls*

## Phonathon 2012

Mark your calendars! On April 10, 11, 12 and 15 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 171 alumni and other donors committed \$29,601 in donations to the MSM-UMR-Missouri S&T Physics Department last year. Last year's fundraising Phonathon raised \$22,751 with an average gift of \$167 from 136 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 **Kai Song** of Missouri S&T's Advanced Materials Characterization Laboratory discussing "*Electron microscopy in materials science.*" The series continued in February with **Charles Munger, Jr.** of the Stanford Linear Accelerator Center speaking about "*Electric dipole moments of fundamental particles.*" After that, **Joseph Heremans**, Ohio Eminent Scholar at the Ohio State University reviewed "*High-efficiency thermoelectric materials: new design strategies, new applications.*" **Kartik Ghosh** of Missouri State University presented "*Nanoscale investigation of domain dynamics in multiferroic thin films using scanning probe microscope,*" and **Stan Brodsky**, also of the Stanford Linear Accelerator Center, discussed "*Novel aspects of hadron physics.*"

In March, **Guoqiang Li** from the College of Optometry at University of Missouri-St. Louis reviewed new aspects of vision care in his talk "*Adaptive lens for vision correction and biomedical imaging.*" Next, **José Abel Hoyos** of the University of Sao Paulo spoke on "*Randomness in one dimensional quantum systems,*" and **Lifeng Dong** of Missouri State University talked about "*Electron microscopy observations of carbon nanomaterials.*"

April began with **Klaus Bartschat** from Drake University, who presented "*Single and double ionization of atoms and molecules by short-pulse intense laser fields and charged-particle impact.*" **Evgeny Tsymbal** of the University of Nebraska-Lincoln then gave a talk on "*Ferroelectric tunnel junctions: controlling electron and spin transport by ferroelectric polarization,*" and **R. Mark Wagner** from the Large Binocular Telescope Observatory summarized the capabilities of the telescope in his talk "*The Large Binocular Telescope: seeing the universe in a new light.*" Our spring series concluded at the end of April with the Fortieth Annual Harold Q Fuller Prize Colloquium. This year the competitors gave posters instead of talks. Details of the Fuller competition appear in a separate article on page 15.

The colloquium series resumed in the fall with a full schedule of fourteen colloquia over a wide range of physics topics. First up in September was **William Ratcliff** from the National Institute of Standards and Technology who discussed "*The multiferroic renaissance.*" **Jay Switzer**, Missouri S&T's Professor of Discovery in Chemistry then reviewed promising new techniques for producing memory devices in "*Epitaxial electrodeposition of metal oxides for solid-state memory.*" Next, **Michael A. McGuire** of Oak Ridge National Laboratory gave a presentation on "*Iron compounds in energy applications: superconductors, thermoelectrics, and ferromagnets,*" **Alexey Snezhko** from Argonne National Laboratory spoke on "*Active materials: self assembly and control far-from-equilibrium,*" and **Eric Majzoub** of the University of Missouri-St. Louis presented theoretical work on "*Thermodynamics and kinetics of nano-cluster and nano-confined complex hydrides.*"

October began with a talk on "*Application of string theory concepts to phenomenology*" by **Christian Schubert** from the Universidad Michoacana de San Nicolás de Hidalgo. Our 2011 homecoming speaker was **Shawn Kathmann**, who received his PhD from our department in 1998. Shawn is pictured below with his thesis advisor Dr. **Barbara Hale**. Now at the Pacific Northwest National Laboratory, he spoke about "*Understanding the chemical physics of nucleation.*" Shawn also gave an informal lunchtime presentation for graduate and undergraduate students.



Next in October, **Lihong Wang** of Washington University in St. Louis showed how ultrasonic waves induced by pulsed laser light can be used to image biological tissue in his talk "*Photoacoustic tomography: ultrasonically breaking through the optical diffusion limit,*" and **Clifford Will**, also from Washington University in St. Louis reviewed experimental evidence for **Einstein's** general relativity in "*The confrontation between general relativity and experiment.*" Continuing a tradition, the department celebrated the awarding of the 2011 Nobel Prizes with lectures by our own **Thomas Vojta** on "*Discovery of the accelerating expansion the Universe,*" and **Alexey Yamilov** on "*Discovery of quasicrystals.*"

November began with the Eighteenth Annual **Laird D. Schearer** Prize Colloquium, which saw three presentations by the finalists. Details are in the article on page 14 of this newsletter. Next up was **Xiaodong Yang**, a new faculty member in S&T's Department of Mechanical & Aerospace Engineering, who told us about "*Manipulating light with engineered optical nanostructures.*" After that, **Kim Fook Lee** of Michigan Technology University gave a presentation on "*Optical quantum technology for communication, imaging and biophotonics.*" The fall colloquium series concluded with a talk in December on "*Electron emission from condensed matter induced by fast ions: applications to microdosimetry*" by East Carolina University's **Jeff Shinpaugh**.

## 18<sup>th</sup> Annual Schearer Prize Competition

The Eighteenth 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 November 3, 2011. Five students submitted applications for the competition. The applications consisted 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 **Barbara Hale**, **Yew San Hor**, and committee chair **Bob DuBois**, selected three finalists who gave oral presentations of their work in a departmental colloquium.

The 2011 finalists were **David Nozadze**, advised by Professor **Thomas Vojta**, **Kisra Egodapitiya**, advised by Professor **Michael Schulz**, and **Ben Payne**, advised by Professor **Alexey Yamilov**. During the colloquium on November 3, Mr. Nozadze discussed “*Non-Fermi liquid transport properties in quantum Griffiths phases*,” Mr. Egodapitiya talked on “*Multiple differential cross sections for dissociative ionization of molecular hydrogen by 75 keV proton impact*,” and Mr. Payne presented “*Position-dependent diffusion coefficient as localization criterion in non-conservative random media*.” All students gave excellent talks. First place and a \$500 prize was awarded to Mr. Payne, second place and a \$300 prize was awarded to Mr. Nozadze, and third place and a \$200 prize was awarded to Mr. Egodapitiya.

Congratulations to all three speakers, and thanks go to all who participated in this year's competition. 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 Ben Payne

It is a happy distinction to be presented with the 18<sup>th</sup> Annual Schearer Prize. I'm grateful to the committee members Drs. **Barbara Hale**, **Yew San Hor**, and **Robert DuBois** for the opportunity to participate in the competition. My success is due in no small part to my advisor Dr. **Alexey Yamilov**. All the graduate students who submitted entries this year are good friends, and I look forward to an exciting final year at Missouri S&T.

The topic of my talk was the central result of my PhD work -- characterizing transitions between different transport descriptions both in the presence of disorder, and also with absorption or gain. A phase diagram was first developed with these two parameters, then transport regimes were determined. Simultaneously, robust numerical simulations have been written to model wave and particle transport. More than one million computational hours were used to verify the predictions of the phase diagram.

In addition to my physics education and research experience at Missouri S&T, I have been participating in conferences on high performance computing for the past few years. My plan is to combine these two passions into a research career. I am in the process of applying to postdoctoral positions at National Labs.

## Come Back for Homecoming

The Missouri S&T Physics Department warmly invites you to return to Rolla for **S&T Homecoming 2012** on **October 12-13, 2012**. On Friday afternoon, October 12, 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 2012 Physics Colloquium at 4 PM. on Friday, October 12. Later that evening, Professors **Ed** and **Barbara Hale** will host a homecoming reception in their lovely home. Contact us at [physics@mst.edu](mailto:physics@mst.edu) for specific information about physics department activities, or [alumni@mst.edu](mailto: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!

Ben  
Payne





## 40<sup>th</sup> Annual Fuller Research Seminar

The 40th annual **Harold Q Fuller** Undergraduate Research Seminar was held on April 28, 2011. This competition promotes participation of undergraduates in research both in the department and in summer intern projects. This year's participants were **Ken Smith**, "*Electric-field guided synthesis of standalone nanowire array for thermoelectric applications*," advised by Dr. **Yew San Hor**; and **Laura Sisken**, "*Electromagnetic wavefront shaping*," advised by Dr. **Alexey Yamilov**. Both projects were performed at Missouri University of Science and Technology.

Ken and Laura presented posters of their work to the entire department. The posters were judged by the Fuller Prize Committee, Dr. **Julia Medvedeva** and Dr. **Ralph Alexander**, who were very impressed with both poster presentations and rated them equally. The judges decided to award both posters \$500.

Laura  
Sisken



## Ken Smith Named Honors Academy Fellow

**Ken Smith** was one of two outstanding seniors at Missouri S&T to be named Honors Academy Fellows for 2011. To qualify for the designation, students must be members of Missouri S&T's Honors Academy, complete 12 hours of honors course credit and an honors senior thesis, and maintain a minimum grade-point average of 3.5.

Smith, of Florissant, Missouri, graduated in May with a BS in Physics and minor in Applied Mathematics.

Ken has been a member of the Society of Physics Students for three years. In his honors thesis, he developed a new process for growing nanowires. Nanowires are tiny wires that may one day be used to connect components into extremely small circuits. Smith is pursuing a MS in electrical engineering at Missouri S&T, where he hopes to conduct further research into the use of nanotechnology for sensor development.

## Faculty Notes

**Ron Bieniek** and **Allan Pringle** are co-PI's on "*Science education and quantitative literacy: an integrated, inquiry-based approach*," which was funded in 2011 for the ninth year in a row by the Missouri Department of Higher Education.

**Agnes Vojta**, **Barbara Hale**, and **David Lay** were among the instructors on campus chosen as winners of the Freshman Engineering Program WE LOVE YOUR CLASS award!

**Greg Story** won a 2011 Outstanding Teaching Award, and **Don Madison**, **Paul Parris**, **Thomas Vojta**, and **Dan Waddill** received 2011 Letters of Commendation for their excellence in teaching.

Two faculty received promotions in 2011 **Thomas Vojta** was promoted to Professor of Physics, and **Julia Medvedeva** was promoted to Associate Professor of Physics with tenure.

**Gerry Wilemski** was invited to serve as an external expert and to speak at the CLOUD Workshop in Vienna, Austria, 16-18 February 2011. His talk was titled, "*Scaling behavior of nonclassical nucleation rates: Nucleation of methanol*," co-authored by his graduate student **Fawaz Hrahsheh** and Professor **Barbara Hale**. The workshop was devoted to reviewing results from the CLOUD (Cosmics Leaving Outdoor Droplets) project operating at the CERN Proton Synchrotron which studies possible effects of cosmic rays on nucleation as well as on cloud droplet and ice particle formation.

**Julia Medvedeva** has co-edited a Materials Research Symposium Proceedings book on "*Transparent conducting oxides and applications*" which appeared in December 2011. The proceeding includes a cross-section of the research on basic materials properties and technological application of transparent conducting oxide materials covered during the 2010 MRS Fall Meeting Symposium that Julia co-organized.

**Michael Schulz** received a Fulbright scholarship to support collaboration with Max-Planck-Institut für Kernphysik for five months. He also received the Mercator award from the Deutsche Forschungsgemeinschaft. This award supports a nine months Visiting Professorship at the University of Frankfurt and another three months in the summer of 2013. He gave invited talks at international conferences in Belgrade, Caen (France), Dublin, and Salt Lake City. Finally, his student **Kisra Egodapitiya** (PhD '11) gave an invited talk on his research at the international conference in Dublin, and accepted an offer for a post-doctoral position at the University of Virginia.

**Ulrich Jentschura** was selected to be a member of the Editorial Board of the Physical Review A for 2011-2013. In September 2011 he was awarded a \$264,000 NSF grant for "*Advanced computational physics in atomic and laser science*," and his NST Precision Measurement Grant was renewed for the second of three years. During 2011 Ulrich provided a total of 15 referee reports for international scientific journals, mostly as an adjudicator for difficult cases reported to the Editorial Board of Physical Review A. These cases include appeals regarding difficult and interesting novel concepts which in turn require much deeper thought than normal referee reports.

## 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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Job Title (if appropriate): \_\_\_\_\_

Business Phone: \_\_\_\_\_

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