LSU

Department of Physics & Astronomy

2017-2018

Annual NEWSLETTER

LSU Research Contributes to Two Physics World 2017 Breakthroughs of the Year

Physics World has announced that the Physics World 2017 Breakthrough of the Year goes to "the international team of astronomers and astrophysicists that ushered in a new era of astronomy by making the first ever multi-messenger observation involving gravitational waves." On Aug. 17, the discovery was made using the U.S.-based Laser Interferometer Gravitational-Wave Observatory, or LIGO; the Europe-based Virgo detector; and some 70 ground and space-based instruments. "This first observation of gravitational waves caused by two neutron stars colliding is a breakthrough for the field, the first detection of signals from black holes started gravitational-wave astronomy, but this detection started multi-messenger astronomy," said Gabriela González, Department of Physics & Astronomy professor and former international spokesperson for the 1,000-member LIGO Scientific Collaboration. "We are very honored to receive this recognition to not only a milestone discovery that has inspired the scientific community and the general public, but also to the teamwork that made it possible."

These coordinated observations have already provided a vast amount of information about what happens when neutron stars collide in what is called a "kilonova." The observations have yielded important clues about how heavy elements, such as gold, are produced in the universe. The ability to measure both gravitational waves and visible light from neutron-star mergers has also given a new and independent way of measuring the expansion rate of the universe. In addition, the observation settles a long-standing debate about the origin of short, high-energy, gamma-ray bursts.

"The staff of the LIGO Livingston Observatory, together with students and scholars in residence, and including many from LSU, have worked hard for many years to operate and improve the detector, making it capable of participating in this discovery," said Joe Giaime, head of LIGO Livingston and LSU professor of physics and astronomy. "The gravitational-wave and other astronomical observations reported mark LIGO's full involvement in multi-messenger astronomy."

Another LSU research project was recognized by Physics World's top 10 breakthroughs of the year: Ultra-high-energy cosmic rays have extra-galactic origins. In 2017, the Pierre Auger Collaboration reported observational evidence demonstrating that cosmic rays with energies a million times greater than that of the protons accelerated in the Large Hadron Collider come from much fartther away than our galaxy.

Professor Jim Matthews works with more than 350 scientists from 17 countries on the world's leading science project for the exploration of the highest energy cosmic rays, the Pierre Auger Observatory. The collaboration measures the paths of the Universe's most energetic particles, bringing new insights into the origin and nature of this intergalactic phenomenon. Professor Matthews is a former co-spokesperson of the Auger Collaboration.

Inside this Issue

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Chair's Corner *John DiTusa, Department of Physics & Astronomy*

Louisianans love to celebrate and we had plenty to celebrate in the Department of Physics & Astronomy at LSU this past year. These celebrations accentuated the 2017/18 academic year and we are delighted to share a synopsis of these events with you in our yearly newsletter. As chair of the department, it has been enormous fun participating in these recognitions of the achievements of our students, faculty, and alumni.

We began the fall semester with a celebration of the solar eclipse with an event that filled the LSU Parade Ground with students, faculty, and staff looking up at the sun through dark eclipse glasses. At the same time, Professors Greg Guzik and Dana Browne led a team in the launching of weather balloons to make measurements and to record video at Southern Illinois University football stadium in the path of totality. We took advantage of the interest in this event to reach out to K-12 teachers in creating a 'Solar Eclipse Teachers Toolkit,' which provided tips and tools for teaching and viewing the eclipse safely that had more than 13,000 views. The fall semester also saw LSU host a meeting of the International Astronomical Union that was held concurrently with the announcement of the discovery of two colliding neutron stars by the LIGO collaboration. This was perhaps the first real example of a multi-messenger detection as the gravity wave signal was quickly confirmed via gamma ray observatories and light measurements at lower frequencies. We were proud of the work done by the LIGO collaboration, including Professor Joe Giaime who led a very large and diverse team in analyzing and reporting this discovery. In fact, this discovery along with the report by the Pierre Auger Collaboration, led by Professor James Matthews, that cosmic rays with extremely high energies come from much farther away than our galaxy, were both named 2017 top 10 Physics World breakthroughs of the year!

The announcement in October that the 2017 Nobel Prize was awarded for the observation of gravitational waves by LIGO added to the celebratory mood surrounding the department.

The celebrations kept up in the spring semester, which saw LSU P&A host the International Conference on Quantum Communication, Measurement and Computing (QCMC) recognizing the prominence of LSU researchers in this field. Added to that, we reveled in Boyd Professor Robert O'Connell's induction into the College of Science Hall of Distinction and in the accomplishments of Professor Ward Plummer who was named as an International Science and Technology Cooperative Award winner by China's President Jinping Xi, as well as the 49th Boyd Professor. As the semester closed, we were honored to have 2017 Nobel Prize in Physics Laureate Rainer Weiss give the College of Science commencement speech in May and to have him join our students and faculty for a special coffee chat where he talked about how teaching students can lead to new ideas and discoveries.

Besides relating some of the highlights that we have been celebrating, I also wanted to recognize the recent retirement of Astronomy Professor Bradley Schaefer. It was a complete surprise when Brad visited my office to give me the news that he had decided to retire from the faculty. He will, of course, remain as active and as passionate about astronomy as he always has been, but now as an emeritus professor. He tells me he has plans to travel the globe while continuing to publish his discoveries.

Finally, I want to encourage all of our alumni to write to us with information about your current activities and interests. We are always curious about what our former students have been doing, what they have accomplished, and what they have planned. As LSU faculty members, we are able to spend time with students for a short period of only a few years and we are often left wondering what became of them after leaving our university. I invite you to take the time to fill us in on your recent activities and career paths.

LIGO Continued from page 1

"LSU has been an important part of this large, long-running international effort for more than 20 years with the Pierre Auger Observatory in western Argentina, including involvement of four LSU Ph.D. students," Matthews said. "We have not yet identified the specific sources of these most energetic particles in the cosmos, but this work is a huge step forward in that hunt."

Crawfish Boil

The annual department crawfish boil, held on the Friday of finals week, featured 400 pounds of crawfish, 50 pounds of potatoes, and 150 pieces of corn. Almost 100 people socialized outside of Nicholson Hall for the event. To view a photo gallery of the event, visit http://bit.ly/2NufVUn

Faculty and students enjoy 400 pounds of crawfish in the LSU quad.

Awards and Graduates

2018 University Distinguished Faculty Awards

Robert Hynes – LSU Alumni Association Faculty Excellence Award
Ivan Agullo – LSU Alumni Association Rising Faculty Research Award
Dalgis Mesa – LSU Chapter of the Honor Society of Phi Kappa Phi for a Non-tenured Faculty Award

Department of Physics & Astronomy Awards

Student Scholarships:
Katherine Dugas – Willie Belle Shockley Scholarship
Rebecca DiTusa – Annie and Willie Austin Scholarship
Margaret Carey – Tiger Athletic Foundation Scholarship
Jonah Hoffman – Tiger Athletic Foundation Scholarship
Vaibhav "Javi" Rajora – Tiger Athletic Foundation Scholarship
Kyle Hamer – R. Greg Hussey Scholarship
Justin Champagne – American Legion A.R. Choppin Scholarship
Shelby Myers – American Legion A.R. Choppin Scholarship

Departmental Awards

Undergraduate Research Awards:
Chris Abadie - working with Mette Gaarde
Colin Kersker - working with Phil Sprunger
Brad Landry - working with Greg Guzik
Richard Tuminello - working with Manos Chatzopoulos
Undergraduate Learning Assistant - Derek Walker

Fall 2017 Graduates
B.S.: Jasmine Jones, Harvey Shows
M.S.: Christopher Buchanan, Steven Dorscher, Safura Sharifi
Ph.D.: Mojammel Khan, Amber Lauer, Haoyu Qi

Spring 2018 Graduates
B.S.: Christopher Abadie, Rory Bentley, Zachary Bradshaw, Megan Chesal, Robert Cottingham, Anthony Ficklin, Ivan Hidrovo, Margarite LaBorde, Brad Landry, Benjamin Lane, John Paul Marceaux, Khang Pham, Richard Tuminello, Derek Walker, Natalie Zimmer
M.S.: John Doiron, Zachary Gryb
Ph.D.: Noah Davis, Paul Maggi, Zhihao Xiao

Summer 2018 Graduates
Ph.D.: John Chapman, Jonathan Cripe, Joseph Steiner

(L-to-R) back row: John Paul Marceaux, Kip Matthews, Derek Walker, Robert Hynes, and Department Chair John DiTusa. (L-to-R) front row: Margarite LaBorde, Tabetha Boyajian, and Chloe DiTusa

College of Science Awards

Margarite LaBorde – College of Science Dean's Award
Derek Walker – College of Science Outstanding Senior
Chloe DiTusa – Science Residential College Distinguished Student Award Honorable Mention
Rory Bentley – Keen-Morris Award
John Paul Marceaux– Keen-Morris Award
Tabetha Boyajian – Non-Tenured Faculty Research Award
Jonathan Dowling – Graduate Teaching Award
Robert Hynes – Tiger Athletic Foundation Undergraduate Teaching Award
Kenneth "Kip" Matthews – Dr. Marion D. Socolofsky Award

Graduate student Anthony Brady plays Twister.

Physics Block Party

ANNUAL KICK-OFF WELCOME EVENT FOR STUDENTS AND FACULTY

Graduate Versus Undergraduate Challenge
Undergraduates: Rory Bentley, Benjamin Box, Justin Champagne, & Rob Cottingham
Graduates: Noah Davis, Arshag Ozian, Anthony Brady, & Siddharth Soni
Judges: Prof. Jim Matthews, & Prof. Ravi Rau

The Five Challenges
1.) Physics Opinions was won by the graduate students with an end score of 2:1.
2.) Physics Charades was won by the graduate students for getting first with the phrase "Professor Matthews' Goatee."
3.) Mad Scientist Laugh Competition was won by the undergraduates, with Justin Champagne's marvelous depiction of 'genius' in his Mad Scientist Laugh; graduate Student Noah Davis also performed a great depiction of 'evil' with his award-deserving laugh.
4.) Physics Pictionary was won by the graduate students for their remarkably fast rendition of "Big Bang Theory."
5.) Physics Brainteasers was won by the undergraduates with a score of 2:1.

Winners: graduate students, by a score of 3:2
Prizes: Einstein doll, Einstein T-shirt, Einstein book, and Dr. Who electronic screwdriver

Ping Pong Tournament
1st place: Professors Lai Chan and Hwang Lee
2nd place: Graduate student Siddhartha Das and postdoc Guillermo Valdes

LSU Hosts International Researchers

International Astronomical Union 2017
Symposium Gravitational Wave Astrophysics: Early Results from GW Searches and Electromagnetic Counterparts

October 16 - 19, 2017, the 2017 IAU Symposium in Baton Rouge, La., brought together astrophysicists and gravitational-wave researchers to compare past, present and the future of observations of gravitational-wave sources, and share the excitement of a new field in astronomy.

Gravitational waves were predicted 100 years ago by Einstein as part of his general theory of relativity. With the development of new and more sensitive detectors, LIGO has now made the first-ever observations of gravitational waves arriving on Earth from space in 2015.

This symposium brought to light the latest results available in gravitational-wave astronomy, progress in multi-messenger astronomy, and the inferences that can be made from joint observations, to open a new window to the cosmos.

Unknown to organizers and participants at the time of registration, the first day of the conference was also the day the discovery of the merger of neutron stars had been observed with LIGO and Virgo detectors, and electromagnetic counterparts in all wavelengths of light had been found. The press conference was streamed live for participants in Baton Rouge, interlaced with talks that became very relevant to the discovery.

Gabriela González said, “The topic of the meeting was very interesting when we proposed it, but it became really exciting once the latest discovery was announced - some attendants said it was the best astronomy meeting they had attended!”

The International Conference on Quantum Communication, Measurement and Computing (QCMC)

QCMC, established in 1990 to encourage and bring together scientists and engineers working in the interdisciplinary field of quantum information science and technology, was held March 12-16, 2018, at LSU.

Organized by the LSU Quantum Science and Technologies Group (QST), the 2018 QCMC conference focused on research areas of nano photonic quantum information and processing.

“It is likely the largest conference in the world focused on quantum technologies,” said Jonathan P. Dowling, principal organizer of QCMC 2018, co-director, Hearne Institute for Theoretical Physics, Hearne Chair Professor of Theoretical Physics, LSU Department of Physics & Astronomy. “This year’s conference had a special emphasis on optical quantum computing and using quantum methods to improve the sensitivity of LIGO.”

The Hearne Eminent Lecture was held on Friday, March 16. This special lecture was open to the public and featured Dr. Carlton M. Caves, distinguished professor in the Department of Physics & Astronomy, and director at the Center for Quantum Information and Control, University of New Mexico. Caves illustrated how weird the atomic-scale world really is and indicated how we might take advantage of that weirdness using new technologies for manipulating atomic scale systems.

Scope of the Conference:

1. Cryptography and Communications
2. Measurement and Metrology
3. Computing and Information Theory
4. Implementations
5. Quantum Simulations
6. Quantum Control
7. Foundations of Quantum Physics

Carlton M. Caves, Distiguished Professor, University of New Mexico with LSU Professor Jonathan P. Dowling, principal organizer QCMC 2018

LSU Society of Physics Students

(L-to-R); Rory Bentley, Benjamin Box, Margarite LaBorde, Zachary Bradshaw, Benjamin Lane, Derek Walker, and Richard Tuminello

The LSU Society of Physics Students (SPS) Chapter began the 2017 school year with the annual Physics Block Party where SPS member Rebecca DiTusa served liquid nitrogen ice cream to the attendees. We also held our first chapter meeting in August, where the freshmen were encouraged to get involved in SPS.

SPS Vice President Rory Bentley presented at the Baton Rouge Mini Maker Faire in October.

We held our department-wide Nerf War in October as well, where Dr. Juana Moreno and Dr. Bradley Schaefer served as team captains. It was definitely one of our favorite events of the semester!

At our final SPS Chapter Meeting, Dr. Gabriela González presented on LIGO and the discovery of gravitational waves. It was very interesting and awesome to be able to ask so many questions in such a small setting.

In January, SPS secretary Margaret Carey and SPS members Katherine Dugas and Rebecca DiTusa traveled to Jacksonville, FL for the APS Conference for Undergraduate Women in Physics (CUWiP), hosted by the University of North Florida.

In February, SPS members Katherine Dugas and Robert Cottingham helped Dr. Juana Moreno present different physics demonstrations at Nanodays held at Highland Road Park Observatory. In March SPS President Margarite LaBorde and Secretary Margaret Carey, worked the Physics table at the College of Science's Girls Night at the Museum. This event helped encourage girls in grades 4–6 to continue their interest in the STEM fields.

Also in March, a few SPS members travelled to the SPS Zone Meeting at Ole Miss in Oxford, Miss., where they helped in recruiting future graduate students to LSU.

In late March, the LSU SPS Chapter hosted the Johns Hopkins University SPS Chapter on their spring break trip to Louisiana, where they were visiting the LIGO facilities. During one night of their trip, we played Laser Tag. Don't worry; we were the winners!

In early April, during LSU's annual Spring Invitational event, high achieving high schools seniors were invited to schedule classes for the fall 2018 semester, the physics department hosted a table at the information fair, and SPS members answered questions for the new students. We then took the students planning on majoring in physics on a tour of Dr. Catherine Deibel's lab.

At the end of April, the LSU SPS Chapter concluded the school year by hosting the Sigma Pi Sigma Induction and the "Physics Prom" that followed. Twelve students were inducted, and the "Prom" was a hit!

Margaret Carey demonstrates the physics of balance at 'Girls Night at the Museum'

Alumni Spotlight: Leslie Austin

Alumna Leslie Austin, BS Physics 2000

If anyone is a life-long learner, it's LSU physics alumna Leslie Austin. After earning her B.S. in Physics in 2000, she worked for a year as a research associate for the Department of Physics & Astronomy, traveling to Antarctica as part of the Advanced Thin Ionization Calorimeter (ATIC) project. She later went to law school at the LSU Paul M. Hebert Law Center, and then began a career in human resources (HR) with a focus on labor and employment law compliance. "I thought about obtaining an MBA, but chose law school because I was always interested in the legal system, I minored in English, and I thought patent law might be a good fit with science backgrounds." Leslie also worked as Chief Operating Officer for HR Solutions. In her spare time, she enjoys indoor and outdoor rock climbing. Today, Austin is serving as director of human resources, where she is responsible for leading and executing all human resource initiatives for Emergent Method as well as the firm's new division, Emergent Talent, which was launched earlier this year to support the firm's clients on large-scale project staffing needs.

Leslie: "I don't do science regularly anymore, but I try to read about and support science on some level as often as I can. I am also married to a full-time scientist (herpetologist) and love hearing and learning about his research. I was super excited in the last few years to read about LSU's involvement in the discovery of gravitational waves. I was also really excited that my husband (Chris Austin), an LSU scientist, discovered the world's smallest vertebrate." (Read more about Chris Austin's discovery at bit.ly/smallfrog).

What advice do you have for students following your career path?

Leslie: "For anyone studying physics, buckle down and study hard. It is very rewarding, but doesn't get 'easier.' I would also highly recommend getting involved in a research program and working in a lab. The experience is fantastic on a number of levels."

Who is your science role model?

Leslie: "There are way too many amazing scientists for me to pick just one, so I am calling 'unfair question' on this one. For a more local response though, I really admire LSU physics professors John Wefel and Greg Guzik, whom I worked for. They provided a lot of experience on a great research project to undergraduates and were patient and nurtured our scientific minds."

What advice would you give new college graduates when entering the job market?

Leslie: "Research the job and understand what the day-to-day entails, talk to people who actually do the job, investigate available salary ranges, and know the necessary education and credentials the employer requires. Apply for lots of jobs, because it is very rare to land the first job you interview for. Also research interview questions and rehearse your responses. Role play the interview with a friend. Don't ask, but be prepared to address salary and benefit requirements. Locate the place you are interviewing beforehand and don't be late. Send a follow up thank you note after the interview. Above all, don't get discouraged, work hard, keep an open mind and take on new responsibilities."

We invite alumni to talk with our current students and share your LSU experience and career path.
Please contact Mimi LaValle mlavall@lsu.edu or call (225) 578-1194.

Landolt Astronomical Observatory

Landolt Astronomical Observatory

Once a month, on the Saturday nearest the First Quarter Moon, with a "rain date" on the next day (Sunday), the general public is invited to observe the sky. Admission is free.

Built in the late 1930s, the Landolt Observatory featured many spectacular viewings this past year, including:

- Saturn, Jupiter, and the crescent
- Saturn, Ring Nebula, Gibbous Moon
- Saturn and the Quarter Moon
- Full moon and Star Party

For more information, visit www.phys.lsu.edu and click on LAO Public Observing Night.

Follow us on Facebook, Twitter, and LinkedIn to keep up to date on the latest news and events!

Saturday Science

Among the topics covered at the monthly Saturday Science events:

"Systems Thinking and Ecosystem Design: Applications to Restoring Coastal Louisiana" Robert R. Twilley

"Solar Eclipses that Changed History" Bradley Schaefer

"Hunting Microbes upon the Coastal Sea" Cameron Thrash

"Bayou Corne: Bubbles and Trouble" Carol Wicks

"The Underwater Forest: a Time Capsule from the Last Ice Age" Kristine Delong

"Exercise and the Role of Mitochondria in Health & Disease" Nick Broskey

"Using Technology to Understand Mental Illness" Alex Cohen

"A Journey into the World of Peptidomimetic Polymers" Donghui Zhang

Visit campus on the third Saturday of the month to share in the wonder of science. Visit www.phys.lsu.edu for a schedule of Saturday Science events.

Discovering the Atmosphere at HRPO

The Highland Road Park Observatory has remained a popular public destination in Baton Rouge. Several LSU professors and students operate the telescope on public nights. Public lectures from LSU Physics & Astronomy faculty, postdocs, and students covered a diverse array of topics including: "The search for exraterrestrial intelligence" (Robert Parks), "Natural Sky Conference" (LSU P&A students and professors), "The Universe with X-ray Vision" (Rob Hynes), "The Star of Bethlehem" (Brad Schaefer), "Einstein, Gravitational Waves and Black Holes" (Gabriela González), "Star Clusters" (Rory Bentley), and "Tabby's Star Update" (Tyler Ellis). The MARS truck and Society of Physics students also participate in outreach events, such as Astronomy Day, to engage the public to discover the world of physics and astronomy.

In 2017, HRPO celebrated it's 20-year anniversary. Over the years LSU has continued to invest in the HRPO technology including a second large telescope, a radio telescope, a radio station, a bank of workstations, multiple portable telescopes, a portable planetarium, a digital portable planetarium, a high speed network, two major upgrades of the telescope control systems and various audio/visual equipment.

NanoDays and LASM Engineering Day

Nanoscale structures, such as a single strand of DNA or gold nanoparticles in church windows, have existed in nature and have been used long before scientists began devoting their studies to them. Recently, this innovative field of study has contributed to numerous discoveries, such as advanced applications in energy, information storage and medicine. Because of its promising future, organizations across the country celebrate NanoDays, a nationwide festival of programs about nanoscale science and engineering.

For the ninth consecutive year, LSU hosted NanoDays at the Highland Road Park Observatory, or HRPO, on Saturday, Feb. 24, followed by a presentation from Professor David Young, "Alternative Energy! Using nanotechnology to improve the performance of thermoelectric materials." The free family-friendly event was open to the public and featured several hands-on activities for guests of all ages, including:

- Learn first-hand how a Scanning Probe Microscope helps scientists explore the nanoworld
- See how nanomaterials are used to make stain-free clothes
- Play with liquid crystals and magnets
- Make an Oobleck, a liquid with both liquid and solid properties

In addition, the observatory had a solar viewing session through HRPO's Coronado Solar Max II. Lunar viewing took place showing a magnified daytime waxing crescent Moon, and Venus was viewed. NanoDays sponsors included the LSU Department of Physics & Astronomy, the Center for Computation & Technology and the Society of Physics Students – LSU Chapter.

Read more about LSU NanoDays at the Highland Road Observatory, visit http://hrpo.lsu.edu/programs/nano.html.

Astronomy on Tap at 7 P.M. in The Varsity Theatre

The astronomy group has started a new activity open to the public, Astronomy on Tap. A monthly series of public talks given by the LSU faculty and students to reveal how they can explore the universe. AoT is hosted at the Varsity Theatre in Baton Rouge. Each free event features engaging science presentations on topics ranging from planets to black holes to galaxies to reveal the beginning of the Universe.

March 13, 2018
Dr. Tabby Boyajian - Alien Zombie Comets
Dr. Geoff Clayton - Is the Earth flat?

April 12, 2018
Dr. Gabriela Gonzalez - Black Holes
Emily Safron - Science of Interstellar

May 16, 2018
Dr. Manos Chatzopoulous - Space Bangs
Dr. Ivan Agullo - Beyond the Big Bang

Jun 13, 2018
Rory Bentley - Astronomer's Guide to the Galaxy
Alison Dreyfuss - Secret Lives of Scientists

July 18, 2018
Dr. Kenneth Matthews - Radiation and Space Travel
Kelsie Krafton - Large and in Charge: The Sun

LIGO Gravitational Wave Detection Wins Nobel Prize

LSU FACULTY AND STUDENTS CRITICAL IN GROUNDBREAKING DISCOVERY

The 2017 Nobel Prize in Physics was awarded to the pioneering leaders of the Laser Interferometer Gravitational-wave Observatory, or LIGO, for the first detection of gravitational waves. The detection confirmed a major prediction of Albert Einstein's 1915 general theory of relativity and opened an unprecedented new window onto the cosmos.

Einstein predicted more than 100 years ago that gravitational waves, or ripples in the fabric of spacetime, would arrive at Earth from a cataclysmic event in the distant universe. The gravitational waves from two black holes colliding over a billion light years away were detected on Sept. 14, 2015, at 4:51 a.m. CST by the twin LIGO detectors, located in Livingston, La., and Hanford, Wash. The LIGO observatories are funded by the National Science Foundation, or NSF.

LSU Adjunct Professor and MIT Professor Emeritus Rainer Weiss and California Institute of Technology professor emeriti Kip Thorne and Barry Barish have been awarded this year's Nobel Prize in Physics. One-half of the prize was awarded to Weiss and the other half is shared by Thorne and Barish. Weiss and Thorne are co-founders of the LIGO/VIRGO Collaboration. Barish led the final design stage, construction and commissioning of the LIGO interferometers in Livingston, La. and Hanford, Wash. The Laser Interferometer Gravitational-wave Observatory, or LIGO, has made a third detection of gravitational waves, which are ripples in space and time, demonstrating that a new window in astronomy has been firmly opened. As was the case with the first two detections, the waves were generated when two black holes collided to form a larger black hole.

The LIGO Livingston observatory is located on LSU property, and LSU faculty, students and research staff are major contributors to the international LIGO Scientific Collaboration, or LSC. Gabriela González, LSU professor of physics and astronomy, is the former elected spokesperson, who led the LSC during the initial detection. Together with other leaders and founders of the LIGO effort, González made the official statements about the historic detection on Thursday, Feb. 11, 2016 at the National Press Club in Washington, D.C., before gathered national science press.

"It was an honor to be the LSC spokesperson during the momentous time of discovery," González said. "We are thrilled for Rai, Kip and Barry to be named Nobel Laureates and are proud of the work done by the many people over many decades in the LSC to support and continue their vision."

LSU's investment in gravitational-wave detection spans more than four decades, and is among the longest of the institutions contributing to the present discovery. LSU faculty, students and scholars have had leading roles in the development of several generations of gravitational wave detectors, in their commissioning and operation as well as the collaborations formed. This recognition in the Nobel Prize in Physics is in part an outcome of LSU's long-term vision and commitment to high-risk, high-potential gain scientific research.

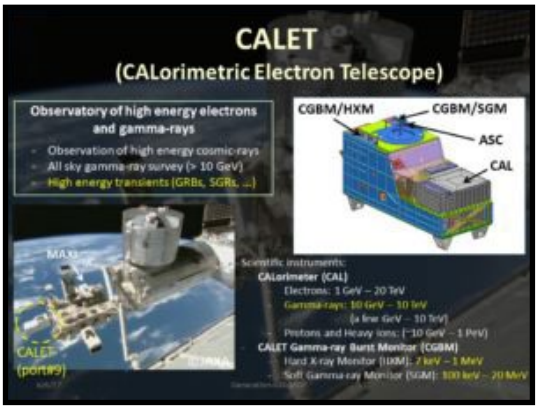
More than 1,000 scientists from universities around the U.S. and other countries conduct LIGO research as members of the LSC. More than 90 universities and research institutes in the LSC develop detector technology and analyze data; about 250 students are strong contributing members of the collaboration.

LSU's pioneering role in this science began in 1970 with the arrival of William Hamilton, now professor emeritus, who along with Physics Professor Warren Johnson, built and operated previous-generation cryogenic bar gravitational wave detectors on campus for many years. Now, LSU Department of Physics & Astronomy Associate Professor Thomas Corbitt focuses his research on advanced quantum metrology techniques for a future detector. This represents more than 45 years of cutting-edge research, with state and institutional commitment, and long-standing multimillion dollar support from NSF producing educational opportunities for students and postdoctoral researchers, several of whom have gone on to professorial appointments around the world.

LSU's campus is located 25 miles from LIGO Livingston in Baton Rouge. LSU has about 1,400 faculty; 31,000 students; and is classified by the Carnegie Foundation as "Doctoral/Research Universities-Extensive." LSU is the only research university in the U.S. located close enough for students and faculty to engage in daily interactions with a LIGO observatory. LSU faculty and administrators, including Chancellor Emeritus James Wharton, led the effort to bring LIGO to Louisiana, and the university owns the land on which LIGO is operated.

"We are very proud of the contributions of the LSU group to the detections of gravitational waves with LIGO detectors - this is just the beginning of a new, exciting era," said González.

CALET Makes First Direct Measurements of High Energy Electrons in Space



The CALET Cosmic Ray experiment, led by Professor Shoji Torii from Waseda University in Japan, along with collaborators from LSU and other researchers in the U.S. and abroad, have successfully carried out the high-precision measurement of cosmic-ray electron spectrum up to 3 tera electron volts (TeV) by using the CALorimetric Electron Telescope (CALET) on the Japanese Experimental Module, the Exposed Facility on the International Space Station (ISS). This experiment is the first to make direct measurements of such high energy electrons in space.

CALET was installed on the ISS in August 2015 and has been accumulating scientific data since October 2015 with a goal of five years of operation. CALET is the first Japanese-led space-based mission dedicated to cosmic ray observations. The CALET team published its first results in Physical Review Letters November 1 (O. Ariadne et al., Physical Review Letters 119, 181101, 2017).

The CALET experiment is funded by the Japanese Space Agency (JAXA), the Italian Space Agency (ASI), and NASA. John Wefel, professor emeritus in LSU's Department of Physics & Astronomy, serves as the spokesperson for the U.S. CALET team, which includes LSU (lead U.S. institution), NASA Goddard Space Flight Center, Washington University, and the University of Denver. Other LSU researchers working with the project are PhD student Nick Cannady, research associates Doug Granger and Amir Javaid, LSU alumnus Anthony Ficklin, and professors of physics and astronomy Greg Guzik and Mike Cherry.

"High energy electrons are difficult to measure, but important because they potentially provide information about nearby astrophysical sources of high energy radiation and/or dark matter," said Cherry. "The initial results provide a hint of anticipated structure in the high energy spectrum, which may indicate the presence of a nearby source of high energy particles like a pulsar or the annihilation of dark matter."

The origin and acceleration of cosmic rays are still one of the cosmic mysteries, and cosmic-ray electrons are one of the most important targets of high-energy cosmic ray research. However, in order to observe high-energy electrons, it is required to have (1) high-precision energy measurement of each cosmic ray particle, (2) sensitivity to detect the very rare electron flux, and (3) the capability to identify electrons buried under the over 1,000 times higher flux of cosmic ray protons. Thus the measurement of electrons above 1 TeV has been a difficult goal to achieve. The calorimeter of CALET, with its unique and crucial capabilities, enables scientists to perform accurate measurement of cosmic-ray electrons into the TeV region thanks to the long-term exposure available on the ISS.

This measurement demonstrates the ability of CALET to do a precise direct measurement of electrons above 1 TeV that was difficult for past experiments. With five years of observations, CALET will achieve nearly six times higher statistics compared to this first result, and will allow for reduction of the systematic uncertainties, including that from the detector response. The goal of the project is to push the energy limit to 20 TeV and to obtain the precise energy spectrum, hopefully making it possible to demonstrate definitively the presence of nearby astrophysical cosmic ray sources and/or to reveal the nature of dark matter.

LSU Physicist's Research Reveals that the Most Energetic Particles in the Cosmos Originated from outside our Galaxy

Jim Matthews and Rishi Meyhandon

Professor Jim Matthews works with more than 350 scientists from 17 countries on the world's leading science project for the exploration of the highest energy cosmic rays, the Pierre Auger Observatory. The collaboration measures the paths of the Universe's most energetic particles, bringing new insights into the origin and nature of this intergalactic phenomenon. Prof. Matthews is a former co-spokesperson of the Auger Collaboration.

Since the existence of cosmic rays with individual energies of several Joules was first established in the 1960s, speculation has raged as to whether such particles are created in our own galaxy or in more distant objects. The 50 year-old mystery has been solved using cosmic particles of mean energy of 2 Joules recorded with the largest cosmic-ray observatory ever built, the Pierre Auger Observatory in Argentina. It is found that the rate of arrival of cosmic rays at these high energies is ~6% greater from one half of the sky than from the opposite one, with the excess pointing well away from the direction of the center of our own Galaxy.

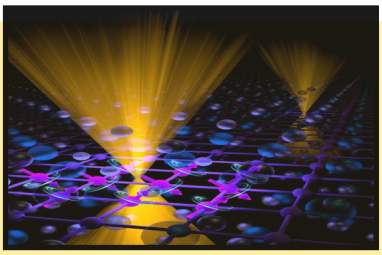
Cosmic ray particles are atomic nuclei ranging from hydrogen to iron. Above 2 Joules the rate of their arrival at the top of the atmosphere is only about 1 per square kilometer per year. Such rare particles are detectable because they create showers of electrons, photons and muons when they collide with nuclei in our atmosphere. These showers spread out, sweeping through the atmosphere at the speed of light in a disc-like structure, similar to a dinner-plate several kilometers in diameter. The showers contain over 10 billion particles. At the Auger Observatory they are detected through the Cherenkov light they produce in some of the 1,600 detectors each containing 12 tons of water. These detectors are spread over 3,000 km^2 of Western Argentina, an area the size of Rhode Island. The times of arrival of the particles at the detectors, measured with GPS receivers, are used to find the arrival directions of the cosmic rays to within about one degree.

By studying the distribution of the arrival directions of more than 30,000 cosmic particles, the Auger Collaboration has discovered an anisotropy, significant at 5.2 standard deviations, in a direction not associated with the center of our own galaxy. Although this discovery clearly indicates an extragalactic origin for the particles, individual sources have yet to be pinned down. The direction of the overall excess is a broad area of sky since even particles as energetic as these are deflected by ten or more degrees in the magnetic field of our galaxy. The observed direction of excess, however, cannot be associated with putative sources in our galaxy for any realistic configuration of the galactic magnetic field.

The highest energy cosmic rays in this study have the kinetic energy of a well-struck tennis ball. As the deflections of such particles are expected to be smaller than average, the arrival directions should point closer to their places of origin. But these cosmic rays are the most rare, so further collecting is underway in order to try to identify particular extragalactic objects as their sources. Knowledge of which particular nuclei comprise the cosmic ray particles will aid this identification and work on this problem is targeted in the upgrade of the Auger Observatory to be completed in 2019.

Scientists Discover New Magnet with Nearly Massless Charge Carriers

Advances in modern electronics has demanded the requisite hardware, transistors, to be smaller in each new iteration. Recent progress in nanotechnology has reduced the size of silicon transistors down to the order of 10 nanometers. However, for such small transistors, other physical effects set in, which limit their functionality. For example, the power consumption and heat production in these devices is creating significant problems for device design. Therefore, novel quantum materials and device concepts are required to develop a new generation of energy-saving information technology. The recent discoveries of topological materials — a new class of relativistic quantum materials — hold great promise for use in energy saving electronics.



The magnetic and electronic states of newly discovered $Sr_{1-y}Mn_{1-z}Sb_2$ are depicted by spheres representing the positions of the atoms in the crystal structure of this material with strontium (Sr) depicted by the small violet spheres; antimony (Sb) by the large blue spheres; and manganese (Mn) by the purple spheres. The arrows attached to the Mn atoms represent the magnetic moments of these atoms which align in the orientation shown to give the magnetic properties of $Sr_{1-y}Mn_{1-z}Sb_2$. Also depicted are the energy and momentum states of the conducting electrons, or charge carriers, which have a Dirac-like dispersion relation shown in gold.

Researchers in the Louisiana Consortium for Neutron Scattering, or LaCNS, led by LSU Department of Physics & Astronomy Chair and Professor John F. DiTusa and Tulane University Professor Zhiqiang Mao, with collaborators at Oak Ridge National Lab, the National High Magnetic Field Laboratory, Florida State University, and the University of New Orleans, recently reported the first observation of this topological behavior in a magnet, $Sr_{1-y}Mn_{1-z}Sb_2$ (y, z < 0.1). These results were published in the summer of 2017 Nature Materials (doi:10.1038/nmat4953).

"This first observation is a significant milestone in the advancement of novel quantum materials and this discovery opens the opportunity to explore its consequences. The nearly massless behavior of the charge carriers offers possibilities for novel device concepts taking advantage of the extremely low power dissipation," DiTusa said.

The phrase "topological materials" refers to materials where the current carrying electrons act as if they have no mass similar to the properties of photons, the particles that make up light. Amazingly, these electronic states are robust and immune to defects and disorder because they are protected from scattering by symmetry. This symmetry protection results in exceedingly high charge carrier mobility, creating little to no resistance to current flow. The result is expected to be a substantial reduction in heat production and energy saving efficiencies in electronic devices.

This new magnet displays electronic charge carriers that have almost no mass. The magnetism brings with it an important symmetry breaking property – time reversal symmetry, or TRS, breaking where the ability to run time backward would no longer return the system back to its starting conditions. The combination of relativistic electron behavior, which is the cause of much reduced charge carrier mass, and TRS breaking has been predicted to cause even more unusual behavior, the much sought after magnetic Weyl semimetal phase. The material discovered by this collaboration is thought to be an excellent one to investigate for evidence of the Weyl phase and to uncover its consequences.

The Most Bizzare Star in the Universe

NEW DATA DEBUNKS ALIEN MEGASTRUCTURE THEORY

A team of more than 200 researchers, led by Assistant Professor Tabetha Boyajian, is one step closer to solving the mystery behind the "most mysterious star in the universe." KIC 8462852, or "Tabby's Star," nicknamed after Boyajian, is otherwise an average star. It is about 50 percent bigger and 1,000 degrees hotter than the Sun. It is more than 1,000 light years away. However, it has been inexplicably dimming and brightening sporadically like no other. Several theories abound to explain the star's unusual light patterns including an alien megastructure orbiting the star.

The mystery of Tabby's Star is so compelling that more than 1,700 people donated over $100,000 through a Kickstarter campaign in support of dedicated ground-based telescope time to observe and gather more data on the star through a network of telescopes around the world. As a result, a new body of data collected by Boyajian and colleagues in partnership with the Las Cumbres Observatory is now available in a new paper in The Astrophysical Journal Letters.

"Dust is most likely the reason why the star's light appears to dim and brighten. The new data shows that different colors of light are being blocked at different intensities. Therefore, whatever is passing between us and the star is not opaque, as would be expected from a planet or alien megastructure," Boyajian said.

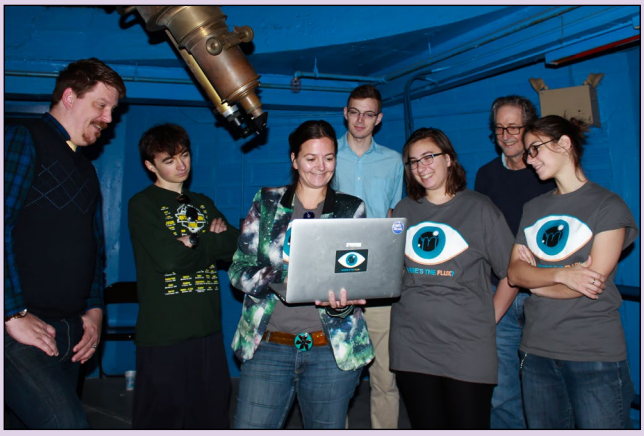
The scientists closely observed the star through the Las Cumbres Observatory from March 2016 to December 2017. Beginning in May 2017 there were four distinct episodes when the star's light dipped. Supporters from the crowdfunding campaign nominated and voted to name these episodes. The first two dips were named Elsie and Celeste. The last two were named after ancient lost cities — Scotland's Scara Brae and Cambodia's Angkor. The authors write that in many ways what is happening with the star is like these lost cities.

"They're ancient; we are watching things that happened more than 1,000 years ago. They're almost certainly caused by something ordinary, at least on a cosmic scale. And yet that makes them more interesting, not less. But most of all, they're mysterious," wrote the authors.

However, the method in which this star is being studied signals a new era of astronomy. "We're gathering so much data on a single target. This project is reflective of changes in astronomy with the access to this flood of data," said Tyler Ellis from Spokane, Wash., an LSU doctoral candidate studying this star.

Citizen scientists, the Planet Hunters, sifting through massive amounts of data from the NASA Kepler mission were the ones to detect the star's unusual behavior in the first place.

"If it wasn't for people with an unbiased look on our universe, this unusual star would have been overlooked," Boyajian said. "Again, without the public support for this dedicated observing run, we would not have this large amount of data."



LSU Astronomer Tabetha Boyajian and her students and research staff (Left to Right) Robert Parks, undergraduate student Rory Bentley, Assistant Professor Tabetha Boyajian, PhD candidate Tyler Ellis, undergraduate Katie Nugent, Professor Geoff Clayton, and graduate student Emily Safron

Still, there are more answers yet to be found. "It's exciting. I am so appreciative of all of the people who have contributed to this in the past year – the citizen scientists and professional astronomers. It's quite humbling to have all of these people contributing in various ways to help figure it out," Boyajian said.

LSU students celebrate the solar eclipse

EDU K-12 Toolkit

The 2017 solar eclipse was visible across North America, passing through the U.S. from Oregon to South Carolina. A solar eclipse occurs when the Moon's shadow passes over the Earth's surface, temporarily blocking the view of the Sun from the Earth. The last time a total solar eclipse occurred in the continental U.S. was 1979. With a grant from the Louisiana Space Grant Consortium (LaSPACE), Dr. Dana Browne, Professor and Associate Chair, led a small team of K-12 teachers to develop a website toolkit for educators to teach students about the solar eclipse.

Browne's website included curricular materials and simple instructions for teachers to leverage this rare astronomic occurrence into an exciting and safe lesson for students.

"The eclipse gives students in Louisiana a unique educational opportunity to observe a natural astronomical phenomenon that both terrified and fascinated the ancient world, and helped develop the science of astronomy," Browne said.

On the website, teachers found historical and contemporary information about eclipses, and lesson plans for science and math classes from pre-kindergarten to high school. Browne has also included instructions for building simple solar eclipse viewers out of cardboard boxes, paper, and aluminum foil for safely viewing the eclipse.

http://laspace.lsu.edu/teacheclipse/

Solar Eclipse at the Start

On August 21, 2017, more than a thousand astronomy enthusiasts gathered on the LSU Parade Ground to view the Great American Eclipse.

Louisiana was not in the path of totality, but that doesn't mean we were not treated to a spectacular event here at LSU. During the event, many viewers used paper plates with pin holes to see tiny crescent-shaped spots of light everywhere there normally would be circles of light.

Physics & Astronomy Department Chair John DiTusa and WAFB Chief Meteorologist Jay Grymes emceed the event on the first day of class for the fall semester. While students, faculty and staff shared solar viewing glasses to look at the partial eclipse, faculty talked about the science and history of the eclipse, including Manos Chatzopoulos, Gabriela Gonzalez and Rob Parks. Attendees also experienced alternative ways to view the eclipse with a sun spotter, solar filter disk, pinhole cameras, and even viewing the eclipse on the ground through the oak trees.

Assistant Professor Ivan Aguillo

LaSPACE team

A team of students and faculty from the Louisiana Space Grant Consortium, LaSPACE, led by LSU, launched two high-altitude balloons on Aug. 21 as part of a NASA-sponsored project to live-stream aerial video footage of the "Great American Eclipse" for public viewing on NASA's website, eclipse2017.nasa.gov.

Both flights were conducted and managed by the LSU team, launched from the Southern Illinois University football stadium in Carbondale, Ill. The second balloon string carried experiments developed over the past year by Delgado Community College, LaTech and MSU students to investigate changes in the high altitude environment as the moon covers the sun.

SIU was selected as the launch site by LSU Professor and Director of LaSPACE Greg Guzik in fall 2016. "I chose SIU because Carbondale, Ill. is very near the point of maximum total eclipse duration and the eclipse team at SIU has been extremely supportive of our needs and responsive to our requirements. Further, we have subsequently learned that NASA, the BBC and other high-visibility organizations plan to use SIU as their central site for eclipse coverage, so we will be in a 'hot bed' of activity," Guzik said.

The NASA-sponsored project, which is led by the Montana Space Grant Consortium, or MSGC, at Montana State University, has been years in the making. According to MSGC Director Angela Des Jardins, the project marks the first time that high-altitude video footage of a total solar eclipse has been broadcast live.

Rainer Weiss College of Science Commencement Speaker

Rainer Weiss at Commencement

Rainer Weiss, 2017 Nobel Laureate in Physics, MIT physics professor Emeritus, and LSU adjunct professor in physics and astronomy, served as the keynote speaker for the LSU College of Science spring diploma ceremony, May 11.

Weiss is a pioneering leader of the Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory, which is comprised of LIGO Hanford and LIGO Livingston, and operates as a consortium of Caltech and MIT.

Weiss and California Institute of Technology professor emeriti Kip Thorne and Barry Barish, were awarded the 2017 Nobel Prize in Physics for the first detection of gravitational waves. The detection confirmed a major prediction of Albert Einstein's 1915 general theory of relativity, which opened an unprecedented new window into the cosmos.

The LIGO Livingston Observatory is located on LSU property, and LSU faculty, students and research staff are major contributors to the international LIGO Scientific Collaboration (LSC). Gabriela González, LSU professor of physics and astronomy, is the former elected spokesperson, who led the LSC during the initial detection of gravitational waves. Together with other leaders and founders of the LIGO effort, González made the official statements about the historic detection on Thursday, Feb. 11, 2016 at the National Press Club in Washington, D.C., before gathered national science press.

Weiss received his bachelor's degree and PhD in physics from MIT. He is known for his pioneering measurements of the spectrum of the cosmic microwave background radiation, his inventions of the monolithic silicon bolometer and the laser interferometer gravitational wave detector, and his roles as a co-founder and an intellectual leader of both the COBE (microwave background) Project and the LIGO Project. Weiss is a member of the National Academy of Sciences and has served on nine National Research Council committees from 1986 to 2007 including the Committee on NASA Astrophysics Performance Assessment, the Panel on Particle, Nuclear, and Gravitational-wave Astrophysics, and the Task Group on Space Astronomy and Astrophysics. He has received numerous scientific and group achievement awards from NASA, an MIT excellence in teaching award, the John Simon Guggenheim Memorial Foundation Fellowship, the National Space Club Science Award, the Medaille de l'ADION Observatoire de Nice, the Gruber Cosmology Prize, and the Einstein Prize of the American Physical Society. Weiss is also a fellow of the American Association for the Advancement of Science, the American Physical Society, The American Academy of Arts and Sciences; and he is a member of the American Astronomical Society, the New York Academy of Sciences, and Sigma Xi. Weiss has been an adjunct professor at LSU since 2001.

"Rai has been a great lifetime mentor not only to two LSU professors, Joe Giaime and myself, but also to generations of LSU and other institutions' graduate students and postdocs - that was indeed the title of a documentary celebrating LIGO generations," said González.

Rainer Wess, 2017 Nobel Laureate in Physics, MIT physics professor emeritus and LSU adjunct professor in physics and astonomy, recieved an honorary degree during LSU's 295th commencement exercises on May 11.

Weiss spoke about his experience at LSU and of the topics he has devoted his research to.

"Of all of the universities in the United States, LSU was one of the very first to take a gamble on the idea that you might find - this exodus idea Einstein had - gravitational waves," Weiss said. "The discovery that was made by LIGO and the discoveries that continue to be made by LIGO are your discoveries as much as everybody else's. They belong to you because you made that investment, and I'm forever grateful for it."

"It's a story about the field of gravitational and how it meandered around. How it had all sorts of ups and downs. It has some lessons that are useful for people." said Weiss. "Science is not always going to be straight lined. In many cases, transformative cases involve taking some risk, and having to convince leaders to support these risky ideas. It is important that we take these risks to move science forward."

Weiss: "At the start of LIGO, LSU had enough spirit for taking a risk. Did the next step and jumped in with both feet for LIGO. They took a risk and won."

Physics & Astronomy Publications

Interface-induced multiferroism by design in complex oxide superlattices, E.W. Plummer, J. Zhang, http://www.lsu.edu/physics/news/2017/07/guo_publication.php

Non-Trivial Berry Phase in Magnetic $BaMnSb_2$ Semimetal, R. Jin, E.W Plummer, http://www.lsu.edu/physics/news/2017/07/huang_publication.php

Misconceptions associated with the Origin of Charge Density Waves, E.W. Plummer, J. Zhang, http://www.lsu.edu/physics/news/2017/07/zhu_plummer_paper.php

A Clarion Call for Large-Scale Collaborative Studies of Pediatric Proton Therapy, W. Newhauser, http://www.redjournal.org/article/S0360-3016(17)30724-1/abstract

Impact of multileaf collimator configuration parameters on the dosimetric accuracy of 6-MV Intensity-Modulated radiation therapy treatment plans, W. Newhauser, R. Zhang, http://www.jmp.org.in/article.asp?issn=0971-6203;year=2017;volume=42;issue=3;spage=151;epage=155;aulast=Petersen

δ-Doping of oxygen vacancies dictated by thermodynamics in epitaxial $SrTiO_3$ films, E.W. Plummer, J. Zhang, http://aip.scitation.org/doi/full/10.1063/1.4985048

Cell-shaped silicon-on-insulator microdosimeters: characterization and response to ^{239}PuBe irradiations, A. Mazza, et al., https://link.springer.com/article/10.1007/s13246-017-0576-9?wt_mc=Internal.Event.1.SEM.ArticleAuthorOnlineFirst

Reentrance of low-temperature nonmetallic phase of $La_{2/3}Sr_{1/3}Mn O_3$ (110) thin films, Z. Diao, J. Zhang, https://www.researchgate.net/publication/319241498_Reentrance_of_low-temperature_nonmetallic_phase_of_L_a_2_3_S_r_1_3_Mn_O_3_110_thin_films

Anomalous Acoustic Plasmon Mode from Topologically Protected States, E.W. Plummer, J. Zhang, https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.119.136805

Shared symmetries of the hydrogen atom and the two-bit system, A.R.P. Rau, http://iopscience.iop.org/article/10.1088/1361-6455/aa8e39/meta

Unconstrained Capacities of Quantum Key Distribution and Entanglement Distillation for Pure-Loss Bosonic Broadcast Channels, M.Wilde, https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.119.150501

Gaussian Hypothesis Testing and Quantum Illumination, M. Wilde, et al., https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.119.120501

An elevation of 0.1 light-seconds for the optical jet base in an accreting Galactic black hole system, R. Hynes, et al., https://www.nature.com/articles/s41550-017-0273-3

Multi-color Photometry of the Hot R Coronae Borealis Star, MV Sagittarii, A. Landolt, https://www.aavso.org/apps/jaavso/article/3306/

The First Post-Kepler Brightness Dips of KIC 8462852, The Astrophysical Journal Letters, T. Boyajian, et al., https://arxiv.org/pdf/1801.00732.pdf

Non-grey dimming events of KIC 8462852 from GTC spectrophotometry, T. Boyajian, https://arxiv.org/abs/1801.00720

Energy-constrained two-way assisted private and quantum capacities of quantum channels, N. Davis, M. Wilde, https://journals.aps.org/pra/abstract/10.1103/PhysRevA.97.062310

On-orbit Operations and Offline Data Processing of CALET Onboard the ISS, Y. Asaoka, N. Cannady, M. Cherry, T.G. Guzik, J. Wefel et al., Astroparticle Phys. 100, 29 (2018), https://arxiv.org/abs/1803.05834

Non-Gaussianity in Loop Quantum Cosmology, I. Agullo et al., Phys.Rev. D97 (2018) no.6, 066021, https://arxiv.org/abs/1712.08148

Signature of charge migration in modulations of double ionization, F. Mauger, M. Gaarde, K. Schafer, Phys. Rev. A 97, 043407, https://journals.aps.org/pra/abstract/10.1103/PhysRevA.97.043407

Low- and middle-income countries can reduce risks of subsequent neoplasms by referring pediatric craniospinal cases to centralized proton treatment centers, R. Zhang, et.al., http://iopscience.iop.org/article/10.1088/2057-1976/aaa1ce

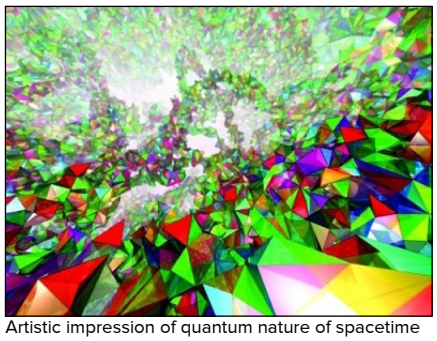
Orientation dependence of temporal and spectral properties of high-order harmonics in solids, M. Wu, D. Browne, M. Gaarde, K. Schafer, et al., https://journals.aps.org/pra/abstract/10.1103/PhysRevA.96.063412

Resonantly-initiated quantum trajectories and their role in the generation of near-threshold harmonics, S. Camp, M. Gaarde, K. Schafer, et al., http://iopscience.iop.org/article/10.1088/1361-6455/aaac12/pdf

Param Singh, edited a special issue on "Applications of loop quantum gravity to cosmology" for Classical and Quantum Gravity, the premier journal for the gravitational physics community.

The special issue had original research articles on resolution of gravitational singularities, observational signatures of loop quantum gravity and various aspects of quantum cosmology by many prominent researchers in the field, including Abhay Ashtekar, Eberly Chair of Physics at the Pennsylvania State University, and Ivan Agullo and Peter Diener at LSU. Param Singh was then invited to write a popular article highlighting this special issue in Classical and Quantum Gravity's website CQG+

http://iopscience.iop.org/journal/0264-9381/page/Focus-issue-loop-quantum-gravity



Artistic impression of quantum nature of spacetime in loop quantum gravity. Copyright: Thomas Thiemann (Albert Einstein Institute & FAU Erlangen–Nuernberg); Milde Marketing Potsdam, Germany; Exozet Potsdam, Germany).

Faculty Awards & Fellowships

Jerry Draayer, Kelvin Droegemeier, Gabriela González, Christopher D'Elia, Dean, Kalliat T. Valsaraj,

LIGO Researcher Gabriela González Honored as SURA Distinguished Scientist
http://bit.ly/2tCJWt0

Gabriela González Elected to the National Academy of Sciences
http://bit.ly/2AdLsmR

China's President Presents Top Foreign Science and Technology Award to Ward Plummer
http://bit.ly/2IrXxbR

Ward Plummer Named Boyd Professor
http://bit.ly/2IAAT8g

On January 8, Chinese president Jinping Xi presided over the 2017 State Natural Science Awards in the Great Hall of China. Ward Plummer was the first to greet the president (center), here shown shaking hands with Chinese Premier Keqiang Li. Later in the ceremony, President Xi personally presented the certificate for international scientific cooperation to Plummer.

LSU Physicist Awarded New NSF Research Fellowship - Alumna and Assistant Professor Kristina Launey one of 30 to receive fellowship
http://bit.ly/2yaigg0

LSU Research contributes to two PhysicsWorld 2017 Breakthroughs of the Year
http://bit.ly/2tAn7Gn

Jonathan Dowling Named Visiting Professor of Chinese Academy of Sciences
http://bit.ly/2L2G1Ne

Jonathan Dowling and PhD student Lu Yang with a certificate of Dowling's name in chinese longhand.

SEC Selects 2018 Faculty Achievement Award Recipients: Boyd Professor Ward Plummer chosen as LSU's honoree
http://bit.ly/2uvohGP

Gonzalez - elected by the HEAD membership to serve as a Member of the HEAD Executive Committee for AAS

Arlo U. Landolt has been elected to a term on the Council of the American Association of Variable Star Observers

Jorge Pullin has been appointed to the Advisory Board of the Journal of Universe

Colleen Fava Honored with Outstanding Service Award

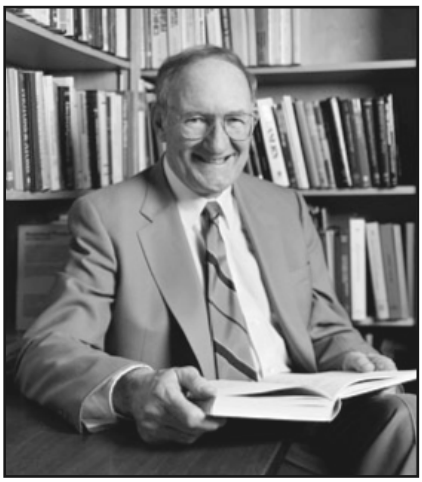
Colleen Fava, program manager of the Louisiana Space Grant Consortium (LaSPACE) / NASA EPSCoR, was announced as one of the recipients of the 2017 LSU Foundation Staff Outstanding Service Awards. This annual award was established to recognize the superior work performance and outstanding contributions of full-time, non-academic staff employees of the LSU A&M campus and the LSU AgCenter.

Program manager since 2012, Fava has consistently provided outstanding service to LSU, the state of Louisiana, and the National Space Grant College and Fellowship program.

Fava organizes state-wide LaSPACE meetings, participates in state level EPSCoR committees as well as national Space Grant meetings, assists in the planning and organization of Space Grant/EPSCoR related national conferences, providing the highest quality reporting to state and federal program managers.

"Colleen's outstanding service to LaSPACE significantly contributes to the state and nation wide perception of LSU as a high quality academic leader," said T. Gregory Guzik, professor, LSU Department of Physics & Astronomy, and director, LaSPACE/ NASA EPSCoR.

Robert O'Connell Named to College of Science Hall of Distinction



Professor Emeritus Robert O'Connell

LSU Boyd Professor Emeritus Robert O'Connell has had a notable 53-year career as an LSU faculty member. O'Connell has well over 300 publications, including six papers he co-wrote with Eugene Wigner, renowned physicist and Nobel Prize winner, with one having over 2,000 citations. He has served as editorial board member of several leading journals in physics including Physical Review A, Hadronic Journal and Journal of Physics A. O'Connell has been a long-time visiting Professor at the Dublin Institute for Advanced Studies; the University of Ulm; the Technical University of Denmark; the University of Oxford, Cambridge University and Queen Mary College in the UK.; the Max Planck Institute; and the Universities of Warsaw, Trondheim, Santa Caterina Brazil and Bilkent, as well as Oak Ridge National laboratory and the Lawrence Livermore Laboratory.

One of his most lasting contributions to physics was his work on the behavior of spinning bodies in general relativity. The outcome of this work laid the foundations for modern-day approaches to calculating the orbits and gravitational radiation for inspiraling spinning black holes. He also contributed to the success of the space mission Gravity Probe B (launched by NASA to measure the precision of the spins of an array of gyroscopes) and extended this work to predict spin precession in a two-body system, a new prediction of General Relativity, which was recently verified by a consortium of astronomers. In addition, his work on magnetic white dwarfs led to the first spectroscopic discovery of very large magnetic fields (300 MG) in compact stars.

Dr. Robert O'Connell with family members at the College of Science Hall of Distinction Ceremony

His summer collaboration at the Dublin Institute for Advanced Studies over a period exceeding 25 years, led to fundamental discoveries in Quantum Statistical Mechanics in addition to important work in Electrodynamics. While at LSU, O'Connell was active on a number of committees and served as vice-president and president of the Faculty Senate. He was also named Distinguished Research Master in 1975 and has been a fellow of the American Physical Society since 1969. He was a NAS-NRC Fellow in New York (1996-1998) and a SRC Senior Visiting Fellow in Oxford and London (1975-1976). O'Connell and his wife, Josephine, are also members of the College of Science Dean's Circle.

Quantum Revolution

US Dept. of Defense funds quantum sensing research

Jonathan P. Dowling

As quantum computers built by Google, IBM, Microsoft and others are coming online, it is imperative to develop quantum control methods to allow these producers to scale up to thousands or millions of transistors.

"We are currently in the midst of a second quantum revolution," said Jonathan P. Dowling, Department of Physics & Astronomy professor. "The first quantum revolution gave us new rules that govern physical reality. The second quantum revolution will take these rules and use them to develop new technologies."

Dowling and collaborators have been awarded more than $7 million from the U.S. Army Research Office to develop quantum technologies related to sensing. Their recently received grant titled, "Quantum control based on real-time environment analysis by spectator qubits," is funded for three years, with the possibility of a two-year extension for a total of $7.05 million. The purpose of the grant is to develop feedback and control techniques on quantum systems that will be used to improve the performance of quantum computers and sensors.

Dowling's team is one of 24 academic research teams to receive this competitive funding. LSU will receive nearly $1 million over the next five years as part of the DoD Multidisciplinary University Research Initiative program, or MURI grant.

"Successful implementation for spectator qubits will allow for higher fidelity and more robust quantum operations," Dowling said. "DoD applications of quantum computers for cryptography, materials simulations and optimization will benefit greatly from increased circuit depth."

Dowling, co-chair of LSU's Hearne Institute for Theoretical Physics and the Hearne Chair Professor of Theoretical Physics in the Department of Physics & Astronomy, is participating on a team of researchers from University of California, Berkeley; Dartmouth College; Duke University; Johns Hopkins University Applied Research Lab; Massachusetts Institute of Technology; and the University of Oregon, as part of the DoD MURI program. MURI projects involve teams of researchers investigating high priority topics that range across a wide variety of disciplines.

"MURI supports research by funding teams of investigators that include more than one traditional science and engineering discipline in order to accelerate the research progress," said Dale Ormond, principal director for research, in the Office of the Under Secretary of Defense for Research and Engineering. "MURI awards also support the education and training of graduate students in cutting-edge research areas."

The highly competitive MURI program complements other DoD basic research initiatives that support traditional, three-year, single-investigator university research grants. By supporting multidisciplinary teams with larger, longer awards in carefully chosen and relevant research topics, DoD and the Services enhance the potential for significant and sustained advancement of research in critical areas of importance to National Security and the DoD's mission.

LIGO Livingston Designated as a Historic Site by APS

The Laser Interferometer Gravitational Wave Observatory, or LIGO, in Livingston, La., was designated a historic physics site by the American Physical Society, or APS, on Wednesday, June 20, 2018.

LIGO Livingston is one of two observatories in the U.S. that made the first direct observations of gravitational waves emanating from violent and distant astronomical events. The two observatories — one in Louisiana and the other in Hanford, Wash. - received plaques to recognize the extraordinary efforts that led to this detection.

The citation on the plaques reads: “On September 14, 2015, LIGO interferometers at Livingston, Louisiana, and Hanford, Washington, made the first direct observation of gravitational waves. The precision required to detect these tiny disturbances in space-time, caused by merging black holes, was made possible by the coordinated labor of over one thousand scientific and technical workers. This and a companion plaque at the other LIGO site recognize their contributions to this historic detection.”

LIGO Livingston is located on LSU property, and LSU faculty, students and research staff are major contributors to the 1,000-member, international LIGO Scientific Collaboration, or LSC. LSU graduate students and post-doctoral researchers have conducted research at LIGO Livingston continuously over the past two decades.

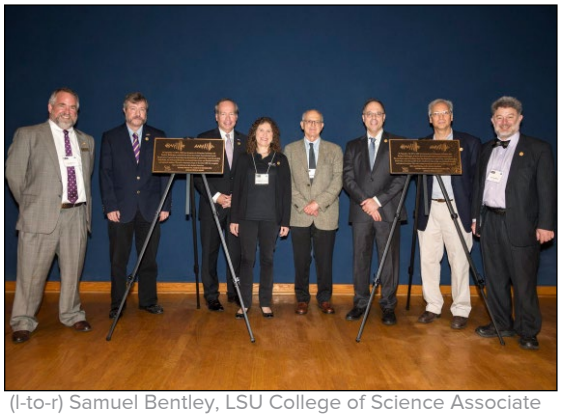
“Achieving this major scientific breakthrough of being the first to detect gravitational waves took a tremendous amount of vision and perseverance by LSU faculty and administrators including then-Chancellor James Wharton and state leaders. LSU continues to be a place where great discoveries are made,” said LSU President F. King Alexander.

In attendance for the ceremony was LSU Adjunct Professor and Nobel Laureate Rainer Weiss, who is a professor emeritus at MIT. He was granted an honorary doctorate at LSU during commencement in May, where he stated:

“Of all the universities in the United States, LSU was one of the very first to take a gamble on the idea that you might find – this exodus idea Einstein had – gravitational waves…The discovery that was made by LIGO and the discoveries that continue to be made by LIGO are your discoveries as much as everybody else’s. They belong to you because you made that investment, and I’m forever grateful for it.”

Weiss was appointed as the first LSC spokesperson. Also in attendance was LSU Department of Physics & Astronomy Professor Gabriela González, who was the elected LSC spokesperson at the time of the first two gravitational wave detections. Since 2015, LIGO has detected gravitational waves from three distinct black hole collisions and one collision of neutron stars.

“Having LIGO Livingston officially designated as an important site in the history of physics is an honor the LSU and LIGO team members are all proud of,” said LIGO Livingston Observatory Head Joseph Giaime, who is also a professor in the LSU Department of Physics & Astronomy.



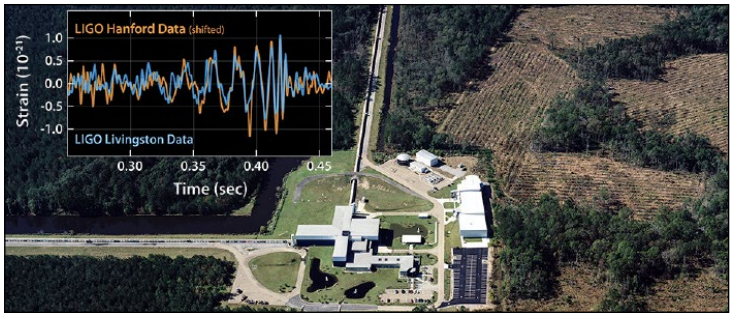
(l-to-r) Samuel Bentley, LSU College of Science Associate Dean of Research; Jorge Pullin, Horace Hearne Chair in Theoretical Physics at LSU; LSU President F. King Alexander; Gabriela González, professor LSU Physics & Astronomy and former spokesperson for the LIGO Scientific Collaboration; Rainer Weiss, 2017 Nobel laureate in Physics and first LSC spokesperson; Joseph Giaime, LIGO Livingston Observatory Head and professor in the LSU Department of Physics & Astronomy; John DiTusa, professor and department chair, LSU Physics & Astronomy; Stephen Beck, associate Vice President, LSU Office of Research & Economic Development

LSU’s investment in gravitational wave science spans more than four decades, and is among the longest of the institutions contributing to the discovery. LSU faculty, students and staff have played leading roles in the development of several generations of gravitational wave detectors, in their commissioning and operation as well as the collaborations formed. This achievement is in part an outcome of LSU’s long-term vision and commitment to high-risk, high-potential scientific research.

LSU’s pioneering role in gravitational wave science began in 1970 led by LSU Department of Physics & Astronomy Professor Emeritus William Hamilton and Professor Warren Johnson, who built and operated previous-generation cryogenic bar gravitational wave detectors on campus for many years.

LIGO is a system of two identical detectors carefully constructed to detect incredibly tiny vibrations from passing gravitational waves. LIGO was conceived and originally built by MIT and Caltech researchers and funded by the National Science Foundation, with significant contributions from other U.S. and international partners including LSU.

For example, the LSU Cartographic Information Center, or CIC, in the LSU Department of Geography & Anthropology played an important role in determining the site of the LIGO Livingston observatory in the 1980s. Johnson used topographic maps from the CIC to determine the site for LIGO’s scientific mission. The National Science Foundation selected the Livingston LIGO site in 1992, and construction began in 1994.



Current faculty including LSU Department of Physics & Astronomy Assistant Professor Thomas Corbitt are working on technology for future gravitational wave detectors.

The APS established its Historic Sites initiative to raise public awareness of physics. The plaques placed at sites identify important and interesting events in the history of physics as a way to engage the general public to increase awareness of important past scientific advances.

Student News and Updates

Bentley and Shows Named 2017 Astronaut Scholars

HARVEY SHOWS

For more than 30 years, the Astronaut Scholarship Foundation has supported hundreds of top performing students pursuing degrees in science, technology, engineering or mathematics. In 2017, LSU physics majors Rory Bentley and Harvey Shows were among the top performing scholars to receive the ASF award.

The ASF Scholarship was created by the six surviving astronauts of Mercury 7, the team of seven astronauts that piloted the manned spaceflights of the Mercury program from May 1961 to 1963. The scholarship aims to encourage students to pursue scientific endeavors that keep the U.S. on the leading edge of technology.

Astronaut Scholar Rory Bentley from Baton Rouge, La., is a physics major with a concentration in astronomy. He's known his love for astronomy since he was two years old, but this recognition affirms that; he not only loves it, but it's his calling.

"Being awarded this scholarship feels like a testament to all the time I've sunk into my research career," said Bentley. "It's a huge relief to see that I ended up in the right field."

Bentley has contributed to several projects over the years. In high school he began working with Dr. Suniti Karunatillake on image analysis from the Mars Reconnaissance Orbiter and the Curiosity Rover. In college Bentley began a survey searching for variable stars corresponding to X-ray sources in the Milky-Way's center with Dr. Robert Hynes, professor in LSU's Department of Physics & Astronomy.

In summer 2017, he worked with Dr. Al Wootten at the National Radio Astronomy Observatory where they performed a hunt for new molecules within the Crab Supernova Remnant using data from the ALMA array. More recently, he's been working with LSU Assistant Professor, Dr. Tabetha Boyajian's group who is looking at peculiar stars found with the Kepler Space Telescope.

"I am planning on continuing my career in observational astronomy in graduate school at UCLA and beyond," said Bentley. "I'm particularly interested in big stars and star clusters, and the center and structure of our galaxy."

Shows, from Covington, La., knew from a young age that studying physics was his calling. He began his college career at Southeastern Louisiana University and transferred to LSU after his freshman year. Shows says that it was the faculty and staff in the Department of Physics & Astronomy who encouraged him to excel within his field

"While the work involved can be strenuous often leading to late nights and early mornings, the prize of finally 'getting it' cannot be overvalued. With each semester I become more and more confident that I am where I ought to be," said Shows.

Shows has an extensive research background. While an undergraduate student, he conducted neutrino physics research at Indiana University. He has also participated in a quantum computing physics research experience sponsored by the NSF's Robert Noyce Teacher Scholarship through the LSU GeauxTeach program in Math & Science. Shows also worked as an undergraduate researcher in Associate Professor of Physics Kristina Launey's research group where the work focused on nuclear structure theory.


RORY BENTLEY

Shows attended the Astronaut Scholars Award Presentation Ceremony in Washington, D.C., and was astounded by the experience.

"This weekend was one of the highlights of my undergraduate career," said Shows. "My expectations were beyond exceeded. The astronauts, as well as the other astronaut scholars were among the most personable, brilliant, genuine, and gracious individuals I have ever met. I had the opportunity to meet the U.S. Astronaut Hall of Fame inductees: Michael Foale and Ellen Ochoa, as well as many other astronauts, including four of the six surviving Apollo astronauts. Meeting these incredible men and women who pursued the excitement of their imagination, uncorrupted by promise of fame or fortune, was an incredibly humbling and inspiring experience."

Khang Pham Awarded LSU Discover Scholar

Khang Pham, a native of Vietnam, and a McNair Research Scholar, has been named a 2018 LSU Discover Scholar awardee. Currently mentored by Professor Catherine Deibel, Pham is conducting research in the nuclear physics group.

"My part of the research involves designing and testing a focal plane detector system for the Enge split-pole spectrograph, which is being assembled at Florida State University," said Pham. "The overall goal of the research is to study nuclear reactions to better understand the reactions that synthesize the elements in various stellar environments."

LSU Discover Scholar Awards celebrate the achievements of the top ten students who exemplify outstanding undergraduate research or creative endeavors within their fields. Awardees are honored with a ceremony and given a $1,500 travel stipend.

"The Department of Physics & Astronomy is very proud that Khang Pham was recognized for his research accomplishments," said Department Chair John DiTusa. "This award is also a recognition of the high level of research being carried out by our students and faculty in P&A and an example of the many benefits that this research creates for our students."

Pham's research has spanned both computational physics and nuclear physics at LSU. "With Dr. Juana Moreno, I was doing computational physics and I learned the skills necessary to program and simulate physics problems. With Dr. Deibel, I was introduced to experimental skills in a lab, and though I love the computational side of physics, I personally find experimental work to be more exciting. It was Dr. Deibel that provided me the opportunity to explore and realize that experimental work is a better fit for me. Overall, I feel very fortunate and grateful to have two very caring and thoughtful mentors that have helped me become a much better version of myself."

LSU Sophomore Corey Matyas Named a 2018 Goldwater Scholar

COREY MATAYAS

LSU College of Science and Roger Hadfield Ogden Honors College sophomore Corey Matyas has been named a 2018 Goldwater Scholar. Matyas, a native of Dahlonega, Ga., was nominated through an internal university process earlier in the year. A list of winners was released on Friday, March 30. Matayas is majoring in physics and math.

“We congratulate Corey Matyas on being awarded the prestigious Goldwater Scholarship,” said LSU President F. King Alexander. “We commend Corey for his academic and research achievements thus far and can’t wait to see where his commitment to pursuing a career in STEM takes him in the future.”

The Barry M. Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to honor Sen. Barry M. Goldwater. Goldwater Scholars are awarded one and two-year $7,500 stipends to pursue undergraduate research in the fields of mathematics, the natural sciences or engineering. To apply for the scholarship, students must submit a research essay that demonstrates their interest and ability in these fields. Goldwater Scholarships are widely considered one of the most prestigious undergraduate awards available to students of the STEM disciplines.

According to the Goldwater website, “This year 1,280 students from 455 institutions were nominated for a Goldwater scholarship. We named 211 new Goldwater Scholars and identified 281 students as Honorable Mentions. The nomination files we received this year were outstanding. We clearly had to choose the best from among the best.”

LSU Physics Students Receive NRC Scholarship in Health Physics

The health physics field focuses on protecting people and the environment from radiation hazards. This typically includes making measurements and calculations, providing radiation safety training, and developing new radiation instruments and software programs. Health physicists find careers in hospitals, cancer clinics, research laboratories, universities, and nuclear facilities.

Rebecca DiTusa, from Baton Rouge, La., appreciates the opportunity the NRC scholarship provides to discover the aspects of the health physics field. “Along with physics, I have found interest in nuclear science and have decided to minor in it,” said DiTusa. “With the knowledge that I will gain in my undergraduate career, I hope to go to graduate school. By combining nuclear science and physics I will be able to apply my knowledge in either a research setting or a medical one. Receiving this scholarship has made me even more dedicated to continue on with getting a health/medical physics career as I feel I have been accepted into this community.”

Khang Pham, from Houma, La., is looking forward to furthering his research with the NRC award. “I have been given the opportunity to continue my nuclear physics research at LSU during the upcoming summer,” said Pham. “With the NRC grant, I can fully commit myself to my research. Furthermore, the research that I conduct in the upcoming summer will give me a much-needed head start into my graduate career.”

LSU’s medical physics and health physics program offers scholarships of $5000 each to fund undergraduate students in STEM fields who are interested in exploring careers in the radiation sciences. To be eligible to apply, students must be a full-time student enrolled at LSU A&M or Southern University in Baton Rouge and maintain a 3.0 grade point average.

REBECCA DITUSA AND KHANG PHAM

LSU Professors Wayne Newhauser and Wei-Hsung Wang received a federal grant to fund the scholarship program. According to Newhauser, “LSU is truly fortunate to have received more than $1 million in funding from the NRC to support our education and research programs in health physics. We will award additional undergraduate scholarships in the next year or so and encourage interested students to apply. We also received grants from the NRC to support graduate students and to hire two new faculty members. The demand for radiation professionals is strong and will continue to grow for the foreseeable future. Nationally, there are many great career opportunities for young people in the radiation sciences, including specialties in health care, the environment, national security, and nuclear power. Locally, LSU has strong programs in radiation science and Louisiana needs radiation professionals.”

LSU Students Recieve Distinguished SPS Chapter Award

From Left to Right: Secretary Margaret Carey, Vice President Margarite Laborde, Department Chair John DiTusa, Public Relations coordinator Rory Bentley, Treasurer Benjamin Box, and event coordinator Rebecca Ditusa

The LSU Chapter of the Society of Physics Students (SPS) received the 2016-2017 Distinguished Chapter Award from the national office of the SPS within the American Institute of Physics. SPS is an organization for students interested in the fields of physics and astronomy. Their primary purpose is to promote the appreciation and advancement of physics and astronomy in the community, as well as to further educate members in these fields.

The LSU SPS group participates in multiple outreach events throughout the year, including Mini Maker Faire, NanoDays, International Astronomy Day, Earth Day, LASM Engineering Day, in addition to visits to middle and high schools for science fairs and similar events.

"The faculty of the Department of Physics & Astronomy are very proud of the students of the LSU chapter of the SPS for their efforts to share their love of the fields of physics and astronomy to the public, particularly with K-12 students," said Dr. John DiTusa, chair, LSU Department of Physics & Astronomy. "We believe it is extraordinarily important for these young students to be exposed to students who embrace the challenge and excitement in STEM. In addition, their work to create a community of students within the department is very much appreciated by the faculty as we believe that the learning community they have created benefits all of our students. Congratulations on this outstanding achievement!"

An important recruitment activity that the LSU SPS chapter initiated is the physics mentor/mentee program. LSU SPS assigns a junior or senior physics student to each freshman and sophomore student seeking a mentor, based on similar interests. The pairs are then encouraged to associate with each other, and the mentor is available to offer the mentee scheduling advice and answer questions pertaining to life as a physics major.

"We are extremely pleased that the LSU SPS chapter has been recognized by the national SPS organization for its many initiatives and activities over the past year," said Dr. J. G. Stacy, LSU SPS faculty advisor. "This is a well-deserved recognition and a tribute to the hard work and resourcefulness of the LSU SPS officers and student members."

SPS group 2016-2017 LSU SPS officers awarded include: President Simon Lorenzo, Vice President Margarite Laborde, Secretary Margaret Carey, Treasurer Benjamin Box, Public Relations Coordinator Rory Bentley, Event Coordinator Rebecca DiTusa, and Webmaster Dylan Ottea.

SPS Distinguished Chapter Awards are determined each academic year after a careful review of the information, photos and supporting material presented in the annual SPS Chapter Reports. The reviewers include a team of four SPS National Council members, including Zone Councilors and Associate Zone Councilors, as well as the national SPS office staff.

New Physics & Astronomy Graduate Student Organization

(l-to-r) Siddhartha Das, Emily Safron, Erin Good, & Sahil Saini

This spring the P&A GSO was founded to connect graduate students of the department and let them know about events and opportunities available to them, as well as to encourage them to attend more events and gatherings. P&A GSO is organized by current graduate students and we encourage everyone to get involved in the leadership process; we're also always looking for suggestions of things to do.

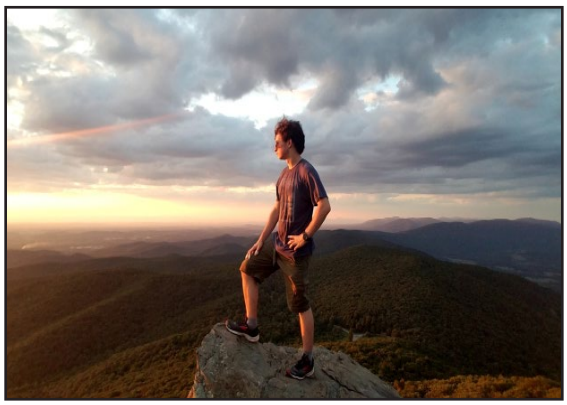
This semester we've put on popular events like pizza lunches with colloquium speakers, where students can talk to speakers about their career path and their interests, as well as other activities outside the department, such as weekly rock climbing and roller skating events, an end of semester BBQ, and a pool party at the UREC.

Aside from hosting social events, we are also acting as a liaison between the faculty and graduate students to address our unique needs, interests, and concerns. We are trying to make the transition to LSU graduate school easier for new students by providing information on graduate student life and hosting events to meet new students.

Please get in touch if you're an alumni of the graduate program who would like to speak to us about your career experiences! Our email is physgradorg@phys.lsu.edu and you can check out our website at https://physgradorg.wixsite.com/mysite.

Student News

RORY BENTLEY



RORY BENTLEY

Rory spent the summer with astronomers at the National Radio Astronomy Observatory (NRAO) looking at radio wave emission from dusty molecular gas structures seen in the Crab Supernova Remnant, the remains of a large star that was seen to explode about a thousand years ago. He and other students identified several molecules which had been seen in a young supernova remnant once before, and produced high resolution position and velocity maps, along with density and mass estimates. These results provided one of the highest resolution observations of a very high energy astrochemical environment.

MARGARITE LABORDE

Margarite is passionate about physics research. She participated in the National Institute of Standards and Technology (NIST) Summer Undergraduate Research Fellowship (SURF) program and presented some of her research "Multiparameter Estimation with Single Photons" at the Japan Society of Applied Physics-Optical Society of America joint symposia in Fukuoka, Japan thanks in part to the LSU Discover Travel Stipend.

MARGARITE LABORDE

The 2017-18 president of the Society of Physics Students – LSU Chapter, Margarite sat with the LSU College of Science to talk about her experience as an undergraduate student in physics. Learn more at http://bit.ly/2ucfkj0

REBECCA DITUSA

REBECCA DITUSA

Rebecca participated in the 'Cornell Center for Materials Research' (CCMR) Research Experience for Undergraduates (REU) program last summer at Cornell University. Students worked on individual projects with Cornell faculty and research staff on a wide range of topics in interdisciplinary materials research projects involving chemistry, physics, materials science, and engineering disciplines. When asked about her work and research DiTusa said, "I got to work on constructing a microscope that would be able to go in an MRI. The campus was amazing, and it was great meeting and working alongside extremely intelligent people from all over the country."

KATIE NUGENT

KATIE NUGENT IN THE LANDOLT ASTRONOMICAL OBSERVATORY

I would describe my job over this past summer as a sort of quality control on the data around Boyajian's Star. I helped make sure that the data we collected about stars that we wanted to compare Boyajian's Star wasn't saturated, or that we didn't pick stars with hot pixels in the apertures or stars that were variable, etc., so that we had the most accurate data. I helped ensure that the stars we chose were the best comparison stars to use for further research on KIC 8462852. It was a lot of fun; I got to know a few professors and graduate students who have proven to be great mentors. They have helped teach me things that you don't always get to know in the classroom, and I'm extremely grateful for this experience. Learn more at http://bit.ly/2zCj8z0

BENJAMIN LANE

Benjamin Lane received the Outstanding Undergraduate Presentation award for "Observation of an Optical Spring with a Beamsplitter"(with Baylee Danz, Thomas Corbitt, Jonathan Cripe) at the APS Physics April Meeting in Columbus, Ohio.

"My favorite thing about working on quantum optics as part of the LIGO Scientific Collaboration is that I get to investigate and explore the smallest scales of energy where quantum mechanics dominates in order to improve our ability to detect gravitational waves, which requires an absolutely massive amount of energy, turns out space time doesn't like being stretched." said Lane.

BENJAMIN LANE WITH RAINER WEISS. WEISS RECIEVED THE 2017 NOBEL PRIZE IN PHYSICS FOR HIS WORK WITH GRAVITATIONAL WAVES

MICHELLE LIS

MICHELLE LIS

Michelle Lis attended the first topical workshop for her fellowship at the Paul Scherrer Institute (PSI) in Switzerland. PSI is a world-renowned, multidisciplinary research institute, actively studying solid-state physics, elementary particle physics, and health science applications. During the workshop, Michelle had the opportunity to learn about the processes of designing treatment rooms. The focus was on discussing how different beam characteristics impact on dose delivery and how this is linked in return to the efficiency of cancer treatment. In addition, gantry and room design options in consideration of the patient needs and minimization of preparation times before treatment were discussed.

During the workshop, Michelle also had the opportunity to present the background and results in her work on 4D robust optimization treatment planning and dose delivery.

Alumnus Mark DiTusa Awarded National Science Foundation Graduate Research Fellowship

MARK DiTUSA

2016 LSU graduate, Mark DiTusa, is the recipient of the 2018 National Science Foundation Graduate Research Fellowship Program, or GRFP. This fellowship from the National Science Foundation helps ensure the vitality of the human resource base of science and engineering in the U.S. and reinforces its diversity. DiTusa is currently pursuing his Ph.D. at the University of Chicago.

"My time at LSU and in the LSU Honors College gave me the ability to pursue research in both physics and chemistry from the very beginning of my college education. This experience was invaluable for preparing me to do polymer physics research at the University of Chicago, and it is an honor to be able to receive this award thanks to the exemplary education I received at LSU. If you take advantage of what LSU has to offer, you can succeed anywhere."

GRFP provides three years of financial support within a five-year fellowship period, a $34,000 annual stipend and $12,000 cost-of-education allowance to the graduate institution. That support is for graduate study that leads to a research-based master's or doctoral degree in a STEM field.

GRFP was developed by the National Science Foundation to create a highly motivated and capable workforce dedicated to ensuring the nation's leadership in advancing STEM-related innovations. The selected fellows are expected to become respected thought leaders and knowledge experts in their given fields.

Medical Physics Student Elizabeth Hilliard Receives 1st Place at LSU Three Minute Thesis Competition

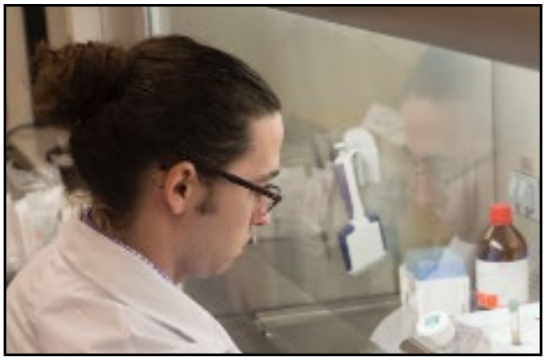
LSU GRADUATE SCHOOL DEAN MICHELLE MASSE and ELIZABETH HILLIARD

Elizabeth Hilliard, a medical physics graduate from the LSU Department of Physics and Astronomy, whose M.S. project was working to improve the efficiency and control of electron beam exposure in cancer patients needing radiation therapy. Elizabeth has undergraduate degrees in both physics and psychology from Rensselaer Polytechnic Institute. She recently won the LSU Three Minute Thesis (#3MT) competition by presenting a winning story about her research on stage for the LSU Graduate School, and moved on to compete in the regional 3MT competition in Fayetteville, AR.

When asked about her research, Hillard said, "My research interests are in improving electron radiotherapy for the treatment of cancer. More specifically, my Master's Thesis project is validating a device that better controls the intensity of radiation at a given depth in the body. Controlling the intensity gives us the ability to irradiate the tumor as evenly as possible while avoiding irradiating surrounding healthy body tissue. The method to control the intensity using patient-specific intensity modulating devices has already been developed, so my project involves re-planning previously-treated patients using intensity modulation then testing these planned devices to make sure they deliver the expected dose (energy per unit mass) at specified depths in water."

Oak Ridge Pilot Research Project Takes a Page from its Storied History

LSU Health Physics gradute student replicates the 1976 'Atomic Man' Incident



LSU GRADUATE DANIEL DIMARCO CONDUCTED RESEARCH ON RADIATION EXPOSURE AT OAK RIDGE NATIONAL LABORATORY.

A pilot project in the summer of 2017 at Oak Ridge Associated Universities, or ORAU, hearkens back to the organization's roots. ORAU has launched a Visiting Faculty Research Program, or VFRP, which creates teams to tackle research projects of interest to the organization. Through the VFRP, faculty from a member institution, a student intern and an ORAU subject matter expert team up to complete a project. LSU was one of two universities selected for this pilot program.

"We used to be much more engaged in research," said Eric Abelquist, ORAU executive vice president and chief research officer. "That engagement goes back to ORAU's founding when, after the Manhattan Project, there was an opportunity for universities in the Southeast to take a lead role in atomic energy research."

The VFRP pilot program demonstrates the feasibility of expanding ORAU's research enterprise. Two research universities – LSU and the University of Tennessee – were selected for the pilot. At the heart of the program is a 10-week internship for one student at each of the universities. Each student is supervised by a faculty adviser, who received a $5,000 award for his or her participation in the project. The student and faculty member work closely with an ORAU subject matter expert, who helps develop and oversee the project. VFRP projects this summer focused on health physics, and Abelquist said there is a practical reason for that.

"As a company that hires health physicists, we want to build a strong pipeline of future health physicists," he said. Building relationships with faculty and strengthening relationships with ORAU's member institutions will help ensure a strong pipeline. We hope health physics becomes a long-term interest for these interns. One possible outcome is that we make a hire at some point," Abelquist said. A near-certain outcome is that the students will finish their internships with a head start on a project that could become their master's thesis or doctoral dissertation.

Such is the case for Daniel DiMarco from Marrero, La. 2017 B.S. alumnus, DiMarco is pursuing his health physics master's degree in the LSU Department of Physics & Astronomy's Medical & Health program. He worked with Jason Davis, ORAU health physicist, on a project to replicate exposure rates similar to the 1976 "McCluskey Room Incident." During that event, Harold R. McCluskey, a chemical operations technician at the Hanford Plutonium Finishing Plant in Washington state who became known as the "Atomic Man," survived exposure to the highest dose of radiation from americium ever recorded.

To replicate the effect, DiMarco took blood samples from the Oak Ridge Institute for Science and Education's Cytogenetic Biodosimetry Lab and exposed them to different radiation dose rates in an attempt to replicate the single-incident acute intake of radiation that occurred at Hanford and also potentially measure the physiological effects of chronic low-dose radiation.

"From a purely scientific perspective, we don't know a lot about chronic low-dose radiation," DiMarco said. "We know much more about what happens from accidents. We need a bigger data set."

DiMarco's research may be helpful in that regard, and his work in the Cytogenetic Biodosimetry Lab will definitely add to his experience. "This project will give Daniel an introduction into how research is conducted in a laboratory setting," Davis said. "And he will have to work out his own methodologies and design his own research questions."

DiMarco's LSU faculty advisor is Wayne Newhauser, the Dr. Charles M. Smith chair of Medical Physics, professor and director of Medical and Health Physics at LSU. Newhauser is enthusiastic about DiMarco's project and the larger implications of the VFRP.

"This is one of those internships that is valuable to building the pipeline of future radiation workers," he said. "It's exciting for students and they get to interact with organizations in the real world who could be future employers."

Newhauser adds that the VFRP is beneficial for his institution as a whole. "LSU is our state's flagship research university and a big part of our graduate program involves research. We like our students to be involved in cutting edge research," he said.

Turning plots into stained glass

BY DIANA KWON OF SYMMETRY MAGAZINE

HUBERT VAN HECKE'S STAINED GLASS WINDOW

At first glance, particle physicist Hubert van Hecke's stained glass windows simply look like unique pieces of art; but there is much more to them than pretty shapes and colors. A closer look reveals that his creations are actually renditions of plots from particle physics experiments.

Van Hecke learned how to create stained glass during his undergraduate years at Louisiana State University. "I had an artistic background—my father was a painter, so I thought, if I need a humanities credit, I'll just sign up for this," van Hecke recalled. "So in order to get my physics bachelor's, I took stained glass."

Over the course of two semesters, van Hecke learned how to cut pieces of glass from larger sheets, puzzle them together, then solder and caulk the joints. "There were various assignments that gave you an enormous amount of elbow room," he said. "One of them was to do something with Fibonacci numbers, and one was pick your favorite philosopher and make a window related to their work."

Van Hecke continued to create windows and mirrors throughout graduate school but stopped for many years while working as a full-time heavy-ion physicist at Los Alamos National Laboratory and raising a family. Only recently did he return to his studio—this time, to create pieces inspired by physics.

"I had been thinking about designs for a long time. Then it struck me that, occasionally, you see plots that are interesting, beautiful shapes," van Hecke said. "So I started collecting pictures as I saw them."

His first plot-based window, a rectangle-shaped piece with red, orange and yellow glass, was inspired by the results of a neutrino flavor oscillation study from the MiniBooNE experiment at Fermi National Accelerator Laboratory. He created two pieces after that, one from a plot generated during the hunt for the Higgs boson at the Tevatron, also at Fermilab and the other based on an experiment with quarks and gluons.

Physicist Hubert Van Hecke

According to van Hecke, what inspires him about these plots is "purely the shapes."

"In terms of the physics, it's what I run across. For example, I see talks about heavy ion physics, elementary particle physics, and neutrinos, [but] I haven't really gone out and searched in other fields," he said. "Maybe there are nice plots in biology or astronomy."

Although van Hecke has not yet displayed his pieces publicly, if he does one day, he plans to include explanations for the phenomena the plots illustrate, such as neutrinos and the Standard Model, as a unique way to communicate science.

"I hope to make a dozen or more," he said. "As I bump into plots, I'll collect them and, hopefully, turn them all into windows."

Alumnus Scholarship Bequest to Help Future Tigers

Rauch (far left) landed his first research position in the gravitational waves lab of Nicholson Hall in the 1970s with Professor William Hamilton

Dr. Rick Rauch (Physics, '77), an expert in rocket propulsion testing, will provide a $1 million bequest to establish an endowed research scholarship fund for the LSU Department of Physics & Astronomy. A product of the 1960s, Rauch is living his childhood dream as project manager at NASA's John C. Stennis Space Center.

"The U.S. space program was just taking off, so to speak, and that was a big influence on me," Rauch remembered. "Who knows what goes on in a 5-year-old's head, but I just wanted to understand how this stuff works—it's so awesome. That was the background that led me to physics."

A Kenner, La., native, Rauch was also heavily influenced by his undergraduate experience at LSU. He worked with Dr. William "Bill" Hamilton from sophomore through junior year, in the early days of gravitational wave-detection research. Now, the Laser Interferometer Gravitational-wave Observatory and LSU have made four detections of gravitational waves (or ripples in space and time via the collision of two blackholes and two neutron stars), and its leaders have received a Nobel Prize in Physics.

"Word got out that they were looking for people to work in this crazy lab in the basement of Nicholson Hall … One day, I got enough courage to wander down there and talk to Dr. Hamilton. I said, 'I don't have any experience, but I'm willing to learn. I can do whatever you need, even sweep the floor,'" Rauch remembered, calling himself a "mediocre" physics student at the time.

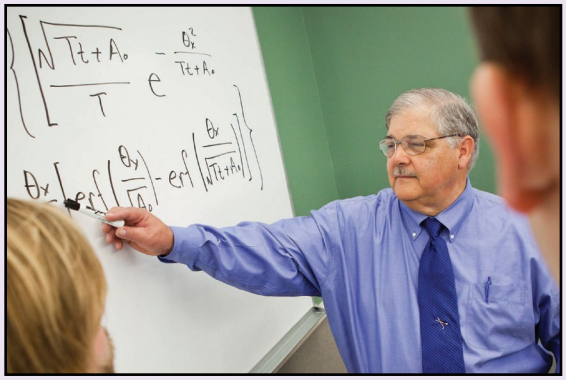
After graduating from LSU, Rauch tackled the "biggest challenge of his life": earning his doctorate in theoretical physics and gravitational theory at Stony Brook University in New York. At the beginning of his career, he relocated to Los Angeles and specialized in nuclear weapons effects and strategic space defense systems against nuclear weapons, ultimately cofounding the Defense Group, Inc. in Washington, D.C. Eventually, he decided to take a leave of absence and earn his commercial pilot's license; that's when his big break happened.

"I kept my application in for NASA all those years. Finally, I got a call from Stennis Space Center after I put my parents' Mandeville address on there because I was without a permanent address. I asked, 'After almost 25 years, why now?' They said, 'We didn't think anyone from California or Washington would want to come down here to Mississippi,'" Rauch laughed. "It's been 17 years, and altogether it's probably been the best job I've ever had."

Currently, Rauch is managing a rocket exhaust capture system project, focusing on processing this exhaust into water and liquid oxygen to support safe ground testing of nuclear rocket engines. He hopes his gift will help students discover their dream jobs, too, by getting their hands dirty through real, meaningful research opportunities.

The future home of LSU's Space Time Institute will seek to capitalize on LSU's unprecedented participation in the detection of gravitational waves, which led to the 2017 Nobel Prize in Physics. If you would like to support LSU research in the Space Time Institute, please donate to the William Hamilton Fund. http://bit.ly/2L9GWLq

Kenneth R. Hogstrom Superior Graduate Student Scholarship



As a highly acclaimed educator and researcher, Dr. Kenneth R. Hogstrom has had a remarkable impact on practice in the field of radiotherapy. He has a passion for graduate education and considers challenging and mentoring graduate students in their research one of his greatest joys. Throughout his 40-year career, Dr. Hogstrom supervised 20 master's and PhD students, served on the supervisory committees of another 35 students, and supervised 12 postdoctoral fellows.

Dr. Hogstrom received his BS in physics and MS in experimental nuclear physics from the University of Houston, and earned his PhD in Experimental Nuclear Physics from Rice University in 1976. He then pursued pion radiotherapy as a research scientist at the University of New Mexico School of Medicine in collaboration with the Los Alamos National Laboratory before assuming a faculty position at the University of Texas M. D. Anderson Cancer Center at Houston. During his tenure, Dr. Hogstrom served as inaugural Chair of M. D. Anderson's Department of Radiation Physics and held the P.H. and Fay Etta Robinson Distinguished Professorship in Cancer Research. He served 20 years as director of the medical physics program at the University of Texas Graduate School of Biomedical Sciences at Houston, where he also served as president of its graduate faculty from 2002-2003.

In 2004, Dr. Hogstrom joined the faculty in the LSU College of Science and Department of Physics & Astronomy, where he served seven years as director of its medical physics program, and in 2007, he was appointed to the Dr. Charles M. Smith Endowed Chair of Medical Physics. This position included a joint appointment as Chief of Physics at the Mary Bird Perkins Cancer Center.

Established in honor of his outstanding research, scholarship and mentorship of graduate students, the Kenneth R. Hogstrom Superior Graduate Student Scholarship will support medical physics graduate students participating in clinical research on radiation oncology at Mary Bird Perkins Cancer Center.

We are pleased to report significant progress in raising funds for this endowed scholarship fund, whose earnings will soon fund each year, in perpetuity, a master's or PhD graduate student to perform cutting-edge physics research benefitting radiation oncology patients.

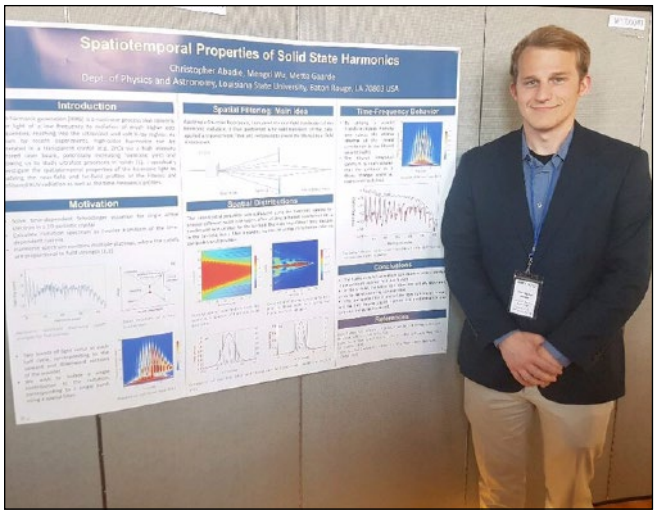
To date, more than 60 individuals or companies have contributed approximately $255,000. Also, in 2017, we were successful in receiving a LSU Board of Regents grant of $120,000 to match our first three increments of $60,000 contributed, resulting in a total of $375,000 raised to date. We are applying for a LSU BOR matching grant ($40,000) for our fourth $60,000 increment in 2018. Once successful, that will bring the amount raised to $415,000. Additionally, the fund has grown by tens of thousands through LSU Foundation investments. Our final push will be to collect another $45,000, which will qualify us for a fifth incremental BOR matching grant ($40,000), allowing us to reach our goal of a $600,000 endowment.

Lorraine and Leon August Student Award

Leon S. August, a renowned nuclear physicist, passed away on Tuesday, Oct. 8, 2013 in Baton Rouge, La. Born and raised in New Orleans, he graduated from Aloysius High School. After an honorable discharge from the U.S. Navy, he received his Bachelor of Science in physics from LSU and then a Master of Science in physics from Tulane University. Leon was awarded his PhD in physics from LSU in 1957. His thesis dissertation was titled 'The Electron Spectra of Cesium-134 and Barium-131,' advised by Professor Max Goodrich.

Moving to Alexandria, Va., he spent his career working at the United States Naval Research Laboratory in Washington, D.C. His research explored beta and gamma ray spectroscopy, basic nuclear physics scattering experiments, microdosimetry, and the study of radiation effects on MOS devices. August was a member of the American Physical Society, IEEE, AAAS, and RESA. In 2003, Leon and his wife Lorraine returned home to the New Orleans and Baton Rouge area.

In 2015, Lorraine and Leon August bequeathed a gift from their estate to support students in LSU's Department of Physics & Astronomy. Recent recipients of the award were named in 2017 to Christopher Abadie, and in 2018 to Rebecca DiTusa.



Christopher Abadie, 2017 Lorraine and Leon August Award recipient

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Private support has always been important in providing the margin of excellence for our students and faculty. In today's challenging economic times, LSU relies even more on our alumni and friends who make a vital investment in the future. Donations to the Department of Physics & Astronomy will be used to enhance our teaching program and facilitate scientific discoveries that shape the future.

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- Kenneth R. Hogstrom Superior Graduate Student Scholarship Fund
- R. Greg Hussey Undergraduate Scholarship for Excellence in Physics
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2018 Commencement with recent graduates on the LSU campus.

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Let us know if you are planning a trip to campus. Tour the Department of Physics & Astronomy, reconnect with former professors and share your career path and LSU experiences with current students. Email Mimi LaValle at mlavall@lsu.edu or call 225-578-2261.