

Matter

March 2017

'n

Motion

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

Fischer Receives CAREER Grant

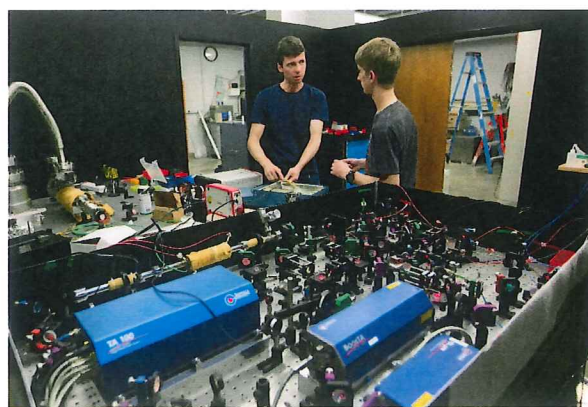
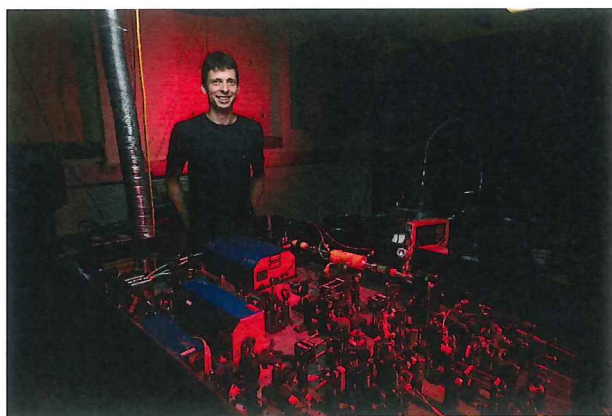
Daniel Fischer, Assistant Professor of Physics, uses laser beams to trap lithium atoms in a magnetic field inside a custom-built vacuum chamber. He then ionizes them using a different laser and, with the aid of a high-resolution momentum spectrometer, measures the distance and velocity they travel.

"It can be extremely challenging to predict the motion of three or more particles due to their mutual forces", says Fischer. "This complex interplay of several particles requires a combination of theoretical and experimental research because such systems cannot be fully described with closed mathematical expressions".

This is what physicists refer to as the "few-body problem", which continues to confound the physics world.

"The few-body problem has both fundamental and technological relevance for the future", he says. "For example, if you destroy a cancerous cell in a body, the destruction of the genetic material is not only driven by their direct absorption of radiation but also by the interaction with nearby molecules and surrounding liquids. By understanding how the atoms of these cells share the absorbed energy, we could better control localized treatments".

Few-body predictions could also be used in materials science, quantum chemistry, biological science and information processing.



Fischer's research was funded through a \$400,000 grant from the National Science Foundation's Early Career Development (CAREER) program

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Contact S&T Physics

If you would like to contact us, 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>.

Memo from the Chair

The past year saw the retirement of long-time faculty member **Don Hagen**. Don and his family remain in Rolla, and we wish them all the best in their future endeavors. Additionally, **Julia Medvedeva** was promoted to full Professor, and **Yew San Hor** was promoted to Associate Professor with tenure. Congratulations to both! Our faculty continued to garner recognition for outstanding scholarly and teaching performance. Notable this year was Prof. **Thomas Vojta's** selection as a Curators' Distinguished Professor. In addition, Prof. **Greg Story** won another Outstanding Teacher Award, Profs. **Parris, Vojta, Waddill and Wilemski** all received Outstanding Teaching Commendations. **Yew San Hor** was again recognized by Thomson Reuters as one of the most highly cited scientists (all fields) in the past decade for his seminal work on topological insulators and superconductors. He was the only faculty member at Missouri S&T to be so recognized.

Our students also continue to perform admirably. Undergraduate and graduate enrollments remain strong. Over 3/4 of our majors graduated with honors this past year, and combined job and graduate school placement for our graduates is at nearly 100%. These and more stories of student, faculty, and staff accomplishments can be found elsewhere in this newsletter.

Finally, I would like to thank all of you for your continued and dedicated support. The department's success reflects the quality and dedication of our faculty, students, staff, and alumni. I know that 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

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 email giving@mst.edu.

Faculty Funding

Julia Medvedeva received continued funding from Northwestern University for her work on “*Multifunctional nanoscale materials structure*” through the Center of Excellence for Materials Research and Innovation.

Yew San Hor received continued funding from the National Science Foundation for his work on “Surface State Studies of Topological Insulators/Superconductors”.

Don Madison received continued funding from the National Science Foundation (NSF) award for “*Theoretical study of few body processes.*”

Michael Schulz received continued funding from the National Science Foundation for his work on “*Coherence Effects and Few-Body Dynamics in Atomic Fragmentation Processes.*”

Ulrich Jentschura received continued funding from the National Science Foundation for his work on “*Quantum Vacuum and Atoms: Exploring QED and Atom-Surface Interactions with the Help of Advanced Numerical Methods.*”

Alex Chernatynskiy received new funding from the Missouri Research Board for his work on “Spin crossover and thermal conductivity of Fe-Mg-O”.

Daniel Fischer received \$400,000 funding from the National Science Foundation's Early Career Development (CAREER) Program. (See article on page 1)

Physics Department Awards 2016-2017 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.

The *Dr. John R. and Patty Rogers Endowed Scholarship* provides scholarships to academically proficient physics majors who demonstrate financial need. The 2016-2017 Rogers scholarships, with values ranging from \$1250 to \$1950, were awarded to **Matthew York** from Ozark, Missouri; **Jacob Cook** from Willard, Missouri; and **Nathan Hock** from Saint Louis, Missouri.

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

Sara Newman from League City, Texas and **Jacob Cook** from Rolla, Missouri were awarded the *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. This \$500 to \$1000 scholarship is awarded to physics students on the basis of their performance at Missouri S&T.

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. **Logan Smith** from Barnhart, Missouri received \$1000 and **Austin Powell** from Highlands Ranch, CO received \$500.

Brendan Ramsey from Festus, 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 Anderson Scholarship Fund* is an endowment established in memory of Dr. **Richard Anderson**. **Brian Ford** from Louisville, Kentucky received \$500; **Katherine Overend** from Lansing, Kansas, **Raylynn Swift** from Saint James, Missouri and **Charlie Winborn** from Jefferson City, Missouri received \$1000 Richard Anderson Scholarship.

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 and development fund, to students who earn a grade point average of 3.5 or higher. This past year, these \$500 to \$2000 scholarships were awarded to **Abdulrahman Alharbi** from Rolla, Missouri; **Rachel Birchmier** from Kansas City, Missouri; **Rebecca Campbell** from Saint Charles, Missouri; **Albert Chua** from O'Fallon, Missouri; **Colton Daily** from Rolla, Missouri; **Kent Gorday** from Foristell, Missouri; **Jacob Hume** from Lake Saint Louis, Missouri; **Aaron Lemmermann** from Raytown, Missouri; **Cameron Lerch** from Lees Summit, Missouri; **Jason Mao** from Springfield, Missouri; **Brady Martin** from Lees Summit, Missouri; **Michael Morrow** from Lees Summit, Missouri; **Mathew Pollard** from Fenton, Missouri; **Austin Powell** from Highlands Ranch, Colorado; **Kevin Rose** from Saint Louis Missouri; **Jason Summers** from Rolla, Missouri and **Skye Tackett** from Kansas City, Missouri.

The department also awards *Physics Scholarships for Academic Access*, funded by a group of alumni and faculty donors. These are needs-based awards to Missouri resident students in Physics. For 2016-2017 these \$500 to \$1000 scholarships were awarded to **Robert Branson** from Butler, Missouri, and **Joshua Maxwell** from Saint Robert, Missouri.

Report from the SPS

The 2016 year began with the installment of new officers: **Rachel McCormick** as president, **Josey Stevens** as vice-president, **Kent Gorday** as treasurer and **Skye Tackkett** as secretary.

Spring 2016 activities included such things as movie night, student research presentation, and preparatory night before the lunch with **Dr. Sandra Magnus**, astronaut and physics alumni. SPS heard from **Dr. Hou** from the Biology Department. Many members of the SPS volunteered to run activities in the regional Science Olympiad in February, held at Missouri S&T. The semester closed as usual with elections for the coming fall semester and a liquid nitrogen ice cream social.

In Fall 2016, a nearly full change-over of officers took place. **Skye Tackkett** began work as president, **Charlie Winborn** became vice-president, **Kent Gorday** remained treasurer, and **Nathan Hock** became secretary.

Besides the standard graduate school presentation from **Dr. Dan Waddill**, fall SPS meetings included a night at the observatory courtesy of **Kent Gorday**, a social bowling night, and a presentation from **Dr. Thomas Vojta** of the Physics Department. Members of the SPS also made liquid nitrogen ice cream and did a demo for potential transfer students from East Central College. As always, the semester closed with a liquid nitrogen ice cream social.

Alumnus Sandra Magnus

Astronaut **Sandra Magnus** was honored at an Aerospace Banquet in April at the Hasselmann Alumni House. While on campus Sandra spent time in the physics department visiting and shared a luncheon with the students of the department. Sandra's visits are always filled with lots of knowledge, great stories and are very enjoyable.



Come Back for Homecoming

The Missouri S&T Physics Department warmly invites you to return to Rolla for the **S&T Homecoming 2017 on October 27-28, 2017**. On Friday afternoon, October 27, 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 2017 Physics Colloquium at 4 PM on Friday, October 27. 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 MSM-UMR, even as we work to dig deeper into our future as Missouri S&T!

Physics Department presented a Certificate of Achievement

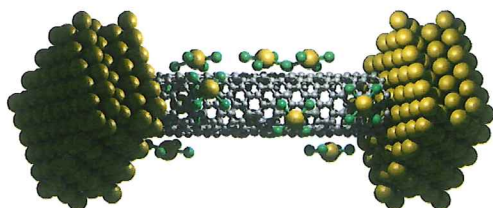
Missouri S&T had a goal of getting all departments and offices up to regulation with the policies of the university concerning records management. **Pam** and **Jan** worked very hard during the summer getting the Physics Department up to regulation and they were awarded the Certificate of Achievement from the Records Management Center in Columbia in Special Recognition of Outstanding Performance in following the UM Policies and Procedures. The award was presented by Willie Jones from Columbia.



**ALTYNBEK MURAT
POSTDOCTORAL POSITION
AT BOSTON UNIVERSITY**



Alumnus, **Altynbek Murat**, got a postdoctoral position in the Department of Electrical & Computer Engineering at Boston University in Oct. 2016. Altynbek will work on grain boundaries in polycrystalline alloys and quantum electron transport in devices at nanoscale. Altynbek was a former graduate student of Professor **Julia Medvedeva**. Prior to that, Altynbek was a postdoctoral researcher at King Abdullah University of Science and Technology (KAUST) in Saudi Arabia for four years. At KAUST, he studied hybrid organic-inorganic perovskite solar cells, novel two-dimensional materials for energy applications and devices, and quantum electron transport in carbon nanotube gas sensors (figure below).



**Congratulations to S&T's 2016
Physics Degree Recipients!**

May 2016

Bachelor of Science

- Nikita Matthew Gahr
- Dawson J Huth
- Giannino Miha Lusicic
- Alexander Charles Mark
- Rachel Elizabeth McCormick
- Kathryn Reed McNabb
- Alyson Paige Smith
- Juan David Remolina Gonzalez
- Kyle Nocona Sanders
- Paul Somers
- Josey Allen Stevens

Master of Science

- Emmanuel Kayitare
- Deniz Tavsan

December 2016

Bachelor of Science

- Sheldon Wayne Harper
- Mathew B Pollard

Master of Science

- Bishnu Prasad Acharya

Doctor of Philosophy

- Hatem Barghathi
- Logan Brown
- Rabi Khanal
- WK Arthanayaka Mudiyansele Thusitha
- Priyantha Arthanayaka
- Gang Wang

NEW ROOF FOR PHYSICS

This year the Physics Department received a new roof. It was noisy but very exciting to not have leaks!!!

Vojta Named Curators' Distinguished Professor of Physics

The University of Missouri System Board of Curators bestows the Curators' Distinguished Professor title upon outstanding scholars with established reputations in their field of study. Dr. Thomas Vojta is recognized for his work in quantum physics.



In 2015, Vojta was named a Fellow of the American Physical Society. He was nominated by the society's Division of Condensed Matter Physics for his "innovative analyses of quantum phase transitions in the presence of strong disorder."

His research in theoretical physics has been supported by grants from the National Science Foundation totaling more than \$1.4 million. It focuses on quantum phase transitions - transformations of materials near the absolute zero of temperature - that occur, for example, due to changes in the material's chemical composition. Vojta hopes to discover new unconventional states of matter that can appear in connection with these transformations, such as superconductors that have the ability to transfer electricity without any loss.

Vojta joined the Missouri S&T faculty as an Assistant Professor in January 2002. He was named Associate Professor in 2006 and full Professor in 2011. Prior to his work at S&T, Vojta served as Heisenberg Fellow in the department of theoretical physics at the University of Oxford in Great Britain.

Vojta earned a Ph.D. in physics from the University of Chemnitz in Germany in 1994. His research interests are in solid state and statistical physics; they include phase transitions, superconductivity and magnetism, as well as transport in disordered materials.

Donald Hagen Retires

Don Hagen retired in September 2016 after 45 years of service to UMR/Missouri S&T. Don received his B.S. in Physics from the University of Dayton in 1965 and his M.S. and Ph.D. from Purdue University in 1967 and 1970 respectively. After a postdoc at Battelle Memorial Institute, Don joined the UMR Physics Department as a postdoctoral fellow in 1971. After appointments as Research Associate, Research Assistant Professor, and Research Associate Professor, Don was appointed Associate Professor in 1990 and full Professor in 1994. Don also served as the Director of the Cloud and Aerosol Sciences Laboratory at Missouri S&T since 2001.

Don's research program focused on the study of combustible aerosols with a focus on gas turbine and rocket engine sources, and the evolution of these aerosols in the atmosphere. He was PI or co-PI on grants from NASA, Air Force Office of Scientific Research, US Air Force, US Navy, Boeing, Pratt & Whitney, General Electric, the European Economic Community, the United Kingdom Ministry of Defense, Princeton University, and the UMR Center for Environmental Science & Technology.

In the mid-90s, Don with collaborator Phil Whitefield were invited to join the Intergovernmental Panel on Climate Change (IPCC). Their research into the role aircraft emissions on climate change was featured in a chapter of "Aviation and the Global Atmosphere". This is one of the scientific reports from the IPCC that contributed to the Nobel Peace Prize shared with former Vice President Al Gore and the IPCC. In Spring 2008, Hagen and Whitefield received official recognition from the Nobel Committee for "efforts to build up and disseminate greater knowledge about manmade climate change, and to lay the foundations for the measures that are needed to counteract such change."

Don continues to reside in Rolla with his wife Judy. They are enjoying travel and spoiling the grandchildren. We wish Don the best in retirement.



Vojta presented lectures in India, Africa, and France

Faculty member Thomas Vojta had a busy year that involved lecturing on three different continents - Asia, Africa and Europe, in addition to North America.

In February 2016, Thomas taught at the International School on Quantum Disordered Systems organized by the Institute of Mathematical Sciences in Chennai, India. A video of the first of four lectures can be found on You Tube. (Simply search for "Phases and Phase transitions in Disordered Quantum Systems".) Thomas also gave an invited talk at the conference accompanying the school. In July, Thomas traveled to Johannesburg, South Africa to deliver an invited talk about his computer simulations of superfluids at the 28th IUPAP Conference on Computational Physics. This was the first time that a conference in this important series was held on the African continent. A special session of the conference was dedicated to big data astronomy and astrophysics because South Africa will be co-hosting the world's largest radio telescope, the Square Kilometre Array. After the conference, Thomas visited Pilanesberg National Park, a game reserve located about two hours from Johannesburg. There, he watched elephants, rhinos, giraffes, and zebras. Unfortunately, the big cats that also roam the Park – lions, leopards, and cheetahs – were all in hiding. Thomas' travels concluded with a trip to France where he was invited to talk at the workshop on Renormalization Group Theory of Disordered Systems held at the Ecole Normale Supérieure in the heart of Paris.



Julia Medvedeva Promoted to Professor

Dr. Julia Medvedeva was promoted to Professor of Physics in 2016. Dr. Medvedeva received her B.S. and M.S. in Physics from Ural State University in 1997 and 1999 respectively. She received her Ph.D. in Physics & Mathematics from Institute of Metal Physics, Ural Branch of the Russian Academy of Sciences in 2002, Julia joined the S&T Physics Department in 2005 after a postdoc at Northwestern University.

Dr. Medvedeva's research interests are in computational condensed matter physics & materials science. Density-functional methods are employed to study structural, electronic, magnetic, optical, and mechanical properties of solids from the first principles. Specific areas of interest include transparent conducting oxides, amorphous oxide semiconductors, thermoelectric and topological materials, advanced steels, dilute magnetic wide-bandgap semiconductors, and magnetoresistivity in strongly-correlated oxides.

Julia's work has been supported by the National Science Foundation, the Kent Peaslee Steel Manufacturing Research Center, Department of the Army, the Goodrich Corporation, the Petroleum Research Fund, and the Army Research Laboratory. Since arriving at Missouri S&T, Julia has published over 35 papers and one book chapter. She has received two Faculty Research Awards and one Faculty Excellence Award. In addition, Julia has been involved in the organization of many international conferences, served on a number of National Science Foundation review panels and site visit teams, and is one of the world's leading experts on transparent conducting oxides.

Yew San Hor - Promoted to Associate Professor

Dr. Yew San Hor was promoted to Associate Professor of Physics with Tenure in 2016. Dr. Hor received his B.Sc. and M.Sc. in Physics from the University of Malaysia in 1989 and 1993 respectively. He received an M.S. degree in Physics from Utah State in 1998, and a Ph.D. from Rutgers University in 2004. Yew San joined the Physics Department in 2010 after postdocs at Argonne National Laboratory and Princeton University.

Dr. Hor's research interests involve the exploration of novel solid state bulk and nanostructured materials such as quantum material systems including, but not limited to three dimensional topological insulators, topological superconductors, nanostructured thermoelectric power/cooling materials, and correlated electron systems which may have implications both for scientific understanding and for future technological developments.

Dr. Hor's work is supported by a National Science Foundation CAREER award and a National Science Foundation Major Research Instrumentation award. Since arriving at Missouri S&T, Yew San has published 25 papers including four prestigious Physical Review Letters. He has also received a Faculty Research Award, and has been listed by Thomson-Reuters as ranking among the top 1% of researchers in Physics worldwide in terms of citations over a 10 year period.

Outstanding GTA's

This past year we again presented graduate teaching awards to honor the outstanding accomplishments of our graduate teaching assistants. The awards are determined by a combination of student evaluations and teaching performance assessed by the faculty overseeing the teaching laboratories. The 2016 winners were **Sam Lee** and **Chandra Adhikari**. Congratulations to the winners for helping to advance the department's commitment to excellence in teaching.



Sam Lee (left) and Chandra Adhikari (right) receiving awards from Dan Waddill

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.

Faculty Honored

Professor **Greg Story** was selected yet again as one of Missouri S&T's outstanding teachers. Greg was one of 41 S&T faculty to receive an Outstanding Teaching Award, which was presented at an awards ceremony on December 5, 2016. This award is based on student teaching evaluations. Every year it gets harder to count this high, but this is the twentieth consecutive year that Greg has received this award.



Professor **Yew San Hor** was named a 2016 Thomson Reuters Highly Cited Researcher. Thomson Reuters analyzed citation data over an 11-year period to identify highly cited researchers. This is the third year in a row that he has received the honor. He is also listed in Thomson Reuters "World's most influential scientific minds" for 2016.

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**. Our most recent endowment came from **John** and **Patty Rogers**.

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.

Congratulations to 2016 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 2016

Abdulrahman Alharbi, Travis Barry, Rachel Birchmier, Robert Branson, Rebecca Campbell, Albert Chua, Jacob Cook, Colton Dailey, Nikita Gahr, David Gillcrist, Kent Gorday, Jacob Hume, Dawson Huth, Aaron Lemmermann, Cameron Lerch, Jason Mao, Alexander Mark, Brady Martin, Joshua Maxwell, Rachel McCormick, Sara Newman, Katherine Overend,

Nicholas Parris, Mathew Pollard, Brendan Ramsey, Kevin Rose, Kyle Sanders, Paul Somers, Josey Stevens, Jason Summers, Raylynn Swift, Skye Tackett, Charlie Winborn, Matthew York

Fall Semester 2016

Abdulrahman Alharbi, Travis Barry, Alyssa Bennett Rachel Birchmier, Brendan Boggs, Rebecca Campbell, Albert Chua, Jacob Cook, Dominic Dalba, Joshua Dalton, Justin Davenport, Michael Ellis, Nicholas Ernst, David Gillcrist, Kent Gorday, Jacob Hume, Aaron Lemmermann, Cameron Lerch, Adem Malone, Jason Mao, Brady Martin, Joshua Maxwell, Sara Newman, Katherine Overend, Benjamin Politte, Austin Powell, Vince Preis, Brendan Ramsey, Ian Ramsey, Kevin Rose, Sean Sause, Sarah Skinner, Owen Smith, Jason Summers, Skye Tackett, Alex Warhaver

Russell Summers Retires

Russell Summers retired on February 7, 2016 after 36-1/2 years of service to the Physics Department and the university. Russ began work in the Physics department in July 1979 as a Research Electronics Technician and retired as a Senior Electronics Technician. Russ was one of the best in his field. He was a great asset to the department for the entire duration of his employment at the university. He could build any type of electronics devices needed for faculty laboratories and the advanced lab student projects, could help with computer issues, kept up the physics webpage, helped teach a physics lab course, took care of departmental needs too numerous to name, was the grill cook for the department picnic, department entertainment keeping us on our toes, and definitely made lunches with the chairman and staff a blast! The department wishes Russ the best in his retirement. Enjoy and don't work too hard with all those tools!!!



Pam Crabtree celebrates 25 years with the University

Pam Crabtree came to work at Missouri S&T (formerly known as University of Missouri-Rolla) on June 4, 1991 working in Norwood Hall. Three months later on September 4, 1991, Pam joined the Physics department as Secretary. Throughout the last 25 years she has moved from Secretary to Senior Secretary and became the department's Administrative Assistant (now titled Office Support Assistant IV) after the retirement of **Ellen Kindle** in May 2012.

The department honored Pam for her dedication to the department and the university with a luncheon at Sybill's in St. James and presented her with an array of fantastic gifts.



Andy Stubbs - New Staff Hire

In February, 2016, longtime electronics technician **Russ Summers** retired from Missouri S&T. Russ' position was filled by **Andy Stubbs**. Andy has an extensive background in residential, commercial and industrial electronics. He also has worked with Missouri S&T Information Technology as a Network Technician. We are delighted to have Andy join the department and we look forward to many years of working with him.

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

Donations over \$100:

Barbara N. Hale
Edward B. Hale
Jeff Hammond
Don Madison
Lina Madison
Paul Parris
Jerry L. Peacher
Agnes Vojta
Thomas Vojta
George D. Waddill
Gerald Wilemski
Edward N. Sickafus
Arthur M. Soellner
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Clayton E. Evans
James D. Sater
Jon Holdman
Patrick Garey
Bart Smith
Erika G. Kisvarsanyi
Michael Noble
Luzheng Meng
Mark Barnhart
Scott Sehlin
Wei Zhao
Daniel B. Marsh
Matthew Pritzker
Casey Morriss
Daniel Chitwood
Amy Morriss
Alissha Feeler PE
Courtney Feeler
Joshua Zirbel
David Cape
Junfang Gao

Lane A. Martin Thomas
M. Schmit Barbara N.
Hale Edward B. Hale
Jeff Hammond
Don Madison
Lina Madison
Paul Parris
Jerry L. Peacher Agnes
Vojta Thomas Vojta
George D. Waddill
Gerald Wilemski

Donations under \$100:

James G. Mullen Sr.
Kenneth C. Adam
Jay A. Peterson
Charles E. Byvik
James P. Canner
Elizabeth A. S. Munson
William F. Munson
John C. Carstens
Kenneth M. Stephens
Gary G. Wooley
Donald G. Rathbun

Harold V. Romero
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Bruce C. Anderson
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Kenneth E. Arnett
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William Meyer
Scott Miller
Havva Malone
Joel F. Peacher
Joseph Eimer
Amanda Kinney
Ryan Kinney
Mark A. Peckham
Derek Anderson

Physics Department Acknowledges Corporate Support

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

Boeing Company
Boeing Foundation
Exelon Corporation
Exelon Foundation
Experimental & Math Physics Consult
General Mills Foundation
Lockheed Martin Corporation
Network for Good
Raytheon Company

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

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

Fully differential study of ionization in $p + H_2$ collisions near electron – projectile velocity matching, A Hasan, T Arthanayaka, B R Lamichhane, S Sharma, S Gurung, J Remolina, S Akula, D H Madison, M F Ciappina, R D Rivarola, and M Schulz, J. Phys. B: At. Mol. Opt. Phys. 49, 04LT01 (6pp) (25 January 2016).

Kinematically complete study of low-energy electron-impact ionization of argon: Internormalized cross sections in 3D kinematics, Xueguang Ren, Sadek Amami, Oleg Zatsarinny, Thomas Pflüger, Marvin Weyland, Alexander Dorn, Don Madison, and Klaus Bartschat, Phys. Rev. A. 93, 062704 (8pp) (13 June 2016).

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Medvedeva Awards from MSE

Julia Medvedeva was honored with two faculty awards for collaborative works with David Van Aken from Materials Science and Engineering in 2016.

2016 AIST Hunt-Kelly Outstanding Paper Award - for their paper entitled "*Developing a Third-Generation Advanced High-Strength Steel With Two-Stage TRIP Behavior*". This award, which includes a US \$2,500 cash prize, is presented to the authors of the Association's best published paper of the year.

2016 TMS-AIME Champion H. Mathewson Medal Award - "to honor contribution to metallurgical and materials science" - for their paper entitled "*An atom Probe study of Kappa Carbide precipitation and the Effect of Silicon Addition*" published in *Metallurgical Materials Transactions A*.



Phonathon 2017

Your continued generosity with Phonathon donations has allowed us to increase teaching laboratory capacity by up to 50% over the past two years.

In addition, your donations help make it possible to continue to attract quality undergraduate and graduate students in our department. Currently we have approximately 80 undergraduates and 30 graduate students, and we have a goal of growing these numbers to 90 and 40 respectively by 2020. 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.

Last year's fundraising Phonathon raised \$26,777 with an average gift of \$246 from 109 donors.

We greatly appreciate your generosity in helping us support scholarships and student activities such as the Society of Physics Students.

Frontiers in Physics Colloquium Series

In 2016, the Frontiers in Physics Colloquium Series began with a talk from **Artem Rudenko** of Kansas State University who gave an overview on “Imaging light-induced dynamics of small quantum systems: From infrared to hard X-ray domain”. In the second talk in the semester, **Richard Dawes** from the S&T’s Chemistry department introduced his research on “Calculations of Molecular Spectroscopy and Scattering using Interpolated ab initio Potentials”.

In February, we hosted a public lecture given by **Charles Adler**, who examined well-known science fiction literature and movies asking critically: “Where is the science in all that fiction?” Charles is professor at the St. Mary's College and author of the book “Wizards, Aliens, and Starships”. His talk did not only attract many undergraduates but also guests from the Rolla community.

In April, we heard from three speakers starting with **Fabien Gatti** from the University of Montpellier in France who introduced “The Multi-Configuration Time-Dependent Hartree (MCTDH) method. Applications to the control of ultrafast phenomena by lasers”. **Stephanie Law Toner** from the University of Delaware discussed “excitations in unusual materials: doped semiconductors and topological insulators”, and **Erik Henriksen** from Washington University in St. Louis told us about “Electronic transport in osmium-decorated graphene”.

The spring series concluded in early May with the poster competition of the *45th Annual Harold Q Fuller Prize Colloquium*. Details of the Fuller competition appear in a separate article in the newsletter on page 15.

The colloquium series resumed in the fall with two talks in September. Javad Shabani from the City University of New York kicked off the semester with “epitaxial superconductor-semiconductor two-dimensional systems: Platforms for quantum circuits.” In the second talk, **Marianna Safronova** from the University of Delaware gave the latest updates on the “Search for variation of fundamental constants”.

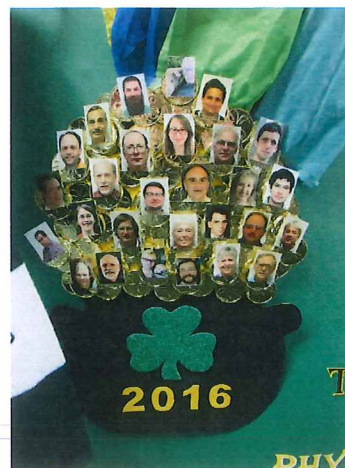
The October schedule included three visitors. First, **Kater Murch** from Washington University in St. Louis was “Exploring quantum measurement with spontaneous emission”. Alumnus **Chris Polly** (BS'96) who is the Project Manager of the Muon g-2 Collaboration at Fermilab, reported on “Muon g-2 and the quest for new physics”. October concluded by a colloquium of **Steven Anlage** from the University of Maryland who addressed the question: “Can waves be chaotic?” In November, **Thomas Gorczyca** from Western Michigan University gave an overview into the field of “Atomic physics in X-ray absorption astrophysics”. **Alexander Dorn** who visited us from the Max Planck Institute for Nuclear Physics in Heidelberg, Germany, presented “Electron impact ionization of atoms, molecules, and clusters”. The last talk in November was given by our own **Thomas Vojta**, carrying on the well-established tradition of a talk on the Nobel Prize physics. Thomas told us about “Strange phenomena in flatland: Physics Nobel Prize 2016”.

We concluded the semester with the *23rd Annual Laird D. Schearer Prize Colloquium* and saw three presentations by the finalists. Details of the Schearer competition are in the article on page 14 of this newsletter.

ST. PAT'S 2016



The Physics Department staff participated in a door decorating contest for the “108th Best Ever St. Pat's”. Even though the department didn't win the contest, faculty and staff still shine bright in the pot of gold at the end of the rainbow!



23rd Annual Schearer Prize Competition

The Twenty-Third 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 8, 2016.

The annual competition is held in memory of Laird Schearer, the department's first Curators' Professor of Physics. In keeping with Professor Schearer's longtime interest in enhancing the quality of research performed at the university, the Schearer Prize rewards graduate students of the Department of Physics for outstanding research performed during the course of their graduate study.

The 2016 Schearer Prize Committee, Professors **Greg Story**, **Aleksandr Chernatynskiy**, and chaired by **Michael Schulz** selected three finalists who gave oral presentations about their work in a departmental colloquium. The finalists this year were **Esam Ali**, advised by Professor **Don Madison**; **Chandra Adhikari**, advised by Professor **Ulrich Jentschura** and **Ahmed Ibrahim**, advised by Professor **Thomas Vojta**.

During the colloquium on December 8, Mr. Ali discussed "*Electron-and photon-impact ionization of furfural*" Mr. Adhikari talked on "*Adjacency Graphs and 2S - 2S Interactions*" and Mr. Ibrahim talked about "*Emerging critical behavior at a first-order phase transition rounded by disorder*". All students gave excellent talks.

After considering the finalists' contribution to the research, knowledge of the area and presentation effectiveness the committee awarded first prize and \$700 to Ahmed Ibrahim, second prize and \$500 to Esam Ali, and third prize and \$300 to Chandra Adhikari. The Schearer Prize committee would like to congratulate Ahmed, Esam and Chandra on the excellent quality of their oral presentations and thank all three finalists for participating in the Schearer Prize 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 wonderful dinner at a local restaurant.

We need your stories to liven up our newsletter! We would like to know what is happening in the lives of our alumni!

Please send us your stories, pictures, and musings for our 2018 newsletter. The best way to do this is by email to physics@mst.edu.

From Schearer Prize Winner Ahmed Ibrahim

The Twenty-Third Annual Schearer Prize Competition was held a few short weeks before my graduation ceremony.

It is my great honor and pleasure to be the winner of such a great award "Schearer Prize", which represents the most important and greatest award I have earned in my academic career. Let me take the opportunity to express my deep gratitude for my advisor, Professor **Thomas Vojta**, for his patience and dedication in supporting and guiding me throughout the study period. In addition, I want to offer my thanks and great gratitude to the prize committee for giving me the opportunity to present my research work. The greatest thanks and deepest appreciation go out toward my family for their support and patience.



My PhD research is about the effect of quenched disorder on the phase transitions. I have shown that the quenched disorder destroys a first-order phase transitions and turned to continues one in the two-dimensional four-color-Ashkin-Teller model. My results for the critical behavior agree with the renormalization group predictions.

Faculty Notes

Congratulations to **Thomas Vojta** who was named Curators' Distinguished Professor.

Congratulations to **Julia Medvedeva** who was promoted to Professor of Physics.

Congratulations to **Yew San Hor** who was promoted to Associate Professor of Physics

Thomas Vojta lectured at School of Quantum Disordered Systems in Chennai (India) in February.

Thomas Vojta presented an invited talk at the IUPAP Conference on Computational Physics in Johannesburg (South Africa) in July and presented an invited talk at International Conference on Renormalization Group Theory of Disordered Systems in Paris (France) in July. Article on page 7.

Fun with the Boss



The staff after finding out that Dan had never had a pumpkin to carve or decorate decided it was time!! So for Boss's day we gave him all the options needed to carve or paint his first pumpkin and his favorite chocolate to help relieve the stress from creativity! Topped it off with a very fun luncheon!!



Society of Physics Students always love to decorate Dan's office for Christmas!!

45th Annual Fuller Research Seminar

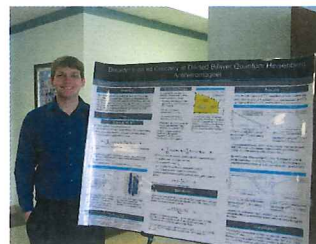
Six undergraduate students presented posters about their research projects at the 45th Annual Harold Q Fuller Undergraduate Research Competition, held on May 5, 2016.

The posters were judged by the Fuller Prize Committee: Dr. **Yew San Hor** and Dr. **Gerald Wilemski**, chaired by Dr. **Aleksandr Chernatynskiy**

The Fuller Awards are given to the students whose projects are judged to be the most outstanding on the basis of accomplishment, presentation, and response to the questioning of the judges. The presenters were **Kent Gorday**, **Seth Kreher**, **Juan David Remolina**, **Nocona Sanders**, **Josey Stevens**, and **Skye Tackkett**.

The six research projects were "*Self-Assembling Gold Nanorod Arrays Using DNA Origami*" by **Kent Gorday**, advised by Dr. Risheng Wang; "*Statistical Analysis of Sprite Streamer Splitting*", by **Seth Kreher**, a summer research project advised by Drs. Jacob Harley, Matthew G. Mcharg, Ryan Haaland, H.C.; "*Fully Differential Study of Ionization of Helium by Proton Impact and Interpretation of Single-Center Interference*" by **Juan Remolina**, advised by Dr. Michael Schulz; "*Structures and Properties of Amorphous In-Ga-Zn-O*", by **Nocona Sanders**, advised by Dr. Julia Medvedeva; "*Disorder Induced Criticality in Diluted Bilayer Quantum Heisenberg Antiferromagnet*" by **Josey Stevens**, advised by Dr. Thomas Vojta; and "*Magnetron Sputtering of Superconducting Niobium Thin Films*" by **Skye Tackkett**, advised by Dr. Cihan Kurter. The judges commented "We have been extremely impressed by your work...we applaud your efforts!"

Josey Stevens was awarded first place and received a \$400 prize, second place was awarded to **Kent Gorday** receiving \$300 prize and third place was a tie between **Skye Tackkett** and **Nocona Sanders** each receiving \$150. Congratulations to the winners!!



Above: Josey Stevens - 1st place winner

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So What's News with You?

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

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

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News or Comments: _____

