

Matter 'n Motion

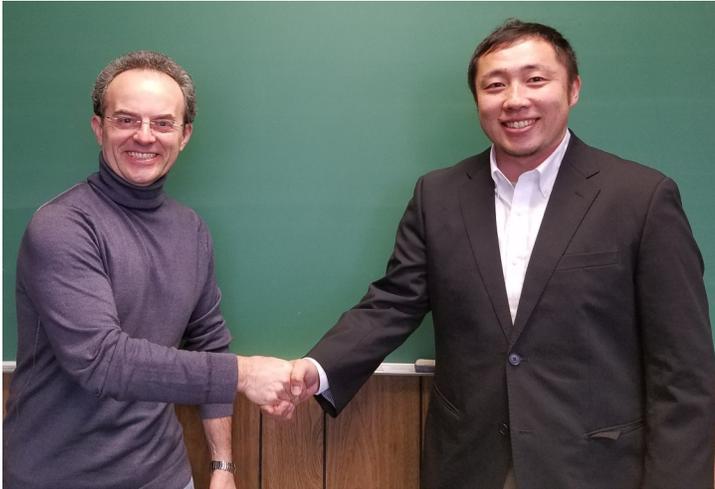
January 2019



Missouri University of
Science and Technology
PHYSICS DEPARTMENT

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

S&T Physics opens a window to the sky



Marco Cavaglia, Shun Saito

Starting in January, two new faculty, Marco Cavaglia and Shun Saito, will work to unravel the mysteries of the universe at S&T. Cavaglia, who joins the department after 15 years at the University of Mississippi, is an expert on gravitational physics and multi-messenger astrophysics. Saito, from the Max Planck-Institute for Astrophysics in Germany, works on observational cosmology. They will collaborate to develop a new astrophysics program at S&T. Detailed faculty profiles for Marco Cavaglia and Shun Saito will be published in the next edition of the newsletter.

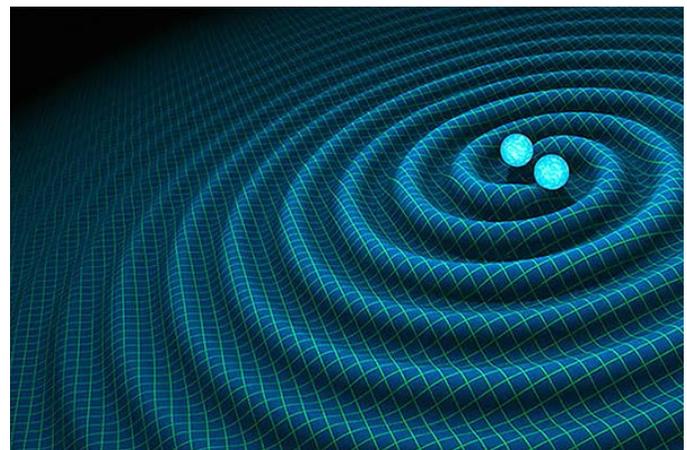
Multi-messenger astrophysics and precision cosmology are research areas at the forefront of today's physics. Multi-messenger astrophysics studies celestial phenomena through different physical carriers (electromagnetic waves, gravitational waves, particles and cosmic rays). Cosmology studies the origin and large-scale structure of the Universe.

Multi-messenger astrophysics is a new branch of science, born in 2015 with the historic discovery of gravitational waves (2017 Nobel Prize) by the Laser Interferometer Gravitational-wave Observatory (LIGO) and the first observation of a merger of two neutron stars with both electromagnetic and gravitational waves in 2017. Precision cosmology is now a mature discipline thanks to the Hubble Space Telescope, large new ground-based telescopes, and the finest observations of the cosmic microwave background radiation by satellites.

Cavaglia has been a member of LIGO for over 10 years. At S&T he will serve as Principal Investigator of the newly formed LIGO group. This is the first time that a Missouri institution joins the LIGO experiment. Cavaglia's group will contribute to LIGO through data analysis, detector science, and outreach. Cavaglia also brings to S&T his 20+ year experience in management and administration of scientific units. From 2012 to 2017, he served as Assistant Spokesperson of the LIGO Scientific Collaboration, an organization of over one thousand scientists from over 80 institutions across 18 countries.

Saito has been deeply involved in the Sloan Digital Sky Survey (SDSS) and is an active member of the Hobby-Eberly Telescope Dark Energy Experiment (HETDEX) and the Subaru Prime Focus Spectrograph (PFS). These galaxy surveys measure the cosmic expansion history and provide valuable information on the nature of dark matter and dark energy. This will allow scientists to test Einstein's General Relativity and theories beyond the standard model of particle physics. Saito's group at S&T will join the HETDEX collaboration.

These are exciting times for multi-messenger astrophysics, gravitational-wave physics, and observational cosmology. S&T will keep its eyes wide open to the sky!



Visualization of gravitational waves emitted by two orbiting black holes. Image credit: NASA

Memo from Chair

The year 2018 was an exciting year for the physics department that brought many changes. We welcomed three new faculty members. Dr. **Anh-Thu (AT) Le** joined us from Kansas State University. He is a theorist in atomic, molecular and optical physics working on laser-matter interaction and attosecond physics; he is profiled in depth elsewhere in this newsletter.

As you may have seen on the front page, the physics department is expanding its research portfolio. Drs. **Marco Cavaglia** and **Shun Saito** are starting an astrophysics program in our department. Marco comes to us from the University of Mississippi; he works on gravitational waves and brings his LIGO group to Missouri S&T. Shun is joining us from the Max-Planck-Institute for Astrophysics in Germany. He is interested in cosmology and will participate in the search for dark energy via the HETDEX project.

We also welcomed several postdocs and visiting scientists. Dr. **Martin Puschmann** joined the **Vojta** group from Chemnitz, Germany. Dr. **Ivan Zhuravlev** from Lincoln, Nebraska and Dr. **Luigi Bagolini** from Rome, Italy came to work with Prof. **Julia Medvedeva**. Dr. **Yingguang Liu** from Baoding, China is visiting Prof. **Aleksandr Chernatynskiy**, and Dr. **Prithvi Singh** from Udaipur, India came to visit Prof. **Don Madison**'s group.

In March, Prof. **Barbara Hale** retired after a long career of 46 years in the department. In 1973, Barbara had been one of the first two women to join the S&T (then UMR) physics faculty. On behalf of the Missouri S&T physics community, I would like to thank Barbara for her dedicated service. We miss her and hope to see her often as she continues to be a part of our physics family. Read more about Barbara elsewhere in this edition of *Matter 'n Motion*.

The physics department also said good bye to Prof. **Cihan Kurter** who left Missouri S&T to take a position at IBM in New York. We are sad to see her leave, but are happy that she was able to solve her "two-body problem" and be closer to her husband.

Last year was another outstanding year for faculty achievements. Profs. **Julia Medvedeva** and **Ulrich Jentschura** were honored with the Faculty Research Award, and Prof. **Greg Story** received a Faculty Teaching Award. Profs. **Agnes Vojta** and **Jim Musser** were promoted to full Teaching Professor and Associate Teaching Professor, respectively. Prof. **Yew San Hor** was listed as one of the nation's most "highly cited researchers" in his field.

Profs. **Aleksandr Chernatynskiy** and **Thomas Vojta** won new major grants, and several other faculty received additional funding for their awards.

Our undergraduate enrollment continues to be strong, and the quality of the students is excellent. This past year, 18 students graduated with a BS degree in physics, 13 of them with honors. In addition, we awarded 2 MS and 5 PhD degrees. We also welcomed one of the largest freshman classes ever to the department. The physics department currently has 87 undergraduate and 32 graduate students.

As I am writing this, I have completed my first year as department chair. It has been a pleasure to work with our faculty, staff, and students, and I am especially grateful for the tremendous support from Pam Crabtree and Jan Gargus in the physics office who helped me transition into my new role. I look forward to a new year of exciting challenges.

Let me close, as I did last year, by emphasizing that the department's success in its teaching, research, and service missions would be impossible without the dedication and generous donations of our alumni. Thank you very much! I know that we can count on your continuing support. As you can read on the last page of this newsletter, there is now a new giving opportunity where your donations to the physics department are matched 1:1 by the University of Missouri System.

Please come and visit us in Rolla to see the exciting things happening in the physics department and to share with us what you have been doing since graduation.



Thomas Vojta

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.

Physics Department Awards 2018-2019

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 recipients of the Rogers Scholarship, with values ranging from \$1000 to \$1950, were awarded to **Zenon Klok** from Belton, MO, **Sean Poth** from Saint Charles, MO and **Jose Padron** from Springfield, MO.

Recipient of the **Harold Q Fuller Scholarship-Loan** was **Jacob Hume** from Saint Charles, MO. 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 student begin to repay when they start their first job.

The recipient of the **Burke H. Miller Memorial Scholarship** was **Zachary Driemeyer** from House Springs, MO. 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.

The **Ed and Mary Sue Sickafus Endowed Scholarship/Fellowship** was awarded to **Nicholas Ernst** from Belleville, IL; **Matthew Small** from Independence, MO; and **Alex Warhover** from Saint Charles, MO. The scholarship/fellowship was established by Ed (BS '55, MS '56) and Mary Sue Sickafus in conjunction with the Ford Motor Company. The \$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. The recipients were **Zachary Driemeyer** from House Springs, MO and **Joseph Franz** from Kansas City, MO.

The recipients of the **Leon E. Woodman Memorial Scholarship** were **Sarah Skinner** from Bolivar, MO and **Matthew Small** from Independence, MO. This scholarship was established by the Woodman family in honor of Dr. L.E. Woodman, Chair of 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. The recipients were **Daniel Money** from Fenton, MO and **Zachary Driemeyer** from House Springs, MO.

The **Allan Pringle Endowed Scholarships** was established by his family in memory of Dr. **Allan Pringle** to recognize academically proficient students majoring in Physics. The recipient of the award was **Rebecca Campbell** from Saint Charles, MO.

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 **Brett Ballard** from Warrensburg, MO; **Joseph Billing** from Saint Charles, MO; **Anzumaan Chakraborty** from Maryville, MO; **Dominic Dalba** from Imperial, MO; **Joshua Dalton** from Saint Charles, MO; **Zachary Driemeyer** from House Springs, MO; **Reagan Dugan** from Columbia, MO; **Cameron Lerch** from Lees Summit, MO; **Tristan Lindeman** from Gladstone, MO; **Taylor Lindenbusch** from O'Fallon, MO; **Brady Martin** from Lees Summit, MO; **Kyle McMillen** from Eureka, MO; **Andrew Niiro** from Hermann, MO; **Nicholas Parris** from Boonville, MO; **Ravi Shastri** Fenton, MO; **Nicholas Small** from Independence, MO; **Seth Stubblefield** from Saint Peters, MO; and **Elizabeth Triller** from Perryville, MO.

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. This \$500 scholarship was awarded to **Nicholas Razo** from South Jacksonville, IL.

Report from the SPS

New officers began their terms for the 2018 Spring semester: Sarah Skinner as President, Nicholas Parris at Vice-President, David Scott as Secretary, Elizabeth Triller as Treasurer and Kyle Foster as Historian. SPS was fortunate enough to visit Argonne National Laboratory in the Spring and spend a day in Chicago. Dr. Aleksandr Chernatynskiy and Dr. Julia Medvedeva presented their research to interested SPS members.

Fall 2018 began with Brett Ballard as President, Sarah Skinner as Vice-President, Reagan Dugan as Secretary, Elizabeth Triller as Treasurer and Kyle Foster as Historian taking over offices. A new officer position of Student Council Representative was installed with Kyle McMillen taking office. Dr. Dan Waddill gave his traditional talk on graduate school, Dr. Greg Story gave his lecture “Relativistic Quantum Mechanics Made Relatively Simple”, and SPS hosted GRE Prep nights for those taking the exams over the fall, as well as another scavenger hunt through the physics building was hosted.

The new officers for the 2019 Spring were elected: Brett Ballard as President, Nicholas Parris as Vice-President, Keith Reece as Secretary, Alex Warhover as Treasurer, Kyle Foster as Historian and Kyle McMillan as STUCO Representative.

~ *Brett Ballard*



Sigma Pi Sigma Inductees



Sigma Pi Sigma, honor society of the Society of Physics Students, held an induction for 17 of our best undergraduate students.

Congratulations to S&T's 2018 Physics Degree Recipients!

May 2018

Bachelor of Science

Travis Michael Barry
Rachel Lucille Birchmier
Albert K Chua
Jacob Lowell Cook
Colton Edward Dailey
David J. Gillcrist
Kent Matthew Gorday
Aaron Andrew Lemmermann
Joshua Nicholas Maxwell

Kevin B. Renick

Kevin Albert Rose

Doctor of Philosophy

Christopher Lee Carr
Ahmed Khalil Ibrahim
Basu Ram Lamichhane
Shane Meyer

December 2018

Bachelor of Science

Alyssa Renee Bennett
Brendan Clark Boggs
Deni Cikota
Brian James Patrick Ford
Kyle James Foster
Jacob Benjamin Hume
Jeremy Ryan McCoy

Master of Science

Jason Robert Summers
Fathiya Thini

Doctor of Philosophy

Waruni Jayawardana

Congratulations to 2018 Physics Academic Scholars

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

Spring 2018

Brett Ballard, Travis Barry, Joseph Billing, Rachel Birchmier, Brendan Boggs, Jonas Buxton, Rebecca Campbell, Anzumaan Chakraborty, Albert Chua, Dominic Dalba, Zachary Driemeyer, Reagan Dugan, Nicholas Ernst, Brian Ford, Joseph Franz, Kent Gorday, Jacob Hume, Brady Martin, Luke Marut, Kyle McMillan, Daniel Money, Andrew Niiro, Austin Padgett, Nicholas Parris, Ashley Pruet, Nicholas Razo, Kevin Rose, Ravi Shastri, Aaron Silvus, Sarah Skinner, Matthew Small, Alex Warhover.

Fall 2018

Sean Anderson, Brett Ballard, Joseph Billing; Rebecca Campbell, Anzumaan Chakraborty, Deni Cikota, Dominic Dalba, Kenneth Distefano, Zachary Driemeyer, Reagan Dugan, Benjamin Edwards, Nicholas Ernst, Brian Ford, Kyle Foster, Javier Franco-Hernandez, Joseph Franz, Jodie Hermann, Jacob Hume, Andrew Janes, Noah Klein, Cameron Lerch, Taylor Lindenbusch, Brady Martin, Kyle McMillen, Daniel Money, Andrew Niiro, Jose Padron, Nicholas Parris, Sean Poth, Ashley Pruet, Nicholas Razo, Troy Savaiano, Aaron Silvus, Sarah Skinner, Matthew Small, Seth Stubblefield, Alex Warhover.

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 \$25,000 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**, **John and Patty Rogers**, and by the estates of **Richard Anderson** and **Richard Hannum**. Our most recent endowment was established in memory of **Dr. Oran Allan Pringle**.

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

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

Donations over \$100:

Harro Ackermann
 Kenneth E. Arnett
 Charlotte A. Bhasin
 Kul Bhasin
 John Bosnak
 Laura Bosnak
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 George Jay & Sabrina Doster
 Ronald C. Epps
 Clayton & Marsha S. Evans
 Courtney & Alissha Feeler
 Bernard Joseph Fendler
 Junfang Gao
 Thomas Gaylord
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 Rolla Animal Hospital
 Shell Oil Company Foundation
 The Benevity Community Impact Fund

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

Ebrahim-Ghanbari-Adivi, **Daniel Fischer**, N. Ferreira, J. Goullon, R. Hubele. **A. LaForge**, **Michael Schulz** and **Don Madison**, “Comparison of Experimental and Theoretical Fully Differential Cross Sections for Single Ionization of the $2s$ and $2p$ States of Li by Li^{2+} Ions”, *J. Phys. B: At. Mol. Opt. Phys.* **50**, 215202 (7pp) (23 October 2017).

C.M. Adhikari and **U. Jentschura**, “Close Examination of the Ground-State Casimir-Polder Interaction: Time-Ordered Versus Covariant Formalism and Radiative Corrections”, *J. Phys. B* **51**, 215002 (2018).

U.D. Jentschura and **C.M. Adhikari**, “Relativistic and Radiative Corrections to the Dynamic Stark Shift: Gauge Invariance and Transition Currents in the Velocity Gauge”, *Phys. Rev. A* **97**, 062120 (2018).

Andrew James Murray, James Colgan, **Don Madison**, Matthew Harvey, Ahmad Sakaamini, James Pursehouse, Kate Nixon and Al Stauffer, “Natural and unnatural-parity contributions in electron-impact ionization of laser-aligned atoms”, *Journal of Physics: Conference Series* **875**, 012002 (6 pp) (2017)

Ahmad Sakaamini, Matthew Harvey, **Sadek Amami**, Andrew James Murray, **Don Madison** and Chuangang Ning, “Differential cross section measurements for ionization of N_2 in coplanar geometry”, *J. Phys. B: At. Mol. Opt. Phys.* **51**, 035207 (8pp) (17 January 2018)..

Xing Wang, Shen Yue Xu, Chuangang Ning, **O. Al-Hagan**, Pengfei Hu, Yongtao Zhao, Zhongfeng Xu, Jing Kang Deng, Enliang Wang, Xueguang Ren, Alexander Dorn and **Don Madison**, “Dynamic effects in electron momentum spectroscopy of sulfur hexafluoride”, *Phys. Rev. A* **97**, 062704 (7pp) (18 June 2018).

Y. Gao, S.F. Zhang, X.L. Zhu, D.L. Guo, **M. Schulz**, A.B. Voitkiv, **D.M. Zhao**, B. Hai, M. Zhang, R.T. Zhang, W.T. Feng, S. Yan, H.B. Wang, Z.K. Huang and X. Ma, “Probing Distortion Phases via Two-Center Interferences in Double Capture Collisions of He^{2+} on CO”, *Phys. Rev. A* **97**, 020701(R) Rapid Communication 2018.

L. Nagy, F. Jarai-Szabo, S. Borbely, **T. Arthanayaka**, **B.R. Lamichhane**, **A. Hasan** and **M. Schulz**, “Wave Packet Scattering in Intermediate-Energy p—He Collisions”, , accepted for publication in *Eur. Phys. J. D* (2018).

Y Gao, **M. Schulz**, D.L. Guo, S.F. Zhang, X.L. Zhu, R.T. Zhang, W.T. Feng, **D.M. Zhao** and X. Ma, “Systematic Study of Transfer and Double Ionization in Slow $\text{He}^{2+} + \text{Ar}$ Collisions”, *Phys. Rev. A* **98**, 062711 (2018) (featured in “Kaleidoscope”).

A.K. Ibrahim and **T. Vojta**, Monte Carlo simulations of a disordered superconductor-metal quantum phase transition, *Eur. Phys. J. B* **92**, 311 (2018).

J. Crewse, **C. Lerch** and **T. Vojta**, Quantum critical behavior of a three-dimensional super-fluid-Mott glass transition, *Phys. Rev. B* **98**, 054514 (2018).

A.H.O. Wada, **Matthew Small** and **Dr. Thomas Vojta**, “Extinction transitions in correlated external noise”, *Physical Review E* **98**, 022112 (2018).

A.H.O. Wada and **T. Vojta**, Fractional Brownian motion with reflecting wall, *Phys. Rev. E (Rapid Communication)* **97**, 020102 (R)(2018).



A.H.O. Wada

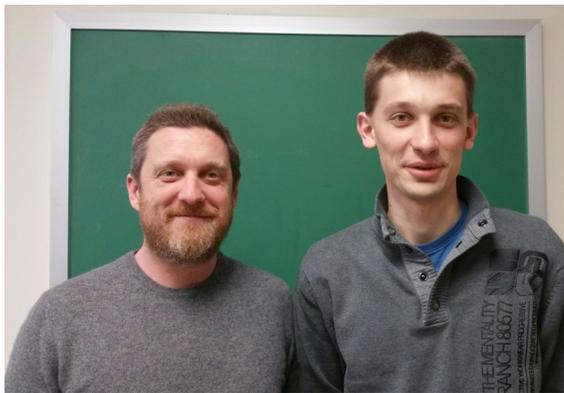


Matthew Small

Alexander Wada and Matthew Small’s paper was featured as Editor’s Suggestions on the journal’s website. Alexander is a visiting grad student from Brazil working in Thomas Vojta’s group.

New Postdocs and Visiting Scholar in the Department

The Physics Department welcomed three Postdocs and a Visiting Scholar to the department this year: **Dr. Luigi Bagolini** who came to us from Rome, Italy and worked with Professor Julia Medvedeva, **Dr. Martin Puschmann** who came from Chemnitz, Germany to work with Dr. Thomas Vojta, and **Dr. Ivan Zhuravlev** who joined us from the University of Nebraska-Lincoln who is working with Dr. Julia Medvedeva. Visiting scholar **Dr. Yingguang Liu** joined us from North China Electric Power University, Baoding, China and worked with Dr. Aleksandr Chernatynskiy.



Dr. Luigi Bagolini, Dr. Martin Puschmann



Dr. Ivan Zhuravlev



Dr. Yingguang Liu

International Research Visitors

The department welcomed visitors doing research with faculty for short periods of time this semester. **Dr. Vitor Luiz Bastos de Jesus** from the Instituto Federal de Educacao, Ciencia e Tecnologia do Rio de Janeiro and joined by his son, Jose Vitor, was here for two weeks working with Dr. Daniel Fischer. **Dr. Prithvi Singh** from Sir Padampat Singhanian University in Udaipur, India, accompanied by his wife, Neema, was here for several months to do research with Dr. Don Madison. His visit was supported by the American Physical Society's US-India Exchange program. **Dr. Jose Hoyos** who was a postdoc in the department in 2006-2007 and is now a professor at the University of Sao Paulo visited after attending the Aspen Center for Physics to work with Dr. Thomas Vojta.



Jose Vitor, Dr. Vitor Luiz Bastos de Jesus, Dr. Daniel Fischer



Dr. Don Madison, Dr. Prithvi Singh



Dr. Thomas Vojta, Dr. Jose Hoyos

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 2020 newsletter. The best way to send information to us is by email to physics@mst.edu.



Ibrahim Adawi Passed Away

Dr. Ibrahim Adawi passed away at his home in Rolla, on April 24, 2018. Dr. Adawi was taken to Tur'an, Israel to be received, buried, and celebrated in his home town.

Ibrahim came to the United States in 1951 and was naturalized in 1961. He was the first student to receive the degree of Bachelor of Science in Engineering Physics from Washington University in St. Louis, MO in 1953. He received his doctorate from Cornell University, Ithaca, New York in 1957.

Ibrahim joined the Physics Department of the Missouri School of Mines and Metallurgy, currently Missouri S&T, in 1968 as a Professor in Physics and stayed until his retirement in 1997. Ibrahim was awarded Emeritus Professor at the University of Missouri-Rolla in the fall of 1997. During his tenure at the university, he also served as a visiting professor at the University of Hamburg, Germany in the winter of 1977 and at the University of East Anglia, Norwich, England in the fall of 1982. Ibrahim was a senior scientist at Motorola in Phoenix, Arizona during the summer of 1979 and a research leader at the International Center of Theoretical Physics in Trieste, Italy during the summers of 1982, 1983 and 1985. Ibrahim became a Fulbright lecturer in Rabat, Morocco in 1982. Moreover, he organized the 19th Midwest Solid State Conference at the University of Missouri-Rolla in 1971.

Ibrahim was a dedicated teacher and researcher who authored and co-authored 43 refereed journal publications and presented many talks and seminars in the fields of solid state theory and statistical physics. His earlier research interests included the penetration of charged particles and radiation in matter, interactions of lasers with solids, the photoelectric effect, transport theory, electrical conduction in strong electric fields, and the screening of impurities in solids. Later in his career he focused his research program on scattering electrons by atoms in the presence of strong electric fields, the screening of electrons in solids, as well as magnetic monopoles. Ibrahim was a member of the Tau Beta Pi, Sigma Xi, American Physical Society and the Arab Physical Society.

He is survived by his wife, Suad (Harb) Adawi whom he married in 1990; his daughters: Nadia, Yasmin and Rhonda; his sons: Omar and Tariq.

Jim Musser and Agnes Vojta Promoted



Dr. Agnes Vojta was promoted to Teaching Professor and **Dr. Jim Musser** was promoted to Associate Teaching Professor. Congratulations!

Visit us on Facebook

Check out our Physics facebook page at *SandTPhysics*. Dr. Agnes Vojta is working hard to keep the facebook page up to date with current news from the Physics Department. If you would like to contribute information, please send it to us. We would love to hear from you.

Come Back for Homecoming

The Missouri S&T Physics Department warmly invites you to return to Rolla for the **S&T Homecoming 2019** on **October 4 & 5, 2019**. On Friday afternoon, October 4th, 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, **Josh Zirbel** (BS2001), will deliver the Homecoming 2019 Physics Colloquium at 4PM on Friday, October 4th.

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 at Missouri S&T!

Frontiers in Physics Colloquium Series

In Spring 2018, the Frontiers in Physics Colloquium Series was opened up by Dr. Bharat Ratra (KSU) talking about “*The Standard Model of Cosmology...and Open Questions*”. We had one talk in February from Dr. Shun Saito (Max Planck Institute for Astrophysics) “*Decoding 3D Galaxy Maps: From Dark Energy to Weighing Neutrinos*”.

In March we had six speakers including Dr. Jake Simon (University of Colorado) “*The Nature of Planet Formation*”, Dr. Jean Marcel Ngoko Djiokap (University of Nebraska-Lincoln) “*Control of Electron Motion on an Attosecond Timescale*”, Dr. Xiag-Feng Qian (University of Rochester) “*Quantum Classical Links: Entanglements, Information and More*”, Dr. Duncan Farrah (Virginia Tech) “*Insights into galaxy assembly from luminous active galactic nuclei in the distant universe*”, Dr. Anh Thu Le (Kansas State University) “*Ultrafast Molecular Imaging with Intense Laser Pulses*”, and Dr. Daniel Savin (Columbia University) “*Laboratory Astrophysics Studies along the Cosmic Cycle of Gas*”.

In April we had six speakers including Dr. Denys Bondar (Princeton University) “*Towards Efficient Model—Building of Complex Quantum Systems from Observed Data*”, Dr. Andrey Moskalenko (University of Konstanz, Germany) “*Quantum dynamics with ultrashort broadband pulses of light*”, Dr. L. Andrew Wray (NYU) “*The birth of new particles from structure and disorder at a topological insulator surface*”, Dr. Marco Cavaglia (University of Mississippi) “*How to find a (gravitational) needle in a (data) haystack: LIGO’s ‘magic’ revealed*”, Dr. Turan Birol (University of Min-

nesota) “*First principles design of correlated transparent conductors*, and Dr. Hae-Young Kee (University of Toronto) “*Emergent Phenomena in Correlated Quantum Materials*”. The spring series included candidates interviewing for two positions with the physics department. Spring colloquia concluded in early May with the poster competition of the 47th Annual Harold Q Fuller Prize Colloquium.

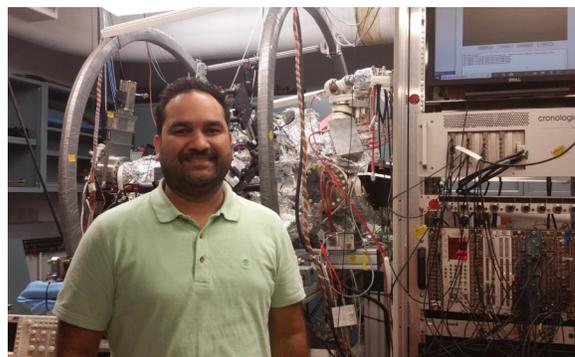
The colloquium series continued in the fall with the first speaker in August, Dr. Nick Bronn (IBM), who discussed “*Quantum Computing with Superconducting Qubits: An IBM Perspective*”. The second talk in September was by Dr. Seth Huber (Missouri S&T) “*What the Library Can Do For You*”. In October, we heard from two people: Dr. Uwe Thumm (KSU) “*The Photoeffect revisited: Attosecond time-resolved photoelectron spectroscopy of atoms, nanoparticles and surfaces*” and the Homecoming speaker Dr. Rastko Sknepnek “*A Journey from Physics to Biology*”. In November we heard from three speakers: Dr. Tung Nguyen-Dang (Laval University) “*Photofragment Spectra and Dynamic Imaging of Molecules*”, Dr. Kaya Wei (The National High Magnetic Field Laboratory) “*The Pursuit of Materials Research for Potential Energy Conversion Applications*”, and the last talk traditionally given by our own Dr. Thomas Vojta and joined by Dr. Daniel Fischer this year (Missouri S&T Physics) *2018 Physics Nobel Prize—“Tools Made of Light”*.

We concluded the year with the 25th Annual Laird D. Scheerer Prize Competition.

Adam Upshaw and Sachin Sharma leaving S&T



Adam Upshaw (MS 2013) pictured with his wife Kristy. Adam and his family left the area this summer to move closer to family in Kansas. After graduation Adam became a lecturer for the department from 2013-2018 teaching introductory physics recitations. Adam was a great asset to the department and we wish him, Kristy and their boys the best in their future endeavors!



Dr. Sachin Sharma, (PhD 2014) left the department to accept a position as a Research Associate at the University of Virginia. After graduating, Sachin stayed at the department teaching recitations for one semester, then taking a postdoctoral position from June 2015 to July 2018 with Dr. Daniel Fischer. Sachin’s PhD thesis was advised by Dr. Michael Schulz. We wish Sachin and his family the best!

25th Annual Schearer Prize Competition

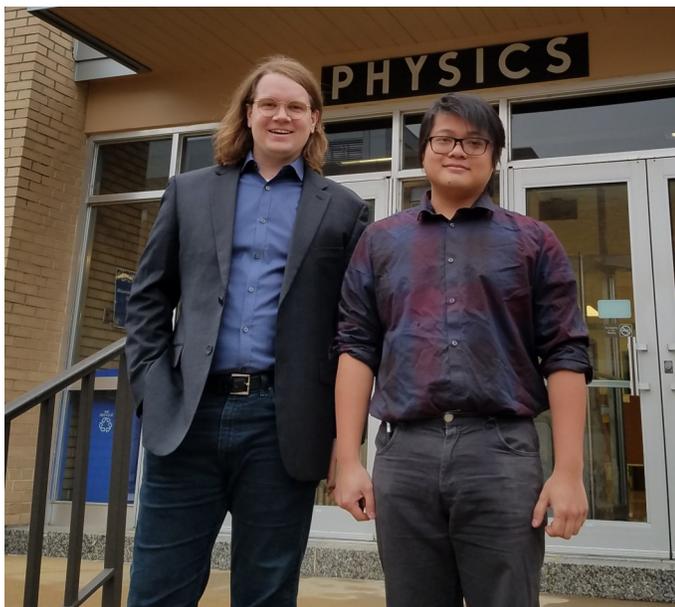
The Twenty-Fifth Annual *Laird D. Schearer Competition for Graduate Research*, established by the family of Dr. **Laird S. Schearer** to recognize research performed by a graduate student, was held on December 6, 2018.

The annual competition is held in memory of Laird D. 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 2018 Schearer Prize Committee, **Dr. A.T. Le** (Chairman), **Dr. Paul Parris** and **Dr. Michael Schulz** (Judges) selected two finalists who gave oral presentations about their work in a departmental colloquium. The finalists this year were **Jack Crewse**, advised by **Dr. Thomas Vojta** and **Yunsheng Qiu**, advised by **Dr. Yew San Hor**.

During the colloquium on December 7th, Mr. Crewse talked about "*Quantum critical behavior of a three-dimensional superfluid-Mott glass transition*" and Mr. Qiu talked about "*Anomalous Hall Effect in n-type CrxSb2Te3 topological insulator*". Both 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 \$500 to Jack Crewse and second prize and \$300 to Yunsheng Qiu. The Schearer Prize committee would like to congratulate Jack and Yunsheng on the excellent quality of their oral presentations and thank both finalists for participating in the Schearer Prize competition. The cash awards were made possible by the generous donations of the Schearer family. Following presentations, the finalists and numerous faculty members had a wonderful dinner at a local restaurant.



Jack Crewse, Yunsheng Qiu

From Schearer Prize Winner Jack Crewse

As an undergraduate student in this department I was inspired by previous years' winners of the Schearer Prize, so it has been a very special honor to have been selected as the winner of the 25th Annual Schearer Prize Competition. I want to thank my advisor, Dr. Thomas Vojta, whose support and guidance has allowed my research to flourish into something worthy of an award. Additionally, I must thank the many professors and faculty in the department whose influence has made my graduate experience so fulfilling. I also want to thank the Schearer Prize committee for the opportunity to present my work among the competition. Last, but not least, I extend thanks to my friends and family, whose personal and emotional support has made my pursuits possible. In the research I presented this year, I have analyzed the effects of disorder on quantum phase transitions of a model of interacting lattice bosons. These models correspond to many physically realizable systems such as ultra-cold atoms in optical lattices, certain quantum magnets, and superfluid Helium in porous media. If we adjust how strongly the bosons of the system interact, a quantum phase transition occurs between a superfluid and insulating state. I have simulated this transition using Monte Carlo techniques and calculated the critical behavior of the transitions. The results are the first reports of the critical behavior of this system in three-dimensions. Finally, I want to acknowledge the Schearer family for making the graduate research competition a possibility. It has been a wonderful honor and opportunity to be named the 25th winner of the Annual Schearer Competition.

~Jack Crewse

PHONATHON 2018

Your donations help make it possible to continue to attract quality undergraduate and graduate students in our department. Currently we have approximately 87 undergraduates and 32 graduate students, and we have a goal of growing these numbers in 2020. Every dollar you can give for scholarship and graduate fellowships will greatly assist the department in its aggressive recruitment plan, and will be greatly appreciated.

In addition, your continued generosity with Phonathon donations has allowed us to increase teaching laboratory capacity by up to 50% over the past four years.

Last year's fundraising Phonathon raised \$15,120 from 108 donors.

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

47th Annual Fuller Research Seminar

Five undergraduate students presented posters about their research projects at the 47th Annual Harold Q Fuller Undergraduate Research Competition, held on May 3, 2018.

The posters were judged by the Fuller Prize Committee: **Dr. Paul Parris** (Chairman), **Dr. Jim Musser** and **Dr. Dan Waddill**.

The Fuller Awards are given to 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 **Katrina Compton**, **Zachary Driemeyer**, **Cameron Lerch**, **Jacob Moore** and **Sean Welter**.

The five research projects were “*Characterization of a Laser-Cooled Atomic Beam*” by **Katrina Compton**, advised by Dr. Daniel Fischer; “*Thermal Properties of GaN and AlN from Classical Interatomic Potentials*” by **Zachary Driemeyer**, advised by Dr. Aleksandr Chernatynski; “*Monte Carlo Simulations of the Magnetic Behavior of Diluted Hexaferrites*” by **Cameron Lerch**, advised by Drs. Thomas Vojta and Julia Medvedeva; “*Manipulating Time Dependent Propagation of Waves Through Multiple Scattering Media Via Wave Front Shaping*” by **Jacob Moore**, advised by Dr. Alexey Yamilov; and “*Electric-Field Exfoliated Bi_xSe₃ Nanolayers*” by **Sean Welter**, advised by Dr. Yew San Hor. The judges commented “We have been extremely impressed by everybody’s work.....we applaud your efforts!”

Cameron Lerch was awarded first place and received a \$400 prize; second place was a tie awarded to **Katrina Compton** and **Zachary Driemeyer**, each received a \$200 prize; and third place was a tie awarded to **Jacob Moore** and **Sean Welter**, each received a \$100 prize.

Congratulations to the winners!!



Cameron Lerch

Physics Faculty & Staff



Front row: Agnes Vojta, Jan Gargus. Second row: Don Madison, Jerry Peacher, Michael Schulz, Thomas Vojta. Third row: A.T. Le, Yew San Hor, Paul Parris, Alex Chernatynskiy. Back row: Andy Stubbs, Julia Medvedeva, Ron Woody, Jim Musser.

Not pictured: Pam Crabtree, Daniel Fischer, Ulrich Jentschura, Greg Story, Dan Waddill, Gerry Wilemski and Alexey Yamilov.

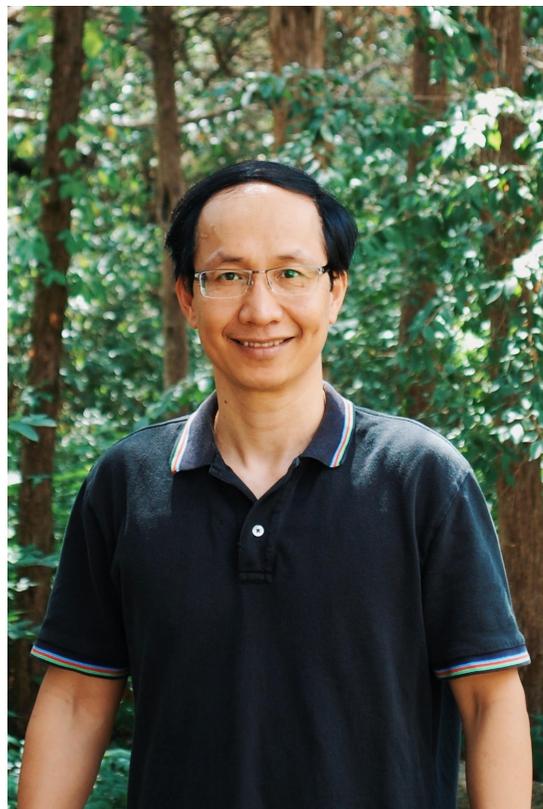
Fuller Prize Winner Cameron Lerch

It is truly an honor to be named the winner of the 47th Annual Fuller Competition. I am deeply thankful for all of the faculty at Missouri S&T and their resounding support for me throughout my undergraduate degree. I am especially thankful for all the undergraduate research opportunities that I had, and I would like to thank Dr. Vojta and Dr. Medvedeva for their continued support, guidance, and patience throughout this project. I would also like to thank the prize committee for allowing me the opportunity to present my research. Lastly, I would like to thank the Fuller family for their continued support of the physics department and making this competition possible.

The research that I have performed on diluted hexaferrites has inspired me to study condensed matter physics in graduate school. I particularly enjoy carrying out simulations on real materials, and the computational and analytic skills that I have developed while studying diluted hexaferrites will be very useful in my graduate work. I am excited to start the next chapter of my research career and look forward to the opportunities that lie ahead.

~Cameron Lerch

Meet New Faculty Member—Dr. A.T. Le



Anh-Thu (A.T.) Le explored the world before ending up in Rolla, Missouri. He was born and grew up in Vietnam, obtained his bachelor and PhD in physics from Belarusian State University in Minsk, Republic of Belarus, worked as a researcher and postdoc at the Institute of Physics in Hanoi, the Max Planck Institute for Physics of Complex Systems in Germany, and Memorial University in Canada. In 2001, he and his family moved to Kansas State University (KSU), where he worked initially as a visiting scientist. He then became a research assistant professor (2006), research associate professor (2014), and research full professor (2018). In August 2018 he joined Missouri S&T as an assistant professor.

A.T.'s research interests cover various areas in theoretical atomic, molecular, and optical (AMO) physics. Currently, his main focus is in ultrashort intense laser-matter interaction and attosecond physics. This is a new research area, which aims to provide insights into the dynamics of electrons in atoms and molecules with unprecedented attosecond resolution (an attosecond is 1×10^{-18} second). His goal is to develop tools and techniques to image and control electronic and nuclear motions in molecules on femtosecond and attosecond timescales, and in particular, to make "*molecular movies*" of chemical reactions. So far, A.T. has made contributions to the development of high harmonic generation (HHG) spectroscopy and laser-induced electron diffraction (LIED) technique, which have been used to successfully "image" electronic and nuclear dynamics in simple molecules. At Missouri S&T, he plans to further extend these techniques to more complex molecules and solids. He also wants to develop new techniques to explore the inner workings of molecules.

A.T. has published more than 90 research papers and coauthored a monograph on intense laser and attosecond physics. He supervised students at both graduate and undergraduate levels.

A.T. got married to Huang (Helen) Pham, who is currently an international student advisor at KSU. They have three daughters: Tracy was born in Vietnam; Alice and Hannah were born in Kansas. A.T. likes playing table tennis, badminton, chess and swimming. He and his family also like traveling and hiking.

Bachelor of Science Graduates



Spring 2018—Front row: Kevin Rose, Albert Chua and Aaron Lemmermann. Back row: Kent Gorday, Kevin Renick, David Gillcrist, Jacob Cook, Colton Dailey, Rachel Birchmeier.

Not pictured: Travis Barry, Joshua Maxwell and Jeremy McCoy.

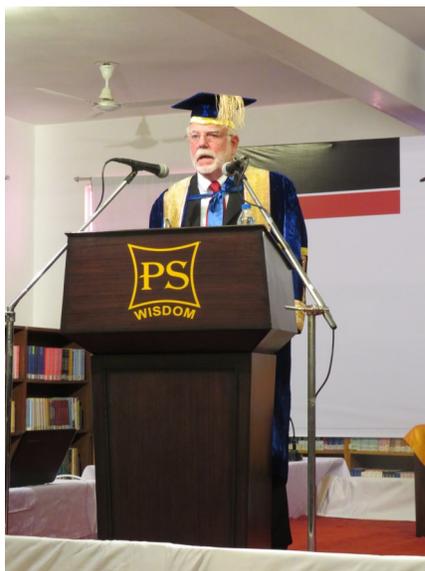


Fall 2018— Jacob Hume, Alyssa Bennett, Brendan Boggs, Deni Cikota and Kyle Foster.

Not pictured: Brian Ford

Don Madison—Trip to India

Dr. Don Madison and his wife, Lina, were invited to Udaipur for a week. Don presented a one-hour professional talk to all the faculty and students which was very well received. Moreover he was asked to give the commencement speech at the Sir Pampat Singhania University's December graduation. Don was honored for his speech in the local news coverages in Rajasthan Patrika and Dainik Bhaskar. Don and Lina were given a 3-day sightseeing excursion in the surrounding area, taking in a light and sound show, stopping at several temples where women and children wanted their picture taken with them. They also visited a fort, palaces and museums in Jodhpur, and toured Udaipur and the palace. Don's visit to India came about after Prithvi Singh had visited the S&T physics department for several months doing research with Don.



Ulrich Jentschura in Switzerland



Ulrich Jentschura has continued his crazy mountain adventures in 2018, completing the Zermatt marathon in less than five hours. This marathon, in addition to the distance of 26.2 miles, also features a total elevation gain of 6377 feet. Ulrich additionally scaled a number of 14ers (peaks over 14000 feet) in both Colorado and Switzerland. The Festi Ridge to the summit of the Dom (14911 feet altitude) was climbed in 4 hours and 20 minutes from the Dom hut. As far as science is concerned, Ulrich received additional funding from NSF; he performed a few interesting calculations in collaboration with Giorgio Parisi and Jean Zinn-Justin, two rather well-known physicists in Europe, while on his Sabbatical in Hungary and Germany. His new book on the quantum electrodynamics of bound states is nearing completion and is scheduled to appear with World Scientific in 2019. The year was rounded out by receiving the Faculty Research Award, which recognized Ulrich's achievements in the last two years, notably, the large number of research articles he published with graduate students (2016-2018). His former graduate student, Chandra Adhikari, found a postdoctoral research associate position in North Carolina.

Barbara Hale Retires



Dr. Barbara Hale retired after 46 years of teaching and research in the physics department at Missouri S&T. Dr. Hale inspired generations of students. She is still a vital part of our physics family and we hope to see her often in the department.

Dr. Hale received her PhD in physics from Purdue University and her Bachelor's degree in physics from Syracuse University.

In 1973, Dr. Hale was one of the first two women to join the Missouri S&T physics faculty. She began as assistant professor, making a major change in her field of study, which had been high-energy particle physics, to join the Graduate Center for Cloud Physics. That center eventually became the Cloud and Aerosol Sciences Laboratory where she was promoted from associate professor and research investigator to professor and senior investigator. She became an expert in nucleation theory with an emphasis on theories of water and ice cluster formation.

Dr. Hale's work has led to over 40 publications, and her articles made truly important contributions to the field. The success of her scaled model of nucleation is one of the most significant contributions to the understanding of this phenomenon in the last 30 years. At S&T, her research generated almost \$1 million in external support. Dr. Hale excelled as an educator, teaching a full range of physics courses, from introductory undergraduate classes to supervising doctoral students. She received numerous faculty excellence awards. In 2013, Dr. Hale was named Missouri S&T Woman of the Year in recognition of her efforts to improve the campus environment for women and minorities. Dr. Hale was an outspoken advocate for the faculty and for her students.

Dr. Hale currently serves as faculty advisor for the Etta Kappa chapter of Chi Omega. She has performed this service since 1979. In 2014, she received the fraternity's lifetime service award.

The physics department honored Dr. Barbara Hale with a retirement celebration in early March. The Physics Department wishes Barbara the best in her retirement. Thank you for the many years of dedication and service to the department and the university.



Joey Franz Volunteer for Kids



Joey Franz, physics undergraduate major and robotics volunteer puts kids' STEM experience first. Joey donated 400 hours during a six-week period to mentor Rolla High School's robotics competition team for its premier participation in the Greater Kansas City Regionals FIRST competition. He helped the team create its financial, community outreach and safety programs, and to apply basic physics and mechanics to their robotic inventions. Those efforts paid off when "10 Factorial" from RHS won Kansas City's Rookie All Star Award, which qualified them to compete in the FIRST World Championships in Houston—a goal the team had set for itself.

Joey has volunteered at 10 robotics competitions in the last academic year, helping out at all four levels of FIRST robotics competitive meets where students from kindergarten to 12th grade progress, gaining experience at each level. Joey worked as a judge, master of ceremonies assistant and safety advisor at the competitions. Joey draws on his high school experience with FIRST— an international, non-profit youth organization that operates robotics competitions—to give back to others the life direction he's gained from the program. Joey loves working with kids. During the summer, he works as a counselor at full-inclusion YMCA camps for kids ages 7-17 from all socio-economic backgrounds. After working two summers as a cabin counselor, he is now a unit director who oversees the counselors and helps run the outdoor survival, leaders-in training and equestrian programs.

Faculty Notes

Dr. Aleksandr Chernatynskiy was awarded an NSF grant jointly with Dr. Amitava Choudhury from Chemistry entitled “Designing Complex Chalcogenides through Building Block Approach”. He also received a three-year award for the project “Irradiation behavior of piezoelectric materials for nuclear reactor sensors in collaboration with Ohio State University.”

Dr. Daniel Fischer received additional funding on his NSF Career award “Control and Analysis of Atomic Few-Body Dynamics”.

Dr. Ulrich Jentschura received additional funding on his NSF grant “Quantum Field Theory, Atomic Physics and General Relativity” which significantly enhances the scope of the grant.

Dr. Julia Medvedeva received additional funding on her NSF grant “DMREF: Collaborative Research: Synthesis, Characterization and Modeling of Complex Amorphous Semiconductors for Future Device Applications”. With Dr. Manashi Nath from Chemistry she also received additional funding on NSF project “Investigating Mixed Metal Chalcogenides Towards Electrocatalytic Water Oxidation: an Integrated Experimental and Theoretical Approach towards Materials Innovations”.

Dr. Julia Medvedeva gave two invited talks: at Purdue University in May 2018, where she was invited to establish new collaboration on using transparent conducting oxides she studies theoretically in plasmonic applications and “Complex Amorphous Semiconductors: Repository, Tools, and E-Collaboration Platform”, at the 2018 Configurable Data Curation System Annual Convention held at the National Institute of Standards and Technology (NIST) in July 2018.

Dr. Michael Schulz received additional funding on his NSF grant “Few-Body Dynamics in Simple Atomic Systems”.

Dr. Michael Schulz was invited to edit a book on ion-atom collisions, to be published by deGruyter. One of his papers was selected as “2017 highlight by J. Phys. B. He also became Expert Member of the “Experimentalists Network of the International Atomic Energy Agency”.

Dr. Thomas Vojta received a new NSF award for the project “Disorder and dynamics in quantum materials” researching the quantum states of matter occurring in materials at low temperatures close to the absolute zero. He also gave invited talks at conferences in Brazil and Germany.

Dr. Alexey Yamilov gave two invited talks: SPIE Metamaterials, Metadevices and Metasystems Conference in San Diego, CA and Materials Research Society Spring Meeting in Phoenix, AZ. He gave one presentation at CLEO/QELS 2018 in San Jose, CA. He wrapped up the second-year of a two-year term as the chair of the “Metamaterials and Complex Media” committee at the Conference on Laser & Electro Optics (CLEO) -the largest conference organized by the Optical Society of America. Alexey is a Senior Member of the OSA.

Physics Graduate Students



Dr. Basu Lamichhane completed his PhD in physics advised by Dr. Michael Schulz. Basu started a postdoc position at Temple University in March, where he will use his expertise on COLTRIMS acquired during his PhD to study sterile neutrinos.



Dr. Ahmed Ibrahim completed his PhD in physics advised by Dr. Thomas Vojta. Ahmed accepted a faculty position at the University of Anbar in Iraq.

Alumni News



Dr. David Fahey, physics alumnus who received his PhD in physics from UMR in 1979, was awarded an honorary doctoral degree at the University of Wisconsin-Madison in December. Dr. Fahey is a leading climate scientist and director of the National Oceanic Administration’s Chemical Sciences Division at the Earth System Research Laboratory in Boulder, Colorado.

Owen Smith-Fulbright



Owen Smith, a 2017 physics graduate, has received a Fulbright scholarship grant to study in Russia from the J. William Fulbright Scholarship Board. Owen will be an English-language teaching assistant at a Russian university for the academic year September 2018 to June 2019. Smith minored in Russian and became a proficient bilingual communicator and teacher. Owen stated that in today's interconnected world, it's vital for any engineer hoping to have an impact to also possess cross-cultural communication skills.

In 2017, Owen was selected as a Post-Secondary Russian Scholar Laureate by the American Council of Teachers of Russian (ACTR) while he served as a Learning Enhancement Across Disciplines (LEAD) tutor on campus. Also, in 2017 Smith was a finalist for Missouri S&T's Renaissance Student Award, a reflection of his multiple academic pursuits in science, foreign language, musical composition, poetry and creative writing. Owen graduated in December and is considering pursuing a long-term teaching career as well as working in a scientific industry where his foreign language proficiency would be an asset.

CONTACT PHYSICS

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

Fun with liquid nitrogen



Joel Peacher and **Rebecca Campbell** made ice cream with liquid nitrogen for future Missouri S&T students and members of the Society of Women Engineers who visited the Physics Department in April. Joel has arranged for several groups to visit the department this year. Joel has taken over the community outreach that Dr. Allan Pringle used to take care of for the department and is doing a fantastic job!

John Johnson Contributor to NOVA Wonders



Dr. John Asher Johnson (BS1999) is a professor of astronomy at Harvard and was a contributor to the NOVA Wonders episode "Are We Alone?" which aired this year. John received his BS degree in physics from Missouri S&T and his PhD in astronomy from the University of California, Berkeley. In 2013, he was named one of Astronomy Magazine's "Ten Rising Stars" in astrophysics. His primary research focus is on the detection and characterization of planets outside our Solar System, commonly known as exoplanets. In 2012 he was awarded Caltech's Richard P. Feynman Prize for Excellence in Teaching and the David and Lucile Packard Foundation Fellowship. In 2015 he was awarded Harvard's Fannie Cox Prize for Excellence in Teaching.

Dr. Thomas Vojta Group shows up in force at the APS March Meeting



Ahmed Ibrahim, Alexander Oniwa Wada, Jack Crewse, Cameron Lerch, Martin Puschmann

Thomas Vojta's many-particle physics research group showed up in force at the 2018 March Meeting of the American Physical Society in Los Angeles. Graduate students Ahmed Ibrahim and Jack Crewse gave talks about their PhD research on disordered superconductors. Alexander Wada, a visiting graduate student from Brazil, presented his work on the extinction of biological populations due to environmental fluctuations. Undergraduate student Cameron Lerch gave a talk about low-temperature magnetism in hexaferrite materials, and postdoc Martin Puschmann presented on the quantum Hall effect.

At the upcoming 2019 March Meeting in Boston, the group will have an even larger footprint consisting of 7 talks and poster presentations.



Rastko Sknepnek 2018 Homecoming Speaker

The Physics Department welcomed back alumnus, **Dr. Rastko Sknepnek** (PhD 2004), to present the 2018 Homecoming Colloquium in the Physics Department. The title of his talk was "A Journey from Physics to Biology". His current position is a Senior Lecturer and Dundee Fellow affiliated with the Computational soft condensed matter and biophysics group at the University of Dundee in Dundee, Scotland. Dr. Sknepnek obtained his PhD in physics under the supervision of **Dr. Thomas Vojta**.

Science Olympiad



Dr. Jim Musser, Joel Peacher, Dr. Dan Waddill

Teams from fifteen middle schools and ten high schools competed at the Missouri Regional Science Olympiad on the S&T campus. Among the volunteers who helped make it a success were three of our physics faculty: Joel Peacher was one of the organizers; Dr. Jim Musser and Dr. Dan Waddill served as judges. Joel stepped in as an organizer from the Physics department replacing Dr. Allan Pringle. Thank you!!

Faculty Awards



Dr. Julia Medvedeva was awarded the 2017 Faculty Excellence Award in February 2018 by **Provost Robert Marley** and **Chancellor Chris Maples**.



Dr. Greg Story was awarded an Outstanding Teaching Award and a Sustained Excellence in Outstanding Teaching award. He received the latter for getting an Outstanding Teaching Award every year for the last ten years.



Dr. Ulrich Jentschura was the recipient of the 2018 Faculty Research Award; **Dr. Julia Medvedeva** was the recipient of the 2018 Faculty Research Award; and **Dr. Greg Story** was the recipient of the 2018 Faculty Teaching Award.

Julia Medvedeva visiting colleagues



(Left) Dr. Julia Medvedeva visits a clean room at Arizona State University with her colleague and long-time friend, Dr. Mariana Bertoni (ASU), in May 2018. Dr. Bertoni shows the state-of-the-art equipment her group uses to grow and characterize transparent conducting oxide films for solar energy applications. Drs. Medvedeva and Bertoni collaborate on several projects that involve transparent conducting materials and their functional interfaces.

(Right) Dr. Julia Medvedeva with Prof. Alex Zunger (Center for Inverse Design and U. of Colorado, Boulder) and Dr. Nadezhda Medvedeva (Russian Academy of Science) in Chania, Crete, in October 2018. Dr. Julia Medvedeva gave an invited talk at the International Symposium on Transparent Conductive Materials in Greece.

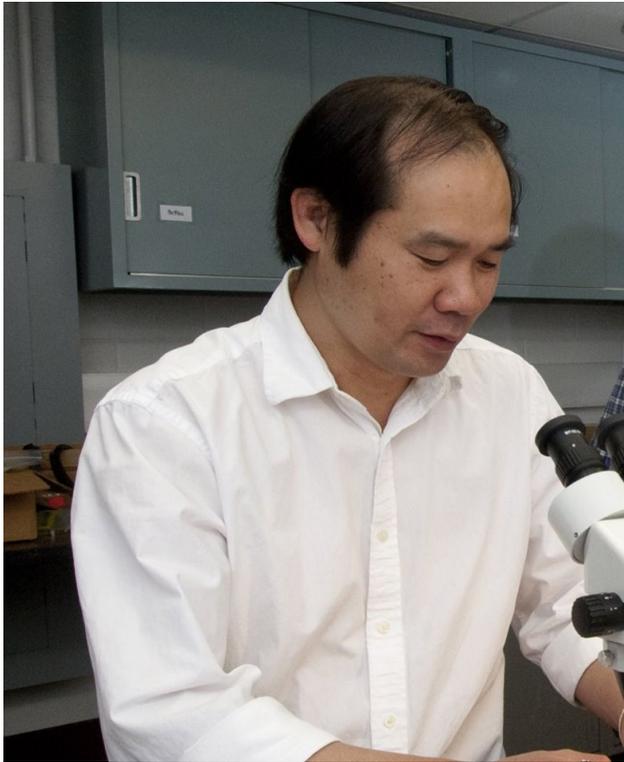
Julia Medvedeva researches phase-change materials

Phase-change materials can be rapidly switched between two distinct atomic arrangements. The two arrangements have different properties (density, optical reflectivity or electrical resistivity) that can be associated with on (1) and off (0) states in applications. These materials are important for non-volatile optical and electrical storage in rewritable DVDs and Blu-ray discs as well as non-volatile computer memory.

In the majority of current optical data storage media, the materials exhibit a transition between an amorphous and a crystalline phase. Materials exhibiting an amorphous-to-amorphous transition, called *polyamorphism*, are exceptionally rare.

Julia Medvedeva and her coworkers recently found $K_2Sb_8Se_{13}$ as the first material that can be switched between two different amorphous states as well as a crystalline one. Julia performed atomistic computer simulations of the three phases of $K_2Sb_8Se_{13}$ and then calculated the resulting optical and electronic properties. All three states are stable in air at room temperature. The electrical conductivity increases by more than 2 orders of magnitude from amorphous-I to amorphous-II, and by another 2 orders of magnitude from amorphous-II to the crystalline state. This extraordinary three-state behavior holds promise for a variety of new science experiments as well as applications related to ternary (three-value) computing logic circuits and reconfigurable logic devices.

For details see the article “Multistates and Polyamorphism in Phase-Change $K_2Sb_8Se_{13}$ ” published in the Journal of the American Chemical Society. <https://pubs.acs.org/doi/abs/10.1021/jacs.8b05542>



Yew San Hor

Yew San Hor Nation's Highly Cited Researcher

Dr. Yew San Hor, associate professor of physics, is among the nation's "highly cited researchers" in his field, according to Clarivate Analytics, which compiles the listing of researchers who are "selected for their exceptional research performance, demonstrated by production of multiple highly cited papers that rank in the top 1% by citations for field and year in Web of Science." He is one of only eight researchers from the University of Missouri System to make the list. <https://hcr.clarivate.com/>

Dr. Yew San Hor has also joined the Materials Research Center (MRC) by invitation as a Senior Investigator.

Observatory

Amanda Wetzel started as Observatory Administrator in the fall semester. She planned out the full semester of public viewings as well as 3 private viewings for other schools/groups. They viewed Saturn, Mars, Jupiter, The Moon and viewed the Orion Nebula. At nearly all the events there has been a great turn out, and the STARS Astronomy Club was able to spread quite a bit of knowledge about different objects in space. Amanda will continue as administrator through the spring semester before deciding on who will take over when she graduates in May. The STARS Astronomy Club looks forward to seeing everyone at the Observatory in the spring. Anyone working the events will have a glow bracelet on so if you see one, feel free to introduce yourself and ask them any questions you may have. Clear Skies!!

University of Missouri System matches donations

Missouri S&T has recently established a new giving opportunity. It is called an Annual Scholarship and requires the donor to commit for 5 years. The best thing about this scholarship is that all donations are matched 1:1 by the University of Missouri System. This means, for every \$1,000 in donations, we will be able to hand out \$2,000 worth of scholarships to lighten the financial burden for hard-working and high-performing physics students.

If you want to learn more about the Annual Scholarship program and how you can participate, please call 1-800-392-4112, or email giving@mst.edu.



Picture taken by Kyle Foster at the observatory

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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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