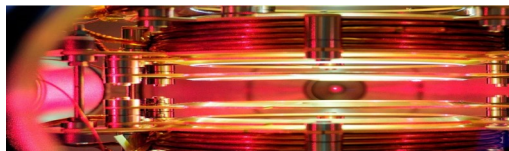


Matter 'n Motion

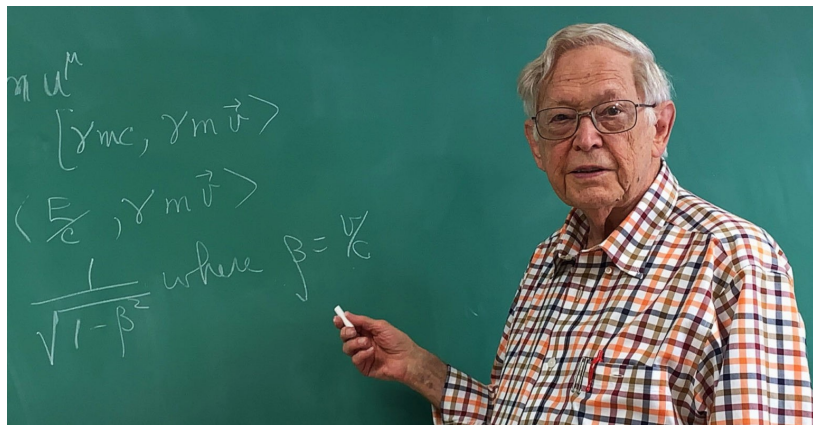
January 2020



Missouri University of
Science and Technology
PHYSICS DEPARTMENT

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

Jerry Peacher celebrates 50 years of service



Congratulations to **Dr. Jerry Peacher** who celebrated 50 years of teaching with the Physics Department and the university in September.

Jerry joined Missouri S&T in 1969 as assistant professor from the University of California, Berkeley, where he was an assistant research physicist in the Space Sciences Laboratory. His research interests have focused on atomic and molecular collision theory, the topic of his postdoctoral work at the University of California, San Diego. Prior to that he worked as a physicist at the Naval Ordnance Test Station in China Lake, California, after earning his Ph.D. in physics at Indiana University.

In addition to his successful research and teaching career, Jerry has been serving as Associate Department Chair and undergraduate advisor for more than 20 years. The department would not run without him.

Jerry was honored with a campus-wide reception by the College of Arts, Sciences and Business and at the annual physics department picnic. Jerry plans to keep teaching and fulfilling all his other duties in the department. The department thanks Jerry for all his hard work!



Don Madison, Paul Parris and Gerry Wilemski retire

In May, the Physics Department celebrated the retirement of Drs. **Paul Parris**, **Gerry Wilemski** and **Don Madison**. They spent a combined total of 86 years teaching and researching in the department — Paul 33 years, Don 31 years, and Gerry 22 years. Paul and Gerry will continue to teach part time in the department.

We thank Don, Paul, and Gerry for their years of service and wish them well in their future endeavors!

Memo from the Chair

It appears that every year brings major changes to the physics department and the university. In August of 2019, Dr. **Mohammad (Mo) Dehghani** became chancellor of Missouri S&T, taking over from interim chancellor Dr. **Christopher G. Maples**.

As you may have seen on the front page, this past May, we celebrated the retirements of three faculty members, Profs. **Don Madison**, **Paul Parris**, and **Gerry Wilemski**. In total, they served the department for 86 years, wrote more than 400 scientific papers, and educated generations of students. I would like to thank Don, Paul and Gerry for their dedication to the department and the university and wish them all the best for the future. Paul and Gerry will continue teaching in the department part time.

In September 2019, the department marked a very special milestone as we celebrated Prof. **Jerry Peacher's** 50th work anniversary. Jerry joined the physics department of what was then the University of Missouri-Rolla in September 1969 as an Assistant Professor. I was three years old at that time. Over his long and successful career, Jerry has become the personified institutional memory of the physics department. I hope that he and his accumulated wisdom will stay in the department for another 50 years.

I am happy to report that our astrophysics group is off to a good start. We have founded a new research center, the Institute for Multi-Messenger Astrophysics and Cosmology, and participate in two large international collaborations, the Laser Interferometer Gravitational-Wave Observatory (LIGO) and the Hobby-Eberly Telescope Dark Energy Experiment (HETDEX). Our two astrophysics faculty members, Profs. **Marco Cavaglia** and **Shun Saito**, are profiled in depth elsewhere in this newsletter.

Our faculty continue to excel in their research and teaching endeavors. 2019 was a banner year for Prof. **Ulrich Jentschura**. He visited Hungary and France for research collaborations, won a grant from the Templeton Foundation, published his 200th scientific paper, got married and became a new father.

The National Science Foundation awarded a large \$2 million grant to a group of S&T faculty which includes Profs. **Julia Medvedeva** and **Thomas Vojta**. The funds will be used to set up a supercomputer on the S&T campus. Additional research funding was received by Profs. **Marco Cavaglia**, **Daniel Fischer**, **Julia Medvedeva**, **Michael Schulz**, and **Thomas Vojta**. Prof. **Greg Story** won a Sustained Excellence in Outstanding Teaching award. Prof. **Alexey Yamilov** published a paper in the prestigious journal *Nature Photonics*, **Michael Schulz** won a distinguished scientist award from the Chinese Academy of Sciences, and Prof. **Yew San Hor** was again named one of the nation's most "highly cited researchers" in his field.

Not to be outdone, our staff continue to perform admirably. **Pam Crabtree** finally won a long-overdue Staff Excellence Award.

Over the past two years, the overall enrollment at the university has dropped by several hundred students, leading to a difficult financial situation. I am happy to report, however, that the physics enrollment continues to be strong, and the quality of the students is excellent. The department currently has 84 under-

graduates and 32 graduate students. In 2019, 12 students graduated with a BS degree. In addition, we awarded 3 PhD degrees. One of our 2019 graduates, Cameron Lerch, received a prestigious Graduate Research Fellowship from the National Science Foundation, and two of our majors won prizes in the 2019 S&T Undergraduate Research Conference. These and more stories of student success can be found elsewhere in this newsletter.

Finally, I would like to emphasize 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. This year, the university continues the Annual Scholarship program in which all donations to the physics department are matched 1:1 by the University of Missouri System; for details see page 10 of the newsletter.

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 2019-2020 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 \$2000, were **Addison Butler** from Sunrise Beach, MO; **Taylor Lindenbusch** from O'Fallon, MO and **Zachary Miller** from Saint Peters, MO.

The **John L. & Betty L. McDaniels Scholarship** was awarded to **Jose Padron** from Springfield, MO (previous years' recipients were inadvertently omitted in the newsletter: 2018-2019 Dominic Dalba; 2017-2018 Aaron Lemmermann and Luke Murat; 2016-2017 Lawrence Thompson and Aaron Lemmerman). The scholarship was established to ensure that talented students who demonstrate financial need have the opportunity to excel in the study of physics.

The **Gerrie Fletcher Endowed Scholarship in Memory of Dale Shull** was awarded to **Ashley Pruett** from Washington, MO. The scholarship was established so academically proficient female undergraduates who are in financial need can pursue their career in physics or other sciences.

Recipients of the **Harold Q Fuller Scholarship-Loan** were **Taylor Lindenbusch** from O'Fallon, MO and **Joseph Franz** from Kansas City, MO. The \$1,336 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 **Sean Anderson** from Warrensburg, 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 **Rebecca Campbell** from Saint Charles, MO; **Kenneth Distefano** from Kansas City, MO; **Samuel Halladay** from Mount Vernon, IA and **Aaron Silvus** from Lee's Summit, 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 recipient was **Jodie Hermann** from Arlington Heights, IL.

The recipients of the **Leon E. Woodman Memorial Scholarship** were **Ashley Pruett** from Washington, MO and **Nicholas Razo** from South Jacksonville, IL. 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 **Allan Pringle Endowed Scholarship** 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 **Nicholas Razo** from South Jacksonville, MO. Miner Match money was awarded to **Alex Warhover** from Saint Charles, MO; **Daniel Money** from Fenton, MO; **Andrew Janes** from O'Fallon, MO; **Zachary Miller** from Saint Peters, MO; **Andrew Niiro** from Hermann, MO; **Benjamin Edwards** from Rolla, MO; **Anzumaan Chakraborty** from Maryville, MO; **Dominic Dalba** from Imperial, MO; **Zachary Driemeyer** from House Springs, MO; **Kyle McMillan** from Eureka, MO; **Elizabeth Triller** from Perryville, MO; **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 **Javier Franco-Hernandez** from Chesterfield, MO; **Noah Klein** from Saint Charles, MO; **Troy Savaiano** from Liberty, MO; **Carson Ripple** from O'Fallon, MO; **Joseph Billing** from Saint Charles, MO; and **Seth Stubblefield** from Saint Peters, MO.

The department also awards **Physics Scholarships for Academic Access**, funded by a group of alumni and faculty donors. These are need-based awards to Missouri resident students in Physics. This scholarship was awarded to **Jose Padron** from Springfield, MO and **Sarah Skinner** from Bolivar, MO.

Congratulations to S&T's 2019 Physics Degree Recipients!

May 2019

Bachelor of Science

Reagan Thomas Dugan
Nicholas Peter Ernst
Cameron Joseph Lerch
Brady Joe Martin
Nicholas William Parris
Matthew Aaron Small
Amanda Shay Wetzel

Doctor of Philosophy

Timothy Sullivan

December 2019

Bachelor of Science

Rebecca Campbell Carollo
Daniel Richard Money
Austin Reed Powell
Aaron Keith Silvus
Sarah Suzanne Skinner

Doctor of Philosophy

Tera Ashley Glaze
Milan Koirala



Spring 2019 — Left to right: Brady Martin, Nicholas Parris, Matthew Small, Cameron Lerch, Amanda Wetzel, Nicholas Ernst and Reagan Dugan

Congratulations to 2019 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.

Spring 2019

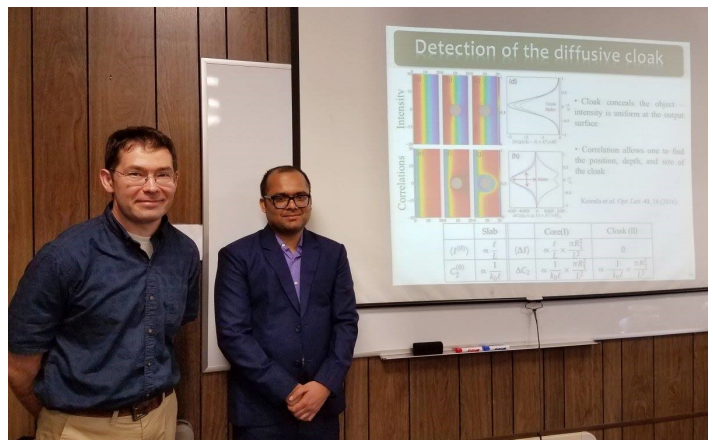
Sean Anderson, Brett Ballard, Rebecca Campbell, Anzumaan Chakraborty, Kenneth Distefano, Zachary Driemeyer, Reagan Dugan, Benjamin Edwards, Nicholas Ernst, Javier Franco-Hernandez, Joseph Franz, Samuel Halladay, Joshua Hedemann, Jodie Hermann, Andrew Janes, Noah Klein, Zenon Klok, Taylor Lindenbusch, Brady Martin, Kyle McMillen, Dillon McNamara, Zachary Miller, Daniel Money, Andrew Niir, Jose Padron, Nathaniel Page, Ashley Pruett, Nicholas Razo, Maxwell Renfrow, Cole Rischbieter, Brandon Robinson, Ravi Shastri, Sarah Skinner, Seth Stubblefield, Alex Warhover, Benjamin Yingling

Fall 2019

Sean Anderson, Brett Ballard, Reece Beattie-Hauser, Rebecca Campbell-Carollo, Anzumaan Chakraborty, Dominic Dalba, Joshua Dalton, Zachary Driemeyer, Javier Franco-Hernandez, Joseph Franz, Samuel Halladay, Colton Helms, Jodie Hermann, Andrew Janes, Taylor Lindenbusch, Anthony Lonsdale, Joshua Maechler, Kyle McMillen, Keith Miller III, Zachary Miller, Daniel Money, Jose Padron, Ashley Pruett, Nicholas Razo, Cole Rischbieter, Aaron Silvus, Sarah Skinner, Ian Smith, Zachary Szatkowski, Nicholas Theodorou, Jacob Thiel, McGowan Toombs, Alex Warhover

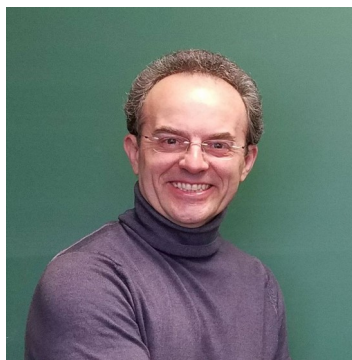


Fall 2019 — Left to right: Sarah Skinner, Austin Powell, Physics Chair Dr. Thomas Vojta, Rebecca Campbell Carollo, Aaron Silvus and Daniel Money



Physics graduate student **Milan Koirala** successfully defended his doctoral thesis on the topic "Coherent effects in wave propagation through complex media". His adviser is Dr. Alexey Yamilov.

Meet New Faculty Members



Dr. Marco Cavaglia

Marco Cavaglia joined the department as a Professor of Physics. A native of Italy, he earned a PhD in Astrophysics at the International School for Advanced Studies in Trieste in 1996. Before joining the faculty at Missouri S&T, he held positions as Assistant, Associate and Full Professor at the University of Mississippi (2004-2018).



Marco previously held positions as research scientist at Tufts University, the Max Planck Albert-Einstein-Institut in Germany, the University of Beira Interior in Portugal and the Massachusetts Institute of Technology, and was Lecturer at the University of Portsmouth, UK. During his career, Marco authored over 200 publications in peer-reviewed journals and was the recipient of research awards for over \$2.5M.

Marco's scientific interests are in gravitational physics, astrophysics, theoretical physics, and education and public outreach. He has been a member of the Laser Interferometer Gravitational-wave Observatory Scientific Collaboration (LSC) since 2007. Marco has more than 20 years experience in management and administration of scientific units, having served from 2012-2017 as Assistant Spokesperson of the LIGO Scientific Collaboration (LSC), an organization of over one thousand scientists from over 80 institutions across 17 countries. From 2008 to 2012 he was founding chair of the LSC education and public outreach group and from 2012 to 2015 he was founding chair of the LSC diversity group.

Marco is a member of the American Physical Society and the International Astronomical Union and has recently been elected senior member of the LIGO Academic Affairs Committee of the LSC and co-chair of the LSC Burst Source Working Group. Cavaglia shares with his LSC colleagues several other recognitions, including the 2016 Special Breakthrough Prize for the detection of gravitational waves, the 2016 Gruber Cosmology Prize, and the 2017 Princess of Asturias Award for Technical and Scientific Research.



Dr. Shun Saito

Shun Saito moved around the world before joining S&T as an Assistant Professor in January 2019. He was born and grew up around Nagoya in Japan where he obtained his bachelor, master and PhD degrees in physics from the University of Tokyo. Soon after receiving his PhD in 2010, he moved to the US as a postdoctoral researcher at the University of California-Berkeley and Lawrence Berkeley National Laboratory. He moved back to Japan in 2013 to hold a postdoctoral position at the Kavli Institute for Physics and Mathematics of the Universe. In 2016, he moved to another continent, Europe, to work as a postdoctoral fellow at the Max Planck Institute for Astrophysics in Garching, Germany.



Shun's research interest is observational cosmology. In recent years, his research focused on theory and data analysis of the large-scale structure of the Universe with a gigantic 3D map of galaxies. The main goal is to unveil the nature of dark energy which causes the cosmic acceleration, one of the biggest mysteries in the Universe. For this purpose, Shun is heavily involved in two state-of-the-art galaxy surveys, the Hobby-Eberly Dark Energy Experiment (HETDEX), and the Subaru Prime Focus Spectrograph (PFS). His group at S&T is the only group in Missouri which officially participates in HETDEX. Shun is also interested in answering questions about the formation and evolution of galaxies in the context of the large-scale structure with HETDEX and PFS.

Shun got married to Kimika who used to work as an advertisement designer and is currently a stay-at-home mother. They have a little son, Kai, who was born in Munich, Germany in 2018 and has never stepped into Japan even though he is Japanese. Shun likes to watch and play soccer, although he is occupied to take care of Kai in his private time.

Ulrich Jentschura collaborates in Hungary and France, gets married, and becomes a new father



Faculty member **Ulrich Jentschura** had a banner year in 2019, both professionally and personally.

During the first half of the year, he visited the Institute for Nuclear Physics of the Hungarian Academy of Sciences in Debrecen. This institute has recently attracted considerable media attention because its researchers may have found evidence for a new, fifth fundamental force in nature, in addition to the well-known gravitational, electromagnetic, strong, and weak forces. Specifically, when studying the decay of excited Helium and Beryllium nuclei, they detected what looks like a new particle not contained in the Standard Model of particle physics. As the new particle has a rest mass (energy) of about 17 MeV, the Hungarian scientists refer to it as the “X17” particle.

It is of prime importance to confirm these findings by other investigations. Together with István Nándori, Ulrich therefore explored how to study the new particle by atomic physics methods [published in *Physical Review A* 97, 042502 (2018)].

A separate collaboration with the widely known physicists Giorgio Parisi and Jean Zinn-Justin led Ulrich to the Commissariat à l’Energie Atomique in Saclay near Paris in France.

During 2019, Ulrich published his 200th refereed journal article which appeared in the *International Journal of Modern Physics A* 34, 1950180 (2019). In this article, he proved the equivalence principle for antimatter. Antimatter consists of particles of opposite charge, but the same inertial mass, as ordinary matter. By analyzing the gravitationally coupled Dirac equation in curved space-time backgrounds, Ulrich established that antimatter does fall down in a gravitational field, just like ordinary matter does.

Ulrich also won a grant from the Small-Scale Fundamental Physics grant program of the Templeton Foundation for his project “Accurate Quantum Field Theory under External Conditions” which he plans to use to hire a postdoctoral researcher.



In addition to being a very productive year, 2019 was also an exciting year personally. Ulrich tied the knot with his wife Katrina and celebrated the birth of his son Heston, reasons for joy during a turbulent year spent on two continents.

Come Back for Homecoming

The Missouri S&T Physics Department warmly invites you to return to Rolla for the **S&T Homecoming 2020** on **October 16 & 17, 2020**. On Friday afternoon, October 16th, 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, Shella Keilholz, (BS 1997) will deliver the Homecoming Physics Colloquium at 4PM on Friday, October 16, 2020.

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, as we work to dig deeper into our future at Missouri S&T!

Report from the SPS

Spring 2019 Officers were 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.

Fall 2019 Officers were David Scott as President, Sarah Skinner as Vice-President, Elizabeth Caputa as Secretary, Ashley Pruett as Treasurer, Aaron Silvus as Historian and Zach Miller as STUCO Representative.

The Society of Physics Students were busy this year. Dr. Fischer, Dr. Jentschura, Dr. Chernatynskiy, Dr. Medvedeva and Dr. Musser gave lectures regarding their research. Dr. Waddill gave the "So you want to go to graduate school" talk. Dr. Story informed the students "Why it's great to be alive right now" and ran through the history and evolution of physics. The SPS participated in the Minerama event for student organizations.

Sarah Skinner and Dr. Agnes Vojta organized a Women in Physics night in order to support and encourage the women in the physics department. The SPS group worked with the Associate Dean of Research and External Relations, Dr. Melanie Mormile, to revive Research on Tap with a presentation by Dr. Cavaglia that left standing room only. Throughout the year, SPS students helped with department tours for prospective students.

David Scott

Sigma Pi Sigma Inductees



Congratulations to the students who were inducted into the physics honors society, Sigma Pi Sigma.

Pictured (left to right): David Scott, Nathaniel Page, Kenneth Distefano, Aaron Silvus, Jonas Buxton, Nicholas Razo, Peter Schonberg.

Not pictured: Joseph Billing, Joshua Dalton, Michael Ellis, Zenon Klok, Ravi Shastri, Seth Stubblefield.

Women in physics night



Our department's first Women in Physics night was a success. Professor Barbara Hale's appearance was a special treat.

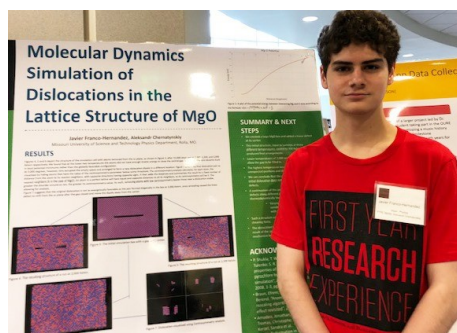
Observatory



The Missouri S&T Observatory appreciates everyone who visited us this past fall semester. It is a joy to be able to share the wonders of the night sky with everyone in the community and to stimulate the curiosity of our youngest minds. Fortunately, we had relatively favorable weather during the Public Viewing Nights, which enabled us to view objects such as Jupiter, Saturn, the moon, and the Owl Cluster (NGC457)! These events would not have been so enjoyable without the help of the many faculty, staff, students and friends of the observatory. An especially big thanks to the S&T Astronomical Research Society (STARS) for assisting during the events; Joe Shuster from the Dent County Astronomers for his knowledge and guidance, and bringing his own telescope to events; Jim and Ginny Stroger from the Camden County Astronomy Associates for their assistance in collimating our telescope and for donating a new focuser, and finally Ronald Woody for modifying the focuser to be compatible with our telescope. Keep up to date with us on Facebook by liking the STARS and Physics Department pages. We hope you visit soon. Clear skies!!

Kenneth Distefano

Undergraduate Accomplishments



Javier Franco-Hernandez, a freshman in physics from St. Louis, plans to continue his first year research experience (FYRE) project in the next S&T OURE program. Mentored by Dr. Aleksandr Chernatynskiy, Javier investigated new atomic structures of magnesium oxide.



Elizabeth Caputa, **Ashley Pruett**, **Elizabeth Triller**, and **Sarah Skinner**, pictured with Dr. Kelly Nash (UT San Antonio, SPS advisor, in the center) attended the Conference for Undergraduate Women in Physics (CUWiP) at Texas A&M. Highlights were meeting Gabriela Gonzales, former LIGO spokesperson, and a video call with Fabiola Gianotti, director-general of CERN.



Brady Martin defended his honors thesis "Assessment of thermal Conductivity in Uranium Dioxide through the Implementation of Molecular Dynamics Simulations". His advisor is Dr. Alex Chernatynskiy.



Elizabeth Caputa had a summer REU at the University of Texas Rio Grande Valley where she helped to run the Cristina Torres Memorial Observatory. She was involved in tracking exoplanets, variable stars, and asteroids. She even followed up as an optical counterpart to gravitational wave signals and was one of the authors of the official astronomical circular for the follow-up of one of the LIGO detection candidates. Elizabeth followed up as an optical counterpart to gravitational wave signals and was one of the authors of the official astronomical circular for the follow-up of one of the LIGO detection candidates.

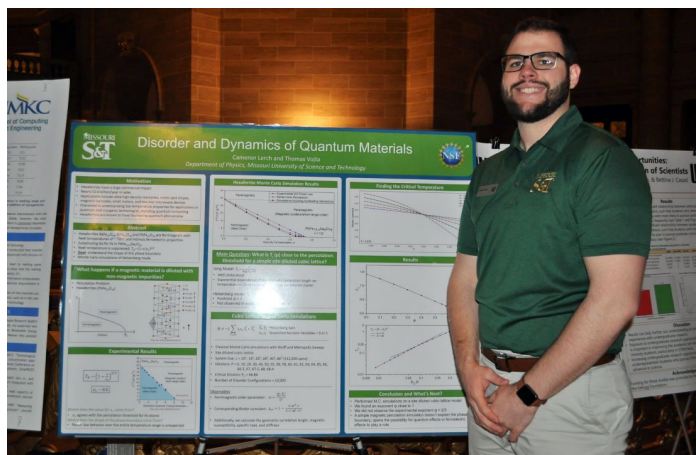


Alex Warhover and **Nicholas Razo** shared the first prize in the Missouri S&T physics competition. The competition is focused on junior undergraduate students, with only the material covered in the introductory physics courses necessary for the solution of the problems. Theoretical and experimental portions of the competition contained three problems with limited time to solve them and generate a report.



Nicholas Parris, **Anzumaan Chakraborty**, and **Nicholas Razo** were members of a team that won a Silver medal in the University Physics Competition. The competition is a worldwide event with over 280 teams participating during one grueling weekend in November of 2018, when each team had to research, solve and deliver a report on the open-ended physics problem. For their work on the "Sending a Light Sail Propelled Nanocraft to Alpha Centauri" problem, the Missouri S&T team received a Silver Medal, a distinction for the top 18% of the field.

Undergraduate Accomplishments continued



Cameron Lerch, who graduated with a BS in May 2019, has been awarded a prestigious Graduate Research Fellowship by the National Science Foundation.

Cameron is currently pursuing a Ph.D. in mechanical engineering and materials science (MEMS) at Yale University, working with Dr. Corey O'Hern, a professor of mechanical engineering and materials science, applied physics and physics. Cameron's research deals with bulk metallic glasses whose high yield strength and fracture toughness make them desirable for a variety of engineering and manufacturing purposes.

In April 2019, Cameron represented Missouri S&T at the Undergraduate Research Day at the Capitol in Jefferson City. During this event, student ambassadors presented their research to lawmakers and demonstrated the unique opportunities they have to work with faculty at their institutions. Cameron presented his results on new quantum-mechanical properties of hexagonal ferrites.



Anzumaan Chakraborty, **Sarah Skinner**, **Katrina Compton**, **Brett Ballard**, **Alex Warhover**, and **Zachary Driemeyer** participated in the S&T Undergraduate Research Conference.

In the poster presentations of the science division, second place went to **Alex Warhover** for research titled "Fractional Brownian Motion with an Absorbing Wall" (advisor: Dr. Thomas Vojta). Third place was awarded to **Katrina Compton** for research titled "Characterization of Laser-Cooled Atomic Samples" (advisor: Dr. Daniel Fischer).



Elizabeth Caputa and **Kyle McMillen** received grants from the Missouri Space Grant Consortium (MOSGC) through Missouri University of Science and Technology and NASA.

Elizabeth will work with Dr. Cavaglia's LIGO group. She will be building a tabletop sized interferometer to engage the public and students in scientific educational outreach. She will also work on analyzing the data from the LIGO collaboration to help identify and resolve sources of instrumental noise.. She even took part in optical follow-up observations of a LIGO gravitational –wave candidate signal and was one of the authors of the official astronomical circular for these observations.

Kyle will be working with Dr. Han in the aerospace department on experimental analysis of plasma density profiles for optimi-



Julia Medvedeva invited to prestigious seminar



Julia Medvedeva was among a few world-leading experts on amorphous oxide semiconductors invited to participate in the 77th Fujihara (also known as Fujiwara) seminar held in Hakone, Japan, in October 2019. Sponsored by the Fujihara Foundation of Science, the seminar series are highly prestigious because a research topic may be chosen for the seminar only one time. Covering topics from fundamentals to applications, the seminar on amorphous oxides was organized by Professor Hideo Hosono from Tokyo Institute of Technology, the recipient of 2016 Japan prize for his pioneering research on In-Ga-Zn-O thin film transistors. These amorphous oxide semiconductors are currently favored for flexible and high-resolution energy-saving displays in smart phones, tablets, PC monitors, and large-area organic LED TVs.

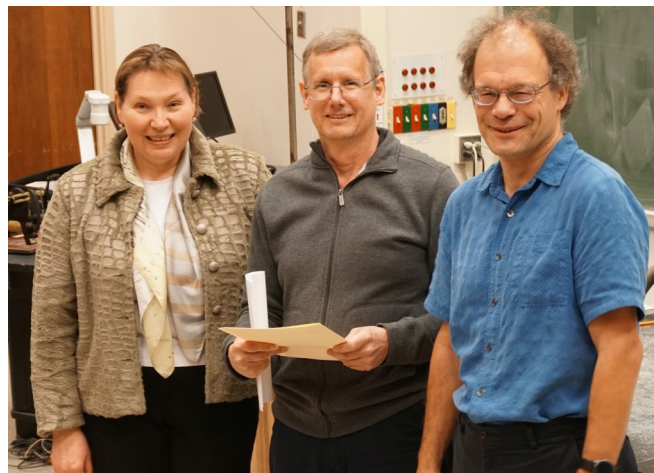
Medvedeva was invited to present her ground-breaking work on complex relationships between the local structure and morphology, defects and carrier generation, electron localization and transport across the crystalline-amorphous transition in oxides. Using computationally-intensive *ab-initio* Molecular Dynamics, comprehensive structural analysis, and accurate Density-Functional calculations, Medvedeva has explained many puzzling observations in the disordered oxides. With the support of her current NSF-DMREF grant, she continues to search for next-generation transparent amorphous semiconductors.

Yew San Hor highly cited again



Yew San Hor made the Web of Science international list of Highly Cited Researchers for 2019. Yew San explores novel solid-state bulk and nanostructured materials. His work has implications both for the basic scientific understanding of quantum materials and for future technological developments. This is the fifth year Dr. Hor has made the list!

Greg Story receives award



Greg Story received a Sustained Excellence in Outstanding Teaching Award. This award is given to faculty who have earned Outstanding Teaching Awards for nine out of the previous 10 years. Greg is pictured here with CAFE director Irina Ivliyeva and physics department chair Thomas Vojta.

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.

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

CORPORATE:

Baker Hughes Foundation
Exelon Corporation
Shell Oil Company

Donations under \$100:

Bruce C. Anderson
Derek Anderson
Howard M. Brown
George Caudle
Melva Crocker
Patricia Huestis
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Donations \$100-\$250

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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**, **John and Betty McDaniels**, **L.E. Woodman** 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.

Missouri S&T Students and Alumni: In Press

“Jet Geometry and Rate Estimate of Coincident Gamma Ray Burst and Gravitational Wave Observations”, **Kentaro Mogushi**, Marco Cavaglia and Karelle Siellez, *The Astrophysical Journal*, Volume 880, Number 1 (2019) 55

“Search for gravitational-wave signals associated with gamma-ray bursts during the second observing run of Advanced LIGO and Advanced Virgo”, LIGO Scientific and Virgo and IPN Collaborations (B.P. Abbott (LIGO Lab., Caltech) et al.), incl. K. Mogushi, M. Cavaglia, *Astrophys. J*886 (2019) 75

“Search for gravitational waves from Scorpius X-1 in the second Advanced LIGO observing run with an improved hidden Markov model”, (B.P. Abbott (LIGO Lab Caltech) et al.), incl. K. Mogushi and M. Cavaglia, *Phys. Rev D*100 (2019) no. 12, 122002.

“Search for intermediate mass black hole binaries in the first and second observing runs of the Advanced LIGO and Virgo network”, LIGO Scientific and Virgo Collaborations (B.P. Abbott (LIGO Lab., Caltech) et al.), incl. K. Mogushi and M. Cavaglia, *Phys. Rev. D*100 (2019) no. 6, 064064

“Pressure Shifts in High-Precision Hydrogen Spectroscopy, I. Long-Range Atom-Atom and Atom-Molecule Interactions”, U.D. Jentschura, C.M. Adhikari, R. Daws, A. Matveev and N. Kolachevsky, *J. Phys. B* vol. 52, article no. 075005 (2019)

“Pressure Shifts in High-Precision Hydrogen Spectroscopy, II. Impact Approximation and Monte-Carlo Simulations”, A. Matveev, N. Kolachevsky, C.M. Adhikari, and U.D. Jentschura, *J. Phys. B* vol. 52, article no. 075006 (2019)

“Study of the Few-Body Dynamics Underlying Post-Collision Effects in the Ionization of H₂ by 75 keV Proton Impact”, M. Dhital, S. Bastola, A. Silvus, A. Hasan, B.R. Lamichhane, E. Ali, M.F. Ciappina, R.A. Lomsadze, D. Cikota, B. Boggs, D.H. Madison, and M. Schulz, *Phys. Rev. A* 99, 062710 (2019)

“Target Dependence of Post-Collision Effects in Ionization by Proton Impact”, A. Silvus, M. Dhital, S. Bastola, J. Buxton, Z. Klok, E. Ali, M.F. Ciappina, B. Boggs, D. Cikota, D.H. Madison, and M. Schulz, *J. Phys. B* 52, 125202 (2019)

“Low energy electron and positron impact differential cross sections for the ionization of water molecules in the coplanar and perpendicular kinematics”. P. Singh, G. Purohit, C. Champion, De. Sebillieu, and D. Madison, *J. Chem. Phys.* 150, 054304 (7pp) 2019

“Triple differential cross sections for electron-impact ionization of methane at intermediate energy”, E. Ali. C. Granados, A. Sakaamini, M. Harvey, L.U. Ancarani, A.J. Murray. M. Dogan, C. Ning, J. Colgan and D. Madison, *J. Chem. Phys.* 150 (194302) 2019

“Multicenter distorted-wave approach for electron-ionization of molecules”, E. Ali and D. Madison, *Phys. Rev. A* 100, 012712 (2019)

“A dynamical (e,2e) investigation into the ionization of the outermost orbitals of *R*-carvone”, D.B. Jones, E. Ali, C.G. Ning, F. Ferreira da Silva, O. Ingolfsson, M.C.A. Lopes, H.S. Chakraborty, D.H. Madison and M.J. Brunger, *J. Chem. Phys.* 151, 124306 (2019)

“Triple Differential Cross Section Measurements for Electron-Impact Ionization of Methane from a Coplanar Geometry to the Perpendicular Plane”, M. Harvey, A. Sakaamini, M. Patel, S. Amami, D. Madison and A.J. Murray, *J. Chem. Phys.* 151, 194305 (2019)

“Wave Packet Scattering in Intermediate-Energy p – He Collisions”, L. Nagy, F. Jarai-Szabo, S. Borbely, T. Arthanayaka, B.R. Lamichhane, A. Hasan, and M. Schulz, in “The State-of-The-Art-Reviews on Energetic Ion-Atom and Ion-Molecule Collisions”, Volume 2, edited by Dz. Belkic, I. Bray and A. Kadyrov, p. 129, World Scientific Publishing (2019)

“Target Dependence of PCI Effects on Fully Differential Ionization Cross Sections”, M. Dhital, S. Bastola, A. Silvus, B.R. Lamichhane, E. Ali, M.F. Ciappina, R. Lomsadze, A. Hasan, D.H. Madison, and M. Schulz, *Phys. Rev. A* 100, 032707 (2019)

“Projectile Coherence Effects in Simple Atomic Systems”, M. Schulz, A. Hasan, B. Lamichhane, T. Arthanayaka, M. Dhital, S. Bastola, L. Nagy, S. Borbely, and F. Jarai-Szabó, accepted for publication in *J. Phys. Conf. Proc.* (2019)

“Probability density of the fractional Langevin equation with reflecting walls”, T. Vojta, S. Skinner and R. Metzler, *Phys. Rev. E*100, 042142 (2019)

“Unconventional Josephson junctions with topological Kondo insulator weak links”, X. Ye, J. Cook, E.D. Huemiller, A.D.K. Finck, P. Ghaemi, T. Vojta, V. Adiga, S.R. Saha, J. Paglione and C. Kurter, *Phys. Rev. B*100, 104505 (2019)

Superfluid density and compressibility at the superfluid-Mott glass transition”, C. Lerch and T. Vojta, *Eur. Phys. J. Special Topics* 227, 2275 (2019)

“Non-Gaussian behavior of reflected fractional Brownian motion”, A.H.O. Wada, A. Warhover and T. Vojta, *J. Stat. Mech.* 2019, 033209 (2019)

“Conductance spectroscopy of exfoliated thin flakes of NbxBi₂Se₃”, C. Kurter, A. Finck, E. Huemiller, J. Medvedeva, A. Weis, J. Atkinson, Y. Qiu, S.H. Lee, L. Shen, T. Vojta, P. Ghaemi, Y.S. Hor and D. Van Harlington, *Nano Lett.* 19, 38 (2019).

“Inverse design of long-range intensity correlation in scattering media”, M. Koirala, R. Sarma, H. Cao, and A. Yamilov, *Phys. Rev. B* 100, 064203 (2019)

New Postdocs and Visiting Scholars in the Department



Dr. **Santwana Dubey**, postdoc with Dr. Daniel Fischer



Dr. **Siddharta Gurung Lopez** postdoc with Dr. Shun Saito and Dr. **Ryan Quitzow-James**, postdoc with Dr. Marco Cavaglia



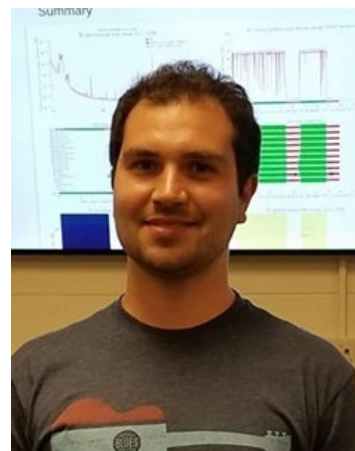
Dr. **Hatem Barghathi**, postdoc with Dr. Thomas Vojta



Dr. **Sudarshan Karki**, postdoc with Dr. Marco Cavaglia (remote from the LIGO site)



Alfonso Corrado, visiting scholar working with Dr. Marco Cavaglia



Francesco DiRenzo, visiting scholar working with Dr. Marco Cavaglia



Dr. **Raj Narayanan** visited from IIT Madras, India to work with Dr. Thomas Vojta



Joao Carlos De Andrade Getelina and his wife, Alessandra visit from Sao Carlos, Brazil. Joao is a graduate student working with Dr. Thomas Vojta



Hung Hoang from Ton Duc Thang University in Vietnam is working with Dr. A.T. Le

Frontiers in Physics Colloquium Series

In Spring 2019, the Frontiers in Physics Colloquium Series was opened by Dr. Se Kwon Kim (University of Missouri-Columbia) talking about “*Spintronics in Quantum Materials*”. In February, Dr. Timothy Gay (University of Nebraska-Lincoln) asked “*Why Isn’t God Ambidextrous? Chirality in Nature and the Role it Plays in Physics, Chemistry and Biology.*”

In March, our speakers were Dr. Zenghu Chang (University of Central Florida) who talked about “*Approaching the Attosecond keV X-ray Frontier*”, and Dr. Klaus Bartschat (Drake University) who presented on “*Coherent Control and Attosecond Dynamics with Pulsed XUV and IR Radiation*”.

In April we had four presentations: Dr. Bhupal Dev (Washington University) “*Ghost Hunting: The Story of Neutrinos and the Cosmos*”, Dr. Louis DiMauro (Ohio State University) “*Attosecond physics: faster than a New York minute*”, Dr. Arthur Suits (University of Missouri-Columbia) “*New Directions in Scattering and Photo dissociation*”, and Dr. Himadri Chakraborty (Northwest Missouri State University) “*Curious cases of resonances in gas-phase fullerenes*”.

Spring colloquia concluded in early May with a talk by Dr. Rafael Fernandes (University of Minnesota) “*A tale of two states: the complex relationship between superconductivity and magnetism in quantum materials*” and the poster competition of the 48th Annual Harold Q Fuller Prize Colloquium.

The colloquium series continued in the fall with John Shumway (Google) who discussed “*Modern Software Development for Academics*”. The second event was an Open House of the Missouri S&T LIGO lab directed by Dr. Marco Cavaglia.

In October we had five speakers: Homecoming Speaker, Dr. Josh Zirbel (AOSense Inc.) “*After Rolla: A 2001 Graduate’s Perspective*”, Dr. Francisco Navarrete (Kansas State University) “*The role of classical uncertainties on the coherence properties of collisions processes and Multi-channel contributions to High Harmonic Generation in solids*”; Dr. Karan Jani (Vanderbilt University) “*Finding black holes that should not exist with LIGO*”, Dr. Karl Gebhardt (University of Texas, Austin), “*The Hobby-Eberly Telescope Dark Energy Experiment*”; and Dr. Yaofu Zhou (Missouri S&T) “*Workflow in Phenomenological High Energy Physics*”.

In November, our own Dr. Thomas Vojta and Dr. Shun Saito gave the traditional Nobel Prize talk “*New perspectives on our place in the universe — the 2019 Nobel Prize in Physics*”.

We concluded the year with the 26th Annual Laird D. Schearer Prize Competition.

2019 Homecoming Speaker—Josh Zirbel



The Physics Department welcomed back alumnus, **Dr. Josh Zirbel** (BS 2001) to present the 2019 Homecoming Colloquium in the Physics Department. The title of his talk was “*After Rolla—A 2001 Graduate’s Perspective*”.

After graduating from UMR in 2001, Josh attended graduate school at the University of Colorado/JILA studying atomic physics. He helped build and use an apparatus to study controlled molecule formation from ultracold gases of atoms. After earning his PhD in 2008, he moved to the University of Illinois to help complete an apparatus which was used to study and characterize how ultra-low energy atoms localize in a disordered potential.

In 2011 he accepted a job at AOSense where he helps build and design sensors utilizing ultracold atoms for use in inertial sensors and clocks.

While visiting the Physics Department, Josh spent time at lunch with graduate and undergraduate students discussing his career after graduating.

26th Annual Schearer Prize Competition

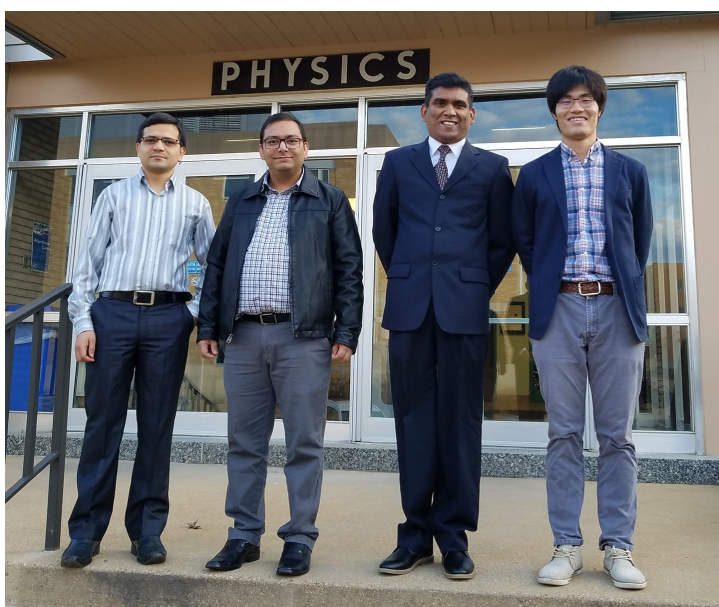
The Twenty-Sixth Annual *Laird D. Schearer Competition for Graduate Research* was held on December 5, 2019.

The 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 Prize, established by the Schearer family, rewards graduate students of the Department of Physics for outstanding research.

The 2019 Schearer Prize Committee, **Dr. Alexandr Chematynskiy** (Chairman), **Dr. A.T. Le** and **Dr. Shun Saito** (Judges) selected four finalists who gave oral presentations about their work in a departmental colloquium:

- **Madhav Dhital** advised by Dr. Michael Schulz, "*Fully Differential Study of Post Collision Interaction on the Few-Body Dynamics in Simple Atomic Systems*"
- **Kentaro Mogushi** advised by Dr. Marco Cavaglia, "*Jet Geometry and Rate Estimate of Coincident Gamma Ray Burst and Gravitational Wave Observations*"
- **Pauf Neupane** advised by Dr. Gerald Wilemski, "*Molecular dynamics study of temperature dependent wetting in alkane-water systems*"
- **A.H.N.C. DeSilva** advised by Dr. Daniel Fischer, "*Circular dichroism in multi-photon ionization of ultra cold ^6Li atoms in an intense femto-second laser field*"

The committee awarded a first place tie to Kentaro Mogushi and A.H.N.C. DeSilva, each student receiving a \$500 prize. The cash awards were made possible by the generous donations of the Schearer family.



Madhav Dhital, Pauf Neupane, Nish DeSilva, Kentaro Mogushi

From the Schearer Prize Winners

It is an honor to be the winner of the 26th Annual Laird D. Schearer competition. I'd like to thank my advisor, Dr. Marco Cavaglia, for his guidance on this project. I thank also our collaborator, Dr. Karelle Siellez, at the University of Santa Cruz, who gave us data samples, and the Prize Committee for the opportunity to present my research. And last, but not least, I wish to thank my family and friends for their support.

My talk in the competition is based on a part of my Ph.D. thesis. Our research is motivated by discoveries in the first detection of the gravitational-wave (GW) signal of the coalescing binary neutron star merger on 2017 August 17th. One of the astonishing discoveries is that the jet geometry of short gamma-ray bursts (sGRBs) that are produced by such binary mergers are wider than used to be thought in the astronomical community. Understanding the sGRB jet geometry is of important to help for putting constraints on the emission mechanism. We statistically inferred the distribution of the jet geometry with sGRB models and observational data in addition to the empirical properties of host galaxies. Also, we estimated the rate of GW detections coincident with sGRB detections in the future, using the inferred jet geometry

Kentaro Mogushi

It is a great pleasure and honor to be awarded as the winner of the 26th annual Shearer prize competition, 2019. First, I would like to thank my advisor, Dr. Daniel Fischer, for his continuous support and guidance throughout my Ph.D. research. And also, it is my pleasure to thank most of the faculty whose influence made my life as a graduate student an invaluable and fruitful endeavor. I would also like to thank the Shearer prize committee for allowing me to present my research work in this competition. Last and most, my thanks extend to my wife and the kids for their kind and sweet patience.

My Ph.D. research focuses on understanding the dynamics of coupled few-body dynamics. To achieve that, we use laser cooling of lithium atoms to ultra-cold temperatures creating highly polarized target atoms in a well-characterized eigenstate. They are ionized with ultra-short (femto-second) intense laser pulses and we can measure the momentum distribution of the charged fragments. During my research, I was involved in the development of an all-optical trap of lithium atoms and in commissioning an electron-ion spectrometer achieving electron momentum resolution which is among the best world-wide. My main responsibility was the operation and modification of a highly intense laser source. In this competition, I presented my experimental results on the helicity dependence of the ionization dynamics of the ultra-cold target atoms.

Nish DeSilva

47th Annual Fuller Research Seminar

Nine undergraduate students presented posters about their research projects at the 48th Annual Harold Q Fuller Undergraduate Research Competition, held on May 9, 2019 :

- “*The Influence of Correlated Temporal Disorder on an Extinction Phase Transition*” by **Matthew Small**, advised by Dr. Thomas Vojta
- “*Target Dependence of Post-Collision Effects in Ionization by Proton Impact*” by **Aaron Silvus**, advised by Dr. Michael Schulz
- “*Individual Phonon-Phonon Processes in GaAs*” by **Brett Ballard**, advised by Dr. Aleksandr Chernatynskiy
- “*Superfluid Density and Compressibility at the Superfluid-Mott Glass transition*” by **Cameron Lerch**, advised by Dr. Thomas Vojta
- “*Thermal Transport Properties of GaN by Classical MD Simulations*” by **Zach Driemeyer**, advised by Dr. Aleksandr Chernatynskiy
- “*Fractional Langevin Equation with a Reflecting Barrier*” by **Sarah Skinner**, advised by Dr. Thomas Vojta
- “*Generation and Characterization of Laser-cooled Atomic Samples*” by **Katrina Compton**, advised by Dr. Daniel Fischer
- “*Phases and Phase Transitions of an Anisotropic Ising-O(3) Model*” by **Anzumaan Chakraborty**, advised by Dr. Thomas Vojta
- “*Fractional Brownian Motion with an Absorbing Wall*” by **Alex Warhover**, advised by Dr. Thomas Vojta

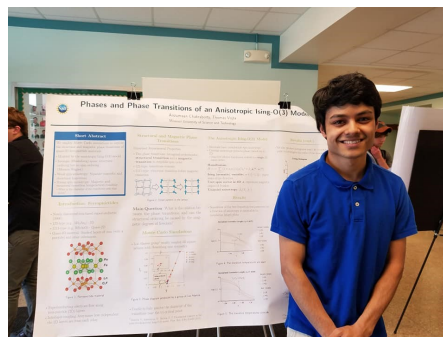
The posters were judged by the Fuller Prize Committee: **Dr. Jim Musser** (Chair), **Dr. Shun Saito** and **Dr. Dan Waddill**.

Anzumaan Chakraborty was awarded first place and received a \$400 prize; second place was a tie between **Brett Ballard**, **Katrina Compton**, **Aaron Silvus** and **Matthew Small**, each received a \$150 prize.



Dr. Thomas Vojta's group showed a strong presence at the APS March Meeting. Cameron Lerch, Sarah Skinner, Anzumaan Chakraborty, Jack Crewse, Matthew Small, Alex Warhover and Martin Puschmann (left to right) all presented talks and posters.

Fuller Prize Winner Anzumaan Chakraborty



Being awarded first prize in the 48th Annual Fuller Competition has been a profound honor. I attribute a large portion of my success to Dr. Thomas Vojta, my research mentor, for his unwavering guidance and support throughout this often-times difficult project.

My research project can be briefly described as a computational study of a class of iron-based superconductors. In particular, I ran Monte Carlo simulations of a specific abstract model known as the anisotropic Ising-O(3) model. Throughout my research, I implemented various algorithmic schemes to efficiently sample the thermodynamic quantities we were interested in resolving. As a result of my work, I had the opportunity to travel to the University of Minnesota - Twin Cities to collaborate with researchers working on the same topic. At the university, I attended the Advances in Correlated Electronic Systems (ASCES) summer school. Throughout this collaboration and school, I learned a great deal about the some of the advanced methods and tools used in theoretical condensed matter physics.

As a graduate student, I hope to specialize in theoretical condensed matter physics. Having this research experience as an undergraduate at Missouri S&T will be an invaluable asset for me going forward. Regardless of how future Fuller Competition contestants do, the research they conduct will absolutely have a positive effect on their careers. I recommend that every undergraduate get involved in research as soon as they can and to compete in the Fuller Competition!

PHONATHON 2019

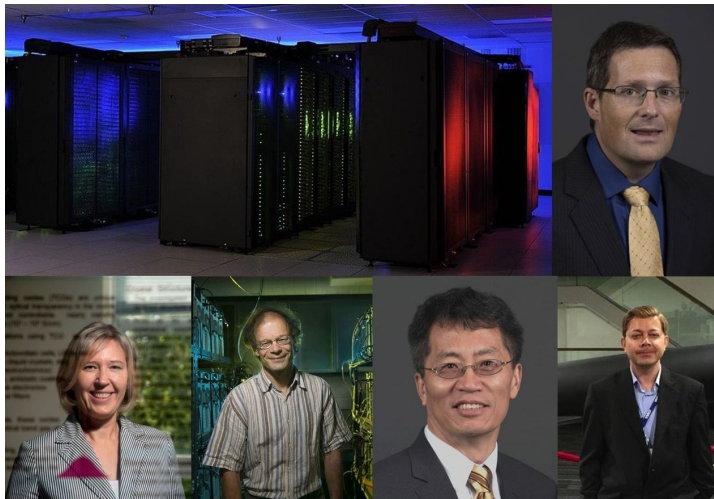
Your donations help make it possible to continue to attract quality undergraduate and graduate students in our department. Currently we have approximately 84 undergraduates and 32 graduate students, and we have a goal of growing these numbers in 2020. Every dollar you can give for scholarship and graduate 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 \$16,570 from 100 donors.

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

NSF awards \$2 million for supercomputer at S&T



A team of Missouri S&T faculty has won a \$1.96 million award from the National Science Foundation's Office of Advanced Cyberinfrastructure. The award will be used to set up a supercomputer that will enable advanced computational science and engineering research and education at Missouri S&T and several partner institutions throughout the state.

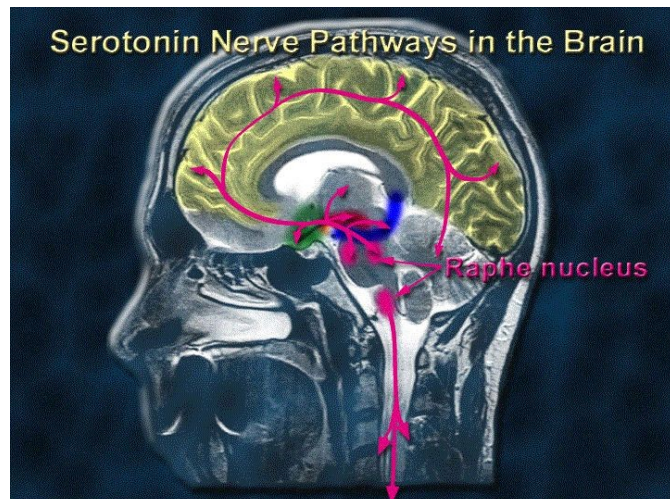
The team consists of **Richard Dawes**, Chemistry, who lead the initiative; **Julia Medvedeva** and **Thomas Vojta** from Physics; **Stephen Gao** from Geosciences and Geological & Petroleum Engineering; and **Serhat Hosder**, Mechanical & Aerospace Engineering. Thomas Vojta will serve as Principal Investigator for the award while Richard Dawes is on leave from S&T.

Pam Crabtree Staff Excellence Award



Pam Crabtree was honored by the university with one of the 9 Staff Excellence Awards at the Staff Day ceremony in May. Pam has been in the physics department for over 28 years.

Thomas Vojta Cottrell SEED Award



Physics meets neuroscience! **Thomas Vojta** has been selected as a recipient of a Cottrell SEED (Singular Exceptional Endeavors of Discovery) Award from the Research Corporation for Science Advancement. In collaboration with neuroscientists and mathematicians from UC Santa Barbara, he will investigate a fractional random walk approach to serotonergic fibers.

Michael Schulz Distinguished Scientist Award



Michael Schulz received a distinguished scientist award from the Chinese Academy of Sciences. The prize money is approximately \$15,000. Each year only 3 recipients from all the physics and mathematics areas are selected to receive the award. Michael will be traveling across China to give a lecture series at several institutes of the academy next summer.

Faculty Notes

Dr. Marco Cavaglia received funding of \$348,181 from NSF, “Improving Data Quality of Advanced LIGO Gravitational-Wave Searches.

Dr. Marco Cavaglia (shared with the LIGO collaboration) was awarded the 2019 Current Achievement Trophy from Smithsonian National Air and Space Museum.

Dr. Marco Cavaglia spearheaded the creation of the “Institute for Multi-messenger Astrophysics and Cosmology” at S&T.

Dr. Marco Cavaglia presented 8 invited talks: at the Annual spring meeting of the Missouri Space Grant Consortium, S&T Astronomical Society: Gravitational waves, October 2019 Dean’s Leadership Council Meeting, Missouri State University-Springfield, Space Week, and We Dig Research at S&T.

Dr. Marco Cavaglia made 3 media appearances: S&T news online and Phelps County Focus on Missouri S&T joins LIGO Scientific Collaboration and world-class astrophysics research; S&T news online on Missouri S&T joins LIGO and Virgo’s newest research on neutron star smash-ups; Radio broadcast and online podcast on NPR STEM spots: Untangling the Mysteries of the Universe using LIGO.

Dr. Ulrich Jentschura received funding of \$150,000 from the Templeton Foundation for Postdoctoral Support.

Dr. Michael Schulz published a book “Ion-Atom Collisions, The Few-Body Problem in Dynamic Systems”. De Gruyter, Berlin, 2019, ISBN: 978-3-11-057942-0.

Dr. Michael Schulz presented 3 invited talks: at ICPEAC in Deauville, France, the most important conference in collision physics, and at the International conferences in Guildford, United Kingdom and College Station, TX.

Dr. Michael Schulz was an invited Visiting Professor at the Institute of Modern Physics of the Chinese Academy of Sciences, Lanzhou in the summer of 2019.

Dr. Michael Schulz became a member of the editorial board of “Atoms” in 2019.

Dr. Thomas Vojta gave invited talks at the International Workshop on Quantum Ferromagnetism and Related Phenomena in Dresden, Germany, and at the International Conference on Frontiers of Quantum and Mesoscopic Thermodynamics in Prague, Czechia.

Drs. Thomas and Agnes Vojta represented the physics department at the “It’s Math and Science Career Night” at East Central College.

Physics faculty Drs. Jim Musser, Daniel Fischer, Alex Chernatynskiy and Dan Waddill along with Joel Peacher helped make this year’s Science Olympiad a huge success.

Alexey Yamilov publishes in Nature Photonics



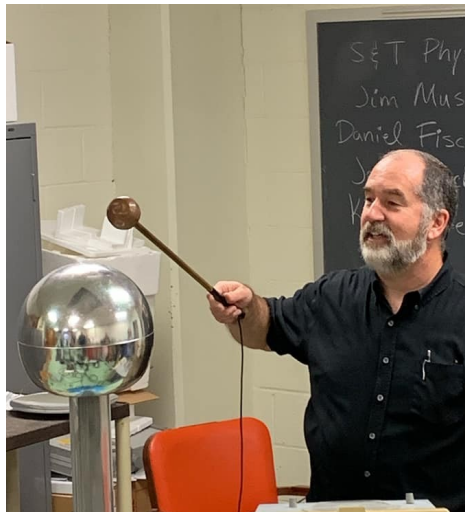
Alexey Yamilov’s paper on a new property of light was published in prestigious Nature Photonics. Alexey together with three applied physics researchers from Yale University, found a technique to focus the typical spreading of light in diffuse media, like biological tissue, with results that could make improvements in imaging and optogenetics.

Agnes Vojta publishes poetry

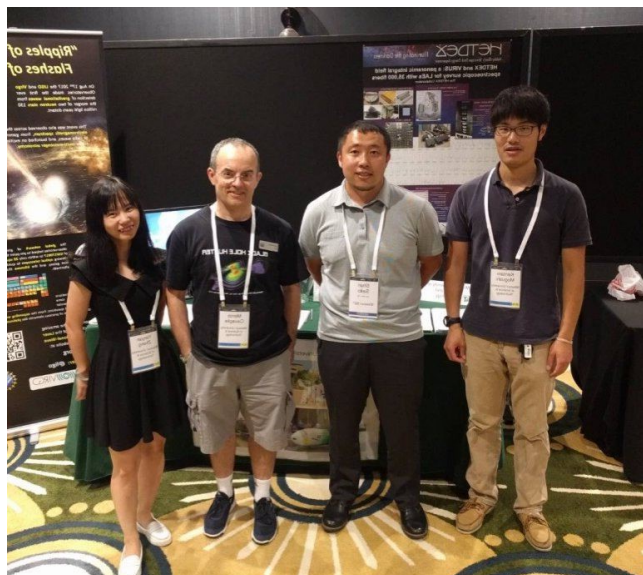


Agnes Vojta’s first collection of poetry “Porous Land” was published in March 2019 by *Spartan Press*.

Outreach



Physics faculty are engaged in outreach to area schools and colleges. Pictured here are **Daniel Fischer**, **Jim Musser**, and **Joel Peacher** performing physics demonstrations for second graders.



Physics faculty **Marco Cavaglia** and **Shun Saito** and graduate students **Kentaro Mogushi** and **Yanyan Zheng** represented the S&T physics program at the grad school fair of the 234th meeting of the American Astronomical Society in St. Louis.



Physics graduate student **Nish de Silva** has been volunteering as a youth tennis instructor with the Optimist Club of Rolla. The Rolla program was awarded the 2019 Community Service Excellence Award by the USTA Missouri District's Awards Committee. Thank you, Nish!

Physics Department

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So What's News with You?

We hope you enjoyed this year's edition of **Matter 'n Motion**. We would like to know what is happening in the lives of our alumni to include in next year's newsletter. Send us stories, pictures and musings by mail to the **Physics Department, Missouri University of Science and Technology, 1315 N. Pine St., Rolla MO 65409-0640** or e-mail at **physics@mst.edu**. Thanks for keeping in touch. It's always good to hear from old friends. If you would like to contact us, you can reach us at (573)341-4781. You might also be interested in checking out our web page, <http://physics.mst.edu> and our facebook page *SandT Physics*.

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