Medical Physics and Health Physics Newsletter

LSU Department of Physics & Astronomy

Mary Bird Perkins Cancer Center

July 2020
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Director's Message

Dear Alumni, Students, Staff, Colleagues, and Friends:

What a year 2020 has been! As you might expect, the COVID-19 pandemic features prominently in this issue of the Medical Physics and Health Physics Newsletter. As a program, we are navigating changes and "new normal" that the pandemic has made necessary. Like most people around the globe, as individuals we are social distancing, wearing face masks, and generally doing what we can to contain the spread of the virus. But there is an unexpected, almost unbelievable story happening mostly behind the scenes. The story can summarized by just three words, "progress continues apace". Allow me to explain.

The story begins with the decision to move all LSU courses online to contain the spread of the virus. Over spring break, all courses being taught in the spring semester were transitioned online. The campus was then shuttered and most faculty and staff were asked to work from home. The transition to online instruction is working because the faculty are intensely committed to their students and because the entire university is united in purpose. We are now busily transitioning our fall courses online. LSU is gradually reopening the campus, but at this writing most are still working from home.

The next major chapter in this story is the resumption of instruction. This had to be done in high gear, using Zoom for videoconference lectures and Moodle course web sites. Together, faculty and students worked through technical glitches, overcame or worked around feelings of isolation, and just generally got on with their tasks at hand. I am not surprised, but still pleased to share that all of our students successfully finished their spring courses.

Mind you, finishing a course was hard enough, but consider writing and defending an original research thesis from your kitchen table! I am so proud of our students because they remained engaged, proactive, and highly motivated. This year, no fewer than TEN students completed their degrees, an all-time record for our program. As in previous years, each graduate successfully competed for their next position of choice, including residency or doctoral training, or an entry level professional position.

In higher education, we sometimes speak of "teaching and learning" to distinguish these separate but tightly coupled activities. In a typical classroom setting, faculty teach and students learn. In a typical research setting, these faculty and students frequent teach and learn from one another. In both settings, the teamwork and dedication of our faculty and students produced uniformly excellent educational outcomes.

Other aspects of the program remain healthy and stable. Our researchers authored more than 13 peer-reviewed scientific articles, and our students and faculty continued to receive awards, honors and extramural funding. Among these, Dr. Joyoni Dey, our most recently tenured faculty member, received a research grant from the National Science Foundation for advanced multiple-contrast imaging. Plus, we will have 26 students enrolled this fall.

In this issue, our major feature story honors Dr. Charles M. Smith, a longtime benefactor of our program. His support has been instrumental in its ascendency in quality and national reputation. We are also pleased to announce the first two students to receive the prestigious Dr. Kenneth R. Hogstrom Superior Graduate Student Award. The award honors

Dr. Hogstrom, who is internationally known for his outstanding career and scientific contributions to radiation therapy. If you already contributed to the Hogstrom Scholarship fund, thank you. If you have not, there has never been a better time to do so. Nationally, the COVID pandemic has decreased resources available for higher education. Your contribution, whatever the amount, will have a large positive impact in the education of one of our students. Please see the back page for quick and easy instructions and make your donation today.

Stay healthy and stay in touch!

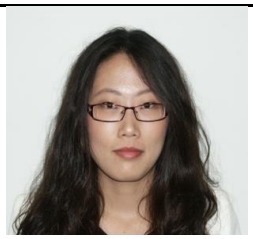
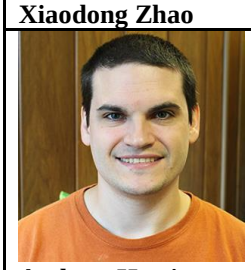
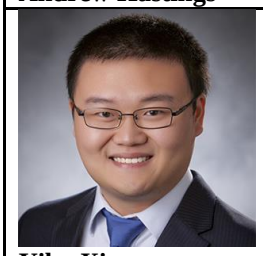
Wayne Newhauser

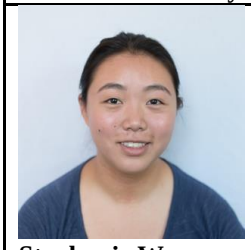
Contents

1 Trainee Milestones

1.1 Graduations

2020 is an all-time record year for the Medical Physics and Health Physics Program; with 10 students having completed their degree requirements! Of these, five earned a PhD degree in Physics with concentrations in Medical Physics. The other five earned an MS degree in Medical and Health Physics; of these, four with a concentration in Medical Physics and one with a concentration in Health Physics. Most graduates will enter a medical physics residency training program, including those at prestigious institutions like the Mayo Clinic in Minnesota, The University of California San Francisco, and Willis-Knighton Cancer Center in Louisiana. Our Health Physics graduate will begin a position at the prestigious Sandia National Laboratory in New Mexico. Additional details on our recent graduates and their future plans are listed in the table below. Please join us in congratulating our recent graduates and in wishing them well in all their future endeavors! To our newest alumni, please stay in touch.

Graduate	Advisor	Thesis/Dissertation Title	Defense Date	Degree/ Concentration	Next Position and Location
 **Xiaodong Zhao**	Rui Zhang	Accurate Tracking of Position and Dose during VMAT based on VMAT-CT	03/03/2020	PhD – Medical Physics	Therapeutic Residency at University of Alabama at Birmingham, AL
 **Andrew Hastings**	Wei-Hsung Wang	Evaluation of Neutron Skyshine Contributions During Injection at an Electron Synchrotron Facility Using FLUKA	03/04/2020	MS – Health Physics	Health Physicist at Sandia National Laboratory at Albuquerque, NM
 **Yibo Xie**	Rui Zhang	Comprehensive Investigation of Radiation?Techniques for Whole Breast and Post-mastectomy Irradiations	03/05/2020	PhD – Medical Physics	Therapeutic residency at Duke University Medical Center in Durham, NC
 **Jingzhu Xu**	Joyoni Dey	X-ray Interferometry Without Analyzer for Breast CT Application, a Simulation Study	03/10/2020	PhD – Medical Physics	Therapeutic residency at University of Maryland School of Medicine

 **Audrey Copeland**	Jonas Fontenot	Analytical Setup Margin for Spinal SBRT based on Measured Errors	04/29/2020	MS – Medical Physics	Therapeutic residency at Thomas Jefferson University Hospital in Philadelphia, PA
 **Krystal Kirby**	Owen Carmichael	Applications of Advanced Structural and Functional MRI Methods	04/30/2020	PhD – Medical Physics	Imaging physics residency at Mayo Clinic in Rochester, MN
 **Phillip Wall**	Jonas Fontenot	Towards Optimizing Quality Assurance Outcomes of Knowledge-based Radiation Therapy Treatment Plans Using Machine Learning	05/06/2020	PhD – Medical Physics	Therapy residency at University of California at San Francisco
 **Troy Jacobs**	Kip Matthews	Visualization of Brown Fat using X-ray Dark Field Imaging	05/22/2020	MS – Medical Physics	Therapy residency at Willis-Knighton Cancer Center, Shreveport, LA
 **Andrew McGuffey** **Andrew McGuffey**	Justin Sick	Log File-Based Dose Reconstruction to Moving Targets during Lung Stereotactic Body Radiation Therapy	05/28/2020	MS- Medical Physics	Begin PhD with Dr. Carver
 **Stephanie Wang**	Robert Carver	Benefits of Continuously Spaced Energies and Scanned Beams for Electron Bolus Conformal Therapy for Left-Side Post-Mastectomy Chest Wall	06/16/2020	MS – Medical Physics	Therapy residency program at Henry Ford Health System, Detroit, MI

1.2 Alumni News

Please join us in congratulating our alumni on reaching their most recent career milestones.

1. Elizabeth Hilliard (MS 2018) completed the residency program at the Medical University of South Carolina, and she will start as a full-time medical physicist at Upstate Cancer Center in Syracuse, NY in July, 2020.
2. Joe Steiner (PhD 2018) completed a nuclear medicine physics residency at the Henry Ford Hospital in Detroit. He will begin the position of "Imaging Physicist and Associate RSO" at Maine Medical Center in Portland, Maine, in July, 2020.
3. Addie Barron (MS 2018) completed the residency program at the Mary Bird Cancer Center. She will go to Beth Israel Deaconess Medical Center in Boston, MA, in August, 2020.
4. Tony Mazza (MS 2015) accepted a new position as a physicist in the Department of Radiation Oncology at the Tulane University School of Medicine.

2 Featured Stories

2.1 Dr. Charles Smith, Happy 90th Birthday

By Ken Hogstrom and Ann Marie Marmande. May, 2020

Dr. Charles M. Smith has led a distinguished and demanding career in medicine and public service. Dr. Smith is a native Louisianan, an LSU graduate, a family practitioner, a cancer survivor, and a philanthropist to Louisiana, LSU, and our LSU-MBPCC Medical Physics and Health Physics Program. His caring and benevolence have helped our program become one of the premier medical physics education and training programs in the world. He is our longtime partner!

Dr. Charles M. Smith was born August 24, 1930, in Bogalusa, located in southeast Louisiana on the Pearl River, which borders Mississippi. His father, Miah Smith, was a postmaster, and his mother, Viola Jenkins Smith, a schoolteacher, in nearby Franklinton. Before Dr. Smith's birth, they moved 20 miles to Bogalusa for work. Bogalusa was a sawmill and paper mill town of about 14,000 people at the time. Both parents were very involved with charities and schools, but they never gave up their roots in Franklinton and eventually retired there.

Childhood

Dr. Smith grew up during the Great Depression and World War II, experiencing challenging times for our country. When the YMCA opened a facility next to the paper mill, he spent his early after school years involved in gymnastics, woodworking, swimming lessons, pocket billiards, bowling, and various team sports. As he got older, he swam in gravel pits, waterskied, and hunted and fished with friends and family. Dr. Smith was also active in Boy Scouts, where he went on camping and bike trips and worked on projects like drawing a map of the city.

Family life was important in those hard times. Dr. Smith remembers playing board games and learning how to play gin rummy with his dad and his mother's cooking. There were no big parties or dinners during the Depression, except for church gatherings or his parents' canasta group get-togethers.

When WWII began, Bogalusa's large paper mill company with its seven big paper machines was vital. Dr. Smith worked every summer, usually the midnight shift, in the paper mill's auto parts store, where the big pulpwood trucks were repaired. He started out as a delivery boy.

Bogalusa was extremely patriotic during the war. To support the war, his family had a victory garden, and he remembers metal scrap drives during grammar school that played a significant part in the war efforts.

Interest in Medicine

As for many, key life events helped direct Dr. Smith's career path. His fascination with hospitals began at an early age, when his paternal grandfather sadly had an unfortunate, fatal accident. Also, Dr. Smith remembers always having an interest in senior people. He often visited an elderly neighbor who had been a doctor in the horse and buggy days. He was intrigued by the stories about saddlebags, filled with medicine, that were made for the doctors who rode horses to make house calls. Back then, he said it was common for doctors to perform procedures in the patient's home. Dr. Smith recalls relatives and friends having surgeries and deliveries at home, even watching a doctor and nurse take an operating room table into a kitchen to perform a simple procedure. Many people back then didn't go to hospitals unless it was a life or death situation.

LSU College of Science

Dr. Smith was inspired to attend college by several of his high school teachers, especially those who taught him chemistry and Latin. The Latin teacher was a graduate of Southwestern College (now Rhodes College) in Memphis, Tennessee, and that's where he wanted to attend school with a friend, but it was too expensive. However, to his credit, he received academic scholarships to LSU.

He arrived at LSU in 1947 with the goal of becoming a physician and received his B.S. in biological sciences in 1951. Dr. Smith didn't think his parents were prepared for his decision to be a doctor because of the many years of school it would take to achieve his career goal. Also, his family was involved in the forestry and timber businesses and thought their son would follow that path. But, it was medicine that Dr. Smith wanted to study, and practicing family or country medicine appealed to him.


Dr. Charles Smith graduation photo in annual Gumbo (1951).

When he entered LSU, there were two student age groups, those right out of high school like Dr. Smith and those returning to the classroom after WWII. At this time, service in LSU's Reserve Officer Training Corp (ROTC) was required, and Dr. Smith served in the Army ROTC his freshman and sophomore years. During that time, he lived in the small dorm rooms under Tiger Stadium, and in his final two years, he lived in the Kappa Sigma fraternity house, where he was social director his senior year. At LSU, he attended football games and parties, attended church, and occasionally enjoyed plays and his first opera. He was a good student and made A's in most subjects, but not in chemistry and physics.

Medical Training

Upon graduation from LSU, Dr. Smith applied for medical school to LSU and Tulane University and was accepted by both. He chose LSU in New Orleans. While in medical school, he worked summers, including being a counselor and camp doctor in Sewanee, Tennessee after his junior year.

He also spent a one-year coveted internship in Shreveport, Louisiana in internal medicine, obstetrics, and general surgery, working shifts of 36 hours on and 12 hours off. When he completed the internship, he went home to Bogalusa for a much-needed vacation and wound up working in a family practice doctor's clinic.

Dr. Smith completed medical school in 1955 and immediately enlisted in the U.S. Air Force's Flight Surgeon Program. He was first stationed in Montgomery, Alabama for a rapid three-month review of requirements that had to be met by a flight surgeon. He spent the next 21 months overseas in the Azores (islands off the Portugal coast). The Hungarian Revolution was occurring at this time, and many refugees from Budapest were being transported through the Azores to the United States. There, while planes refueled, people requiring medical care were treated at a local hospital wing. The U.S. base there

had around 5,000 people, and the doctors provided care for sick families, including the delivery of babies and minor surgery. Dr. Smith considered the Azores special, as he had Portuguese relatives on his father's side who had homesteaded land in Franklinton.

Family Practice in Sulphur

After completing his military duty, Dr. Smith started a rotating residency program in family practice in Lafayette, Louisiana in 1957. Halfway through, he was recruited for a family practice in Sulphur – that had been there since 1927 – after one of its doctors died suddenly. Sulphur, which is located in Calcasieu Parish, Louisiana, had a shortage of doctors, and the residency program allowed him to take the position in January 1959.

Dr. Smith at the time of his family practice, circa 1970.

A typical family practice day was a full one. Dr. Smith had walk-in appointments in the mornings and afternoons and headed out in the late afternoons to make house calls both in town and in surrounding rural communities. Later, he expanded the practice to include industrial medicine and chemical dependency. Throughout his career, Dr. Smith was highly respected as a skilled medical practitioner and for the kindness and care he gave his patients.

Calcasieu Parish Coroner

Motivated to improve the Calcasieu Parish Coroner's Office, Dr. Smith ran for office and was elected Calcasieu Parish Coroner in 1975. He held this office for more than 20 years, serving the community with honor and dignity. During his tenure, a state-of-the-art morgue was built, with a large autopsy area, conference rooms, and offices. His office managed postmortem examinations and laboratory tests to determine the cause, manner, and circumstances of death, pauper burials, exhumations, and emergency psychiatric care.

Dr. Smith's Country Home

Dr. Smith lives in a beautiful country setting north of Sulphur. He purchased the 100-acre property in the early 1970s as it reminded him of the terrain where he grew up. A winding country road leads visitors about a quarter mile off the main entrance to his home, which also includes a guest house and pool. The main house was designed by Louisiana architect A. Hayes Town, who is well-known for his residential designs that used recycled wood and other materials and were influenced by the state's Spanish, French, and Creole history. Dr. Smith enjoyed the design and construction of his home, has taken pride in its landscaping, and kept quarter horses on the property.

Left: Backyard view of house, Dr. Smith with Ken Hogstrom.

Right: Sitting room inside house, Dr. Smith with Janet Hogstrom.

Service and Philanthropy

In addition to serving as a physician, Dr. Smith has supported his community through his generosity and many volunteer commitments over the years. He was a Rotarian and directed the parish heart drive fund, polio drive, and immunization programs.

After retirement, his philanthropic efforts to his community have been inspirational. Dr. Smith is a benefactor to the Methodist Children's Home of Southwest Louisiana, which provides assistance to adolescents with various needs. He never forgot that some of his fellow students were unable to afford college, so he has funded several scholarships for local students interested in medicine at McNeese State University in Lake Charles, Louisiana. Devoted to the Arts, he served on the board of the Imperial Calcasieu Museum, and he donated medical furniture and equipment from that original 1927 practice to Sulphur's Brimstone Museum.

Dr. Smith planning American Heart Fund Campaign with Charlotte Vincent (L) and Mavis Ivey (R), circa 1975.

However, the hallmark of Dr. Smith's generosity includes his alma mater LSU, its College of Science, and most specifically, our LSU-MBPCC Medical Physics and Health Physics Program in Baton Rouge, Louisiana. In 2006, he teamed with the Mary Bird Perkins Cancer Center and the Louisiana Board of Regents to create the $1 million endowed Dr. Charles M. Smith Chair in Medical Physics in the Department of Physics and Astronomy. This gift has cultivated other significant contributions to our program, making it one of the premier medical physics programs in the world for providing highly qualified and trained medical physicists to Louisiana and throughout the United States. Dr. Smith's gift was motivated by care provided by medical physicists, who were an integral part of his team of health care professionals at the Mayo Clinic in Rochester, Minnesota, to the radiation therapy he received there for his cancer treatment. Now, the gift has come full circle as several of our LSU program's graduates work in the radiation therapy facilities at the Mayo Clinic.

Dr. Charles Smith with LSU-MBPCC Graduate Students in December 2006 (L-R): Front Row Ricky Hesston, Koren Smith, David Perrin, Natalie Lonsberry, Dr. Charles Smith, Shima Ito, Olivier Blasi Back Row Jason Matney, Will Hill, Scott Oves, Allen Beardmore, Todd Racine, Jabari Robinson, John Eley, Chad Robertson, Justin Vinci, Chris Welch.

Although Dr. Smith never relocated to his hometown, he wanted to contribute something to that area. His involvement with the LSU-MBPCC Medical Physics and Health Physics Program has done that, as the Mary Bird Perkins Cancer Center, with its main facility in Baton Rouge and satellite facilities in Hammond, Covington, and Houma, provides quality medical care throughout southeast Louisiana. Dr. Smith's investments in the LSU-MBPCC Program have had a critical role in advancing health care in this area of Louisiana—with broad implications for communities around the world. He has ensured the continuation of his longstanding legacy by including the program in his estate plans.

Dr. Smith has been recognized for his philanthropic leadership and commitment to LSU. He has been inducted into the College of Science's Hall of Distinction (2009) and the LSU Alumni Association Hall of Distinction (2017). His life is a model and inspiration to all, and he will always be part of our Program!

December 2006 Luncheon at LSU Faculty Club Celebrating Creation of Smith Chair (L-R): Front Row Lynn Weill (MBPCC Chief Development Officer), Mary Lou Applewhite (Former Classmate and Friend), Dr. Charles Smith, Louis Curet (MBPCC BOD), John Barton Jr. (MBPCC Foundation BOD), Bob Greer (MBPCC BOD), Ann Marie Marmande (LSU Foundation, College of Science) Back Row Harold Silverman (LSU Outgoing College of Science Dean), Todd Stevens (MBPCC President & CEO), Ken Hogstrom (Director, Medical Physics Program), Kevin Carman (LSU College of Science Dean), Sean O'Keefe (LSU Chancellor), Roger McNeil (LSU Dept. of Physics & Astronomy Chair), Paul Nowacki (MBPCC Chief Financial Officer), John Gibbons (MBPCC Chief of Clinical Physics). (titles at time of 2006 luncheon).

Smith Chair Benefits Medical Physics Program

Dr. Smith with Dr. Wayne Newhauser, current holder of the Dr. Charles M. Smith Chair of Medical Physics.

The Dr. Charles M. Smith Chair in Medical Physics in the LSU Department of Physics and Astronomy is currently held by Professor and Program Director Wayne Newhauser. Dr. Newhauser's focus has been to enhance the LSU-MBPCC Medical Physics and Health Physics Program, using the approximately $45,000 annual earnings from Dr. Smith's endowment to fund important, strategic investments in research and opportunities to prepare students for success in this field. Each year, usually one full or partial student stipend provides funding for innovative graduate student research, which often seeds new research directions. Also, it has supported student research by helping fund travel to collaborating research institutions and laboratories and to external courses teaching complex research methods, such as Monte Carlo calculations. The funds also have helped support important programmatic expenses such as travel for student recruitment and practice exams to prepare students for future certification by the American Board of Radiology. The Dr. Charles M. Smith Chair in Medical Physics is a program lifeline, which has been instrumental in the LSU-MBPCC Medical Physics and Health Physics Program becoming one of the premier programs in the world.

2.2 LSU Professor Featured on Fox News for Professional Protective Equipment Efforts During Covid-19 Pandemic

Reproduced from the LSU Daily Reveille, by Jacob Mathews
April 28, 2020.

LSU Medical Physics Program Director Wayne Newhauser was interviewed on Fox News' "FOX & Friends First" to discuss the University's efforts to produce ventilator parts and personal protective equipment (PPE) for healthcare professionals on the front lines of the COVID-19 pandemic. The live interview was broadcast nationally on April 20, 2020. Fox News picked up the story as a part of a series titled "America Together" which highlights stories of communities performing acts of volunteerism and heroism to uplift viewers, according to Carolina Chao of Fox News.

Newhauser started these efforts in his garage as the LSU campus was closed. Scores of volunteers from LSU and the Louisiana community performed research and development on a highly compressed time scale. As the initiative grew, additional leaders stepped forward to scale up the scope and pace of production. Trey Bowman from the Bella Bowman Foundation, Greg Trahan from the LSU ORED, and Ross Reily from Lamar Advertising helped launch the system into being mass produced on the LSU campus.

Examples of PPE include gowns, face masks, ventilator parts, shields and other types of protective gear. By the time the mass production facility was shut down, more than 20,000 gowns had been produced.
When Newhauser started late March, he was assisted by volunteers, including students, faculty, staff, neighbors, and family members. Students enjoyed the opportunity to be involved in a real-world learning experience, with many of them contributing to the research and development at home to limit the number of volunteers present in any one area.

As production grew, the efforts were moved to campus and work was performed by LSU employees.
Newhauser and many other Louisiana residents believe this is the way Louisiana responds to a crisis, and that brings out the best in people. "Louisiana was settled by people were both extremely self-reliant but also community-oriented, and situations like this showcases these enduring strengths," Newhauser said.

2.3 Understanding the Physics of Neutrons can be Key to Improving Hip Replacement Surgeries

Reproduced from an article by Elsa Hahne, LSU Office of Research & Economic Development

February 16, 2020

“First, let me tell you about X-rays. Ordinary X-ray machines will only find attenuation, or gradual absorption, of X-rays as they pass through the body. So, all you see is that difference in attenuation contrast. But as the X-rays move through the body, they’re also going to phase-shift and scatter. For X-ray scatter we mainly consider elastic small angle scatter (SAXS) and in-elastic Compton scatter. The Compton scatter in the context of X-ray interferometry basically just degrades the image contrast. The small-angle scatter, on the other hand, can give us a lot of information, and it would be great if we could capture all of this useful information—including the phase-shift and small-angle-scatter—and not just the attenuation.

My work here at LSU has been on developing these extra two modalities, phase-shift and small-angle scatter, and a novel phase-contrast X-ray system using special grating-based interferometry. We will potentially obtain these multiple-contrast (attenuation, phase-shift, and small-angle scatter) images using the same X-ray dose.

There is a big difference between X-ray and X-ray-interferometric imaging. If a patient stands in front of a regular X-ray machine, you’ll see “shadows” of the internal organs in their body. But it is different for grating-based X-ray interferometry. What you’ll see instead are interference patterns, which are attenuated, shifted, and locally distorted by the three phenomena of absorption, phase-shift, and small-angle scatter of X-rays as they travel through a patient’s body. And then, from those interference patterns in comparison with a blank reference scan without a patient, we can derive the attenuation, phase-shift, and scatter images.

In traditional X-ray attenuation images, a radiologist may not see much difference between a healthy patient and another with emphysema or cystic fibrosis. But if you look at a small-angle scatter image, the diseases are well-differentiated. These scatter images can also detect lung tumors much better than attenuation images. So, having both scatter and attenuation images will help. That’s where we’re heading. Hopefully, future X-ray machines will have all three of these complementary modalities.

If you toss two pebbles into a pool, you’ll see waves generated from each; constructive and destructive patterns on the surface. That’s interference. If you add a grating—sort of like a sieve pattern—in front of the neutron (or X-ray) beam, you get a corresponding expected pattern, depending on the distance. When you add an object, the pattern will change. It will attenuate, phase-shift, and locally distort (analogous to X-rays) the interference pattern. Again, (analogous to X-rays) we can derive attenuation, phase-shift, and elastic scatter from the object by comparing and analyzing the interference pattern with and without the object. We can then infer information about the object, and very accurately, at high resolutions.

Now, to our main topic—neutrons. Neutrons can be defined as particles as well as waves, and you have similar absorption, phase-shifting, and elastic and in-elastic scattering effects. We’re mostly interested in the elastic scatter, as well as the attenuation and phase.

Neutrons have already been studied as particles, including how much they attenuate and scatter. Several computer simulation packages exist for simulated neutron particle beams. But we’re going to add the phase-shift to that mix, adding a phase analysis after a random or Monte-Carlo-based absorption and scatter analysis.

So far, very few researchers have looked at the phase-shift of neutrons together with absorption and scatter. To do this, we first propose to make the neutron particle beam coherent, and then for each particle, calculate the path-lengths between each interaction and use these path-lengths to compute the phase shifts of the waves.

To summarize, my team's contribution here will be to add the phase-shifting to the already known simulators for attenuation and scatter. This will be useful for the National Institute of Standards and Technology (NIST), Oak Ridge National Laboratory, and neutron researchers at other places.

If you toss two pebbles into a pool, you'll see waves generated from each; constructive and destructive patterns on the surface. That's interference. If you add a grating—sort of like a sieve pattern—in front of the neutron (or X-ray) beam, you get a corresponding expected pattern, depending on the distance. When you add an object, the pattern will change. It will attenuate, phase-shift, and locally distort (analogous to X-rays) the interference pattern. Again, (analogous to X-rays) we can derive attenuation, phase-shift, and elastic scatter from the object by comparing and analyzing the interference pattern with and without the object. We can then infer information about the object, and very accurately, at high resolutions.

With this new EPSCoR grant, we will collaborate with NIST and their Center for Neutron Research in Maryland. I will be going up there soon (March/April) and then for the whole summer, and one of my students will also work on the project and travel there. Hopefully, it will amount to his PhD work.

So, why do we want to study neutrons? They probe deeper. They interact relatively weakly with metal compared to X-rays. They interact strongly with hydrogen or oxygen. For medical applications, this is useful, as neutrons will be better for imaging bone-metal joints, where X-rays would lead to strong metal artifacts. Neutrons give high-quality information about surfaces, and they are very useful for looking at bone-metal implants, such as hip replacement joints. We hope to get samples from the LSU Vet School. Now, I have to be clear—you cannot use neutrons for imaging patients due to high radiation concerns. It will not be used for in-vivo imaging anytime soon. But materials scientists can use neutrons and neutron interferometry to look at tissues and metal-tissue interfaces ex vivo; and this could teach us a lot about metal implants in the body.

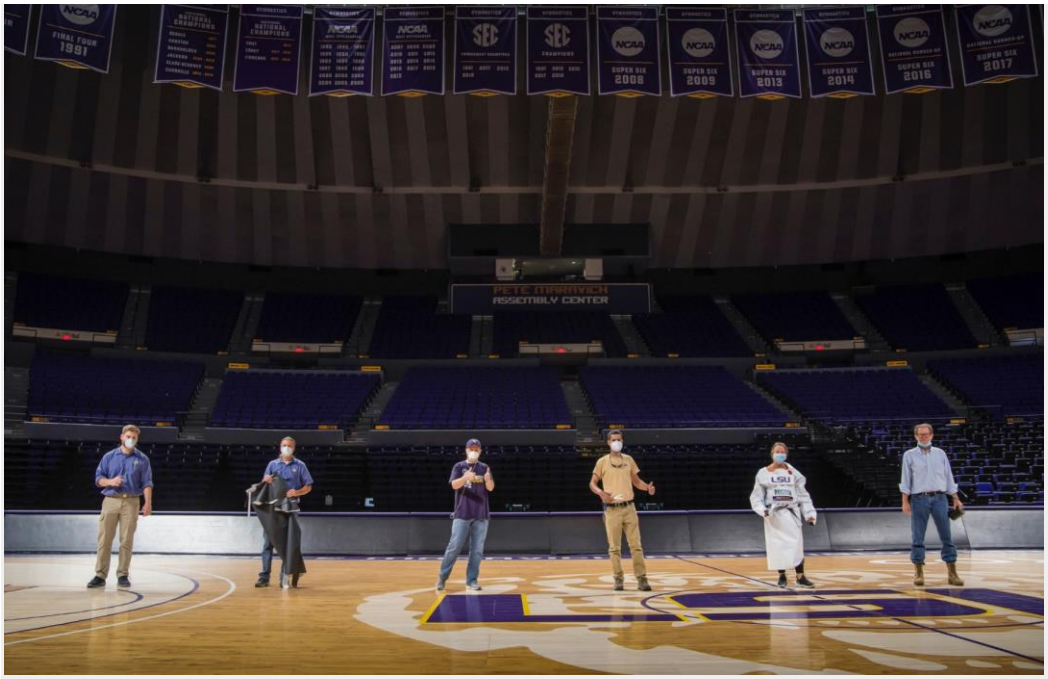
There are three key benefits of the work we're doing: One is determining the grating and detector distances that will bring the best visibility and sensitivity; when we build a simulator, this will help other researchers who work in this field. Number two, we will explore different dual gratings, some borrowed from Professor Butler's lab at LSU and see what results we get. Third, we hope our bone-metal imaging techniques can help improve the success rate of hip replacement surgeries around the world, and contribute to the knowledge of materials scientists who make hip replacements. Hip replacements are one of the most popular and fastest growing elective surgeries. But about five percent fail, and this is something we hope to help scientists reduce. If we get a sample from a failed surgery, we can see what went wrong; for example, if it cracked, how, where, etc. If we can help scientists make the interface between metal and bone more stable and more secure for the rest of a patient's life, they don't have to return to the hospital or do the surgery again."

2.4 Protecting the Protectors: LSU Kicks Off PPE Manufacturing in PMAC

Reproduced from an article by Ernie Ballard, LSU Media Relations
April 13, 2020

With support from the State of Louisiana, LSU began large-scale production of personal protective equipment, or PPE in the Pete Maravich Assembly Center, or PMAC, as part of its statewide response to support medical professionals on the front lines of the COVID-19 pandemic. The PMAC PPE production effort unifies LSU's

innovation, research, expertise, assets and facilities into a single purpose-driven initiative: Protecting Louisiana's doctors and nurses through bold and creative efforts to fill shortages in critical equipment, specifically gowns and face shields.



LSU has begun large-scale production of personal protective equipment (PPE) inside the Pete Maravich Assembly Center (PMAC).
Photo Credit: Yao Zeng

The entire LSU community is working together to support Louisiana's fight against COVID-19. Activating the PMAC in the very heart of campus as a medical emergency operation—as it was when LSU cared for victims of Hurricane Katrina 15 years ago—and developing a novel and safe production environment underscores LSU's complete commitment to its statewide mission.

Within the PMAC, LSU employees are actively working with physicians in New Orleans and Shreveport to develop and produce two types of critically necessary PPE: Heavy-duty, reusable gowns made from billboard vinyl donated by Lamar Advertising and Circle Graphics, and face shields with donated materials and design feedback from Baker Hughes.

"At every pivotal moment in our history, the LSU community has come together for the good of our state and our nation," said LSU Interim President Tom Galligan. "What's happening today is an example of our university's unwavering commitment to providing solutions to the most challenging problems facing society. I am proud of the outstanding and innovative work being conducted by our faculty, staff and students in the face of such great adversity."

"We are proud to see the response being rallied at LSU," said Louisiana Gov. John Bel Edwards. "Not only is the flagship ramping up PPE production and testing capabilities, but the Health Sciences Centers in New Orleans and Shreveport are doing a phenomenal job of treating and testing as well. The entirety of the LSU family has responded to this health crisis and are making a difference for the people of Louisiana through their innovation and commitment."

The **gown project** began in the garage of LSU Medical Physics Program Director Wayne Newhauser. Working with Biomedical Engineering student Meagan Moore and in partnership with the Bella Bowman

Foundation, Newhauser began developing prototypes for gowns and other PPE as shortages of the important gear made headlines across the nation. The university's COVID-19 response team assessed the gown design and determined it could be scaled, and under the directive of Interim President Tom Galligan, began assembling a cross-campus team to bring the operation to reality.

Staffed entirely by LSU employees, the PMAC operation will rely on comprehensive security and health measures as well as close coordination with the Governor's Office of Homeland Security and Emergency Preparedness, or GOHSEP, to ensure the safety of its people and the production environment. University personnel from Athletics, Facility Services, Environmental Health and Safety, Emergency Operations, Industry Engagement, and Research & Economic Development collaborated to turn the PMAC into a safe, real-scale fabrication space.

The PMAC effort is made possible through expertise across campus: The Theater Department donated sewing machines and helped adjust the design of the gowns to fit the recommendations from GOHSEP and physicians; Facility Services worked with the College of Engineering's Advanced Manufacturing and Machining Facility, or AMMF, to fabricate custom metal stencils for the gown's creation; Athletics is facilitating the use of the PMAC and supporting logistical and communications efforts; and Environmental Health & Safety designed a safe and operational space that facilitates scaled production. A further example of community partnership in the project includes Coca-Cola, Baton Rouge, donating drinks for those working in the PMAC each day. As output expands, LSU will continue to bring expertise from every area of campus as well as new partners to support new initiatives.

"Crises like the one we face today illustrate why research universities exist," added Galligan. "We will make it through this pandemic by working together and ensuring that LSU's efforts from Shreveport to New Orleans make it to those on the front lines of this fight."

For those interested in supporting this effort, donations can be made at **http://c-fund.us/rhl**.

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Beyond PPE production, LSU's collective COVID-related efforts to date have been wide-ranging and extensive, including:

- Establishing coronavirus testing facilities at LSU Health Sciences Center in Shreveport, LSU's School of Veterinary Medicine's River Road Laboratory, and LSU Health Sciences Center in New Orleans.
- Initiating clinical trials measuring the safety and efficacy of drugs like hydroxychloroquine and potential treatments like inhaled nitric oxide against the virus;
- Coordinating PPE collection and donation from LSUA, LSUE, and LSUS;
- Facilitating extension, outreach and education through LSU's Pennington Biomedical Research Center and the LSU AgCenter; and
- Funding and managing rapid innovation in gown and shield PPE design, UV-based mobile sterilization technology, and large-scale hand sanitizer production in Baton Rouge.

2.5 Combatting Covid-19 by Creating Masks, Ventilator Parts

Reproduced from an article by Libby Haydel, LSU Communication specialist
March 30, 2020

LSU Biomedical Engineering senior Meagan Moore is never one to back down from a challenge, especially if it means helping others (**she created a cancer model to help personalize treatment last year**). So, why would the coronavirus pandemic be any different?

Working alongside LSU Medical Physics and Health Physics Director Wayne Newhauser, emergency room physician Tom Fox, two LSU physics students, and members of the community, Moore is once again helping those in need by creating face masks, ventilators, and face shields for nurses and doctors working with COVID-19 patients at LSU Health in New Orleans.

Before Moore got the call to help create a ventilator prototype less than a week ago, she and her mother Kathryn Moore were knee deep in looking at patterns and sewing face masks for the nurses and doctors in New Orleans who are treating patients with COVID-19, the disease caused by the coronavirus. Moore and Kathryn, who has two degrees in the fashion and textile merchandise field, followed a mask pattern they found online that was designed by a hospital chain. They, along with other experienced seamstresses, found the pattern difficult to follow, so they improvised.

Their mask consists of two layers of tightly woven cotton sewn together with elastic bands that go over the ears. Once elastic became hard to come by, Kathryn got creative and used elastic bands from old Mardi Gras ball masks.

“Ideally, the mask is going over an N-95 mask to provide additional protection so the N-95 can continue being used,” Moore said. “Our masks can be sterilized appropriately at the hospitals because most people aren’t going to use or don’t have the level of disinfectant needed at their house.”

So far, Kathryn has sewn more than 130 masks, with each one taking 30 to 45 minutes to sew.

“My mom has been very meticulous with the details,” Moore said, to ensure they are effective and comfortable. Each mask is individually packaged and were delivered to Ochsner Hospital in Kenner on Saturday.

In the midst of her mask endeavor, Moore received a call from Newhauser asking if she could help him create a ventilator part for COVID-19 patients in New Orleans. Seeing the dire need for more ventilators should the number of COVID-19 cases continue to increase, Moore said yes without hesitation.

Moore and Newhauser, who is also a professor in LSU’s Department of Physics & Astronomy, are working directly with local respiratory specialists, medical physicists, and engineers to fabricate ventilator parts and a variety of personal protective equipment for healthcare personnel in Louisiana.

“We’re doing a lot of telecommunicating with doctors,” Moore said. “We’re currently doing 3D prints with base stock because the hospitals have gotten to the point where they are desperate and we’re trying to push things through. Certain companies have done copper printing but it’s extremely slow and expensive. Our 3D-printer material is PLA (polylactic acid) but we could possibly move up to another type of material.”

An LSU resident emergency room physician picked up prototype ventilator pieces from the LSU team on Saturday for inspection and evaluation. LSU Physics student Maxwell Cole and LSU Renewable Natural

Resources alumna Cathlin Disotell are assisting Newhauser and Moore; all are working in Newhauser's garage while practicing social distancing.

"We've contacted multiple filter companies to ask questions like, 'Where can we get this filter right now?,'" Moore said, "and realize, 'Oh, it's made in China.' One thing I read is that one single country cannot produce a ventilator on its own. All of the different parts come from different countries. That was eye-opening. We're seeing a stopgap like never before. You don't have time to do full-on testing and hit it with everything a lab could do."

While the team is working on prototyping ventilator parts, it is also prototyping field-expedient face shields with help from LSU Chemical Engineering Research Specialist Nick Lombardo and St. Joseph's Academy, who loaned Moore its laser cutter, 3D printer, and some of the initial material used for prototyping.

"I was using a laser cutter to make an acrylic template for people to make their own face shield using cardboard that would go on their head and a clear plastic document protector to staple onto it to protect against initial droplet exposure," Moore said.

A local surgeon, Dr. John Faust of Baton Rouge Orthopedic Clinic and Our Lady of the Lake Children's Hospital, is assisting the team in prototyping protective gowns, which are in short supply. The LSU COVID-19 response team is exploring production and other business logistics, including collaboration with local industry and possible public private partnerships.

"Our goal for today is to figure out how to make gowns of reasonable quality from materials and tools that are readily available," Newhauser said. "Soon, we will hand off to other teams to scale up training of workers and production of the gown."

Additionally, the team is coordinating with LSU personnel on the COVID response to explore scaling of the instruction and materials to create a community effort.

Though the team has not yet been asked to create a ventilator splitter, which would allow more than one patient to use a ventilator at the same time, Moore has unsurprisingly started creating one because, "it seems like that's the direction things are going to go," she said.

Though being under quarantine may cause many people boredom and stress, Moore seizes every free moment of it to make a difference.

"I really don't get exhausted from doing this kind of stuff," she said. "It can wear a lot of people down. I like helping people and this is unlike any other scale of being able to help, other than [Hurricane] Katrina, which was the most horrible thing I can think of. I'm happy to show up and throw whatever I have at it. We have a lot of brilliant people on our project and we're really fortunate to have the opportunity to help others."

"In the war on COVID-19, our modern-day equivalent of Rosie the Riveter is 'Meagan the Maker,'" Newhauser said. "She exemplifies the spirit and engagement of LSU's students."

Newhauser also noted the outstanding support and leadership of the LSU administration in deploying its arsenal of academic resources to help healthcare workers.

2.6 LSU 2020 Inspire Award Winners Meagan and Max

Reproduced from an article by LSU Ethics Institute
May 2020

The LSU Ethics Institute Inspire Award for Exemplary Ethical Action recognizes students who help another individual or group, stand up for a cause or belief, or otherwise exhibit extraordinary ethical leadership. Amid the COVID-19 pandemic, two undergraduate students have particularly stood out for stepping up and using their skills and knowledge to provide crucial help to their community. We are pleased to award the 2020 Inspire Award to Meagan Moore, biomedical enginnering, and Maxwell Cole, physics for their dedication to making Personal Protective Equipment (PPE) to protect first responders throughout Louisiana during the ongoing COVID-19 pandemic. Meagan and Max were nominated by Dr. Wayne Newhauser, the Director of Medical and Health Physics and holder of the Dr. Charles M. Smith Chair of Medical Physics at LSU. As concerns about the severity of the pandemic grew in Louisiana and after LSU closed campus, Dr. Newhauser recognized a need for ventilator filters and other PPE for first responders throughout the state. Supported by the Bella Bowman Foundation, LSU, and Lamar Outdoor Advertising, a new nonprofit was formed, OneLouisianaNow!, comprising a 13-member leadership team and more than 80 volunteers. The first members to join the team

Meagan Moore and Max Cole pose with PPE they helped develop

were Meagan and Max, followed by Cathlin Disotell (LSU alumnus), Frank Womack (research specialist, LSU Physics and Astronomy), Nicholas Lombardo (research specialist, Chemical Engineering), and Dr. Newhauser's wife Heike and sons Sven (LSU mechanical engineering) and Nils (LSU Laboratory School).

The volunteers worked quickly, meeting regularly in Dr. Newhauser's garage and working eight to ten-hour days. They created the prototypes for ventilator filters, as well as face shields, masks, and gowns, and mass

production of these items has since begun in the LSU PMAC and other LSU laboratories. The garage operation yielded more than 3,400 items of PPE, which were successfully distributed to hospitals in the greater New Orleans and Baton Rouge areas in the first few weeks. Early mass production on the LSU campus yielded approximately 5,000 items per week.

While we have immense gratitude for the entire group of volunteers, we would like to especially recognize Meagan and Max for their efforts. Amid great turmoil and uncertainty, after shifting to online classes and having their normal lives as students completely upended, Meagan and Max rose to the challenge and put their community in front of their own concerns. We are thrilled that Dr. Newhauser nominated them for the Inspire Award, which recognizes students who have engaged in exemplary ethical conduct with a $1,000 scholarship.

In Dr. Newhauser's nomination, he noted that "The students showed initiative and commitment to a fledgling initiative to help healthcare professionals in their hour of need…they demonstrated exemplary ethical conduct by putting the needs of others before their own."

Meagan Moore, daughter of Michael and Kathryn Moore, is a senior in Biological Engineering. She is from Baton Rouge and as she continues her studies in Biological Engineering, she also serves as the Assistant Director of the STEM Lab at St. Joseph's Academy. Max Cole is a senior, studying Physics at LSU. He is from Dallas and the son of Michelle and Laurence Cole. This fall Max will pursue a Ph.D. in Medical Physics at LSU. We are pleased to recognize Meagan and Max's efforts with the Inspire Award and wish them well in their future endeavors.

Meagan poses with a tool used in developing equipment.

Max tries on a sample face shield and gown.

Photo Credit: Yao Zeng

2.7 Understanding the Physics of Neutrons can be Key to Improving Hip Replacement Surgeries

Reproduced from an article by Elsa Hahne, LSU Office of Research & Economic Development

February 16, 2020

"First, let me tell you about X-rays. Ordinary X-ray machines will only find attenuation, or gradual absorption, of X-rays as they pass through the body. So, all you see is that difference in attenuation contrast. But as the X-rays move through the body, they're also going to phase-shift and scatter. For X-ray scatter we mainly consider elastic small angle scatter (SAXS) and in-elastic Compton scatter. The Compton scatter in the context of X-ray interferometry basically just degrades the image contrast. The small-angle scatter, on the other hand, can give us a lot of information, and it would be great if we could capture all of this useful information—including the phase-shift and small-angle-scatter—and not just the attenuation.

My work here at LSU has been on developing these extra two modalities, phase-shift and small-angle scatter, and a novel phase-contrast X-ray system using special grating-based interferometry. We will potentially obtain these multiple-contrast (attenuation, phase-shift, and small-angle scatter) images using the same X-ray dose.

There is a big difference between X-ray and X-ray-interferometric imaging. If a patient stands in front of a regular X-ray machine, you'll see "shadows" of the internal organs in their body. But it is different for grating-based X-ray interferometry. What you'll see instead are interference patterns, which are attenuated, shifted, and locally distorted by the three phenomena of absorption, phase-shift, and small-angle scatter of X-rays as they travel through a patient's body. And then, from those interference patterns in comparison with a blank reference scan without a patient, we can derive the attenuation, phase-shift, and scatter images.

In traditional X-ray attenuation images, a radiologist may not see much difference between a healthy patient and another with emphysema or cystic fibrosis. But if you look at a small-angle scatter image, the diseases are well-differentiated. These scatter images can also detect lung tumors much better than attenuation images. So, having both scatter and attenuation images will help. That's where we're heading. Hopefully, future X-ray machines will have all three of these complementary modalities.

If you toss two pebbles into a pool, you'll see waves generated from each; constructive and destructive patterns on the surface. That's interference. If you add a grating—sort of like a sieve pattern—in front of the neutron (or X-ray) beam, you get a corresponding expected pattern, depending on the distance. When you add an object, the pattern will change. It will attenuate, phase-shift, and locally distort (analogous to X-rays) the interference pattern. Again, (analogous to X-rays) we can derive attenuation, phase-shift, and elastic scatter from the object by comparing and analyzing the interference pattern with and without the object. We can then infer information about the object, and very accurately, at high resolutions.

Now, to our main topic—neutrons. Neutrons can be defined as particles as well as waves, and you have similar absorption, phase-shifting, and elastic and in-elastic scattering effects. We're mostly interested in the elastic scatter, as well as the attenuation and phase.

Neutrons have already been studied as particles, including how much they attenuate and scatter. Several computer simulation packages exist for simulated neutron particle beams. But we're going to add the phase-shift to that mix, adding a phase analysis after a random or Monte-Carlo-based absorption and scatter analysis. So far, very few researchers have looked at the phase-shift of neutrons together with absorption and scatter. To do this, we first propose to make the neutron particle beam coherent, and then for each particle, calculate the path-lengths between each interaction and use these path-lengths to compute the phase shifts of the waves.

To summarize, my team's contribution here will be to add the phase-shifting to the already known simulators for attenuation and scatter. This will be useful for the National Institute of Standards and Technology (NIST), Oak Ridge National Laboratory, and neutron researchers at other places.

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With this new EPSCoR grant, we will collaborate with NIST and their Center for Neutron Research in Maryland. I will be going up there soon (March/April) and then for the whole summer, and one of my students will also work on the project and travel there. Hopefully, it will amount to his PhD work.

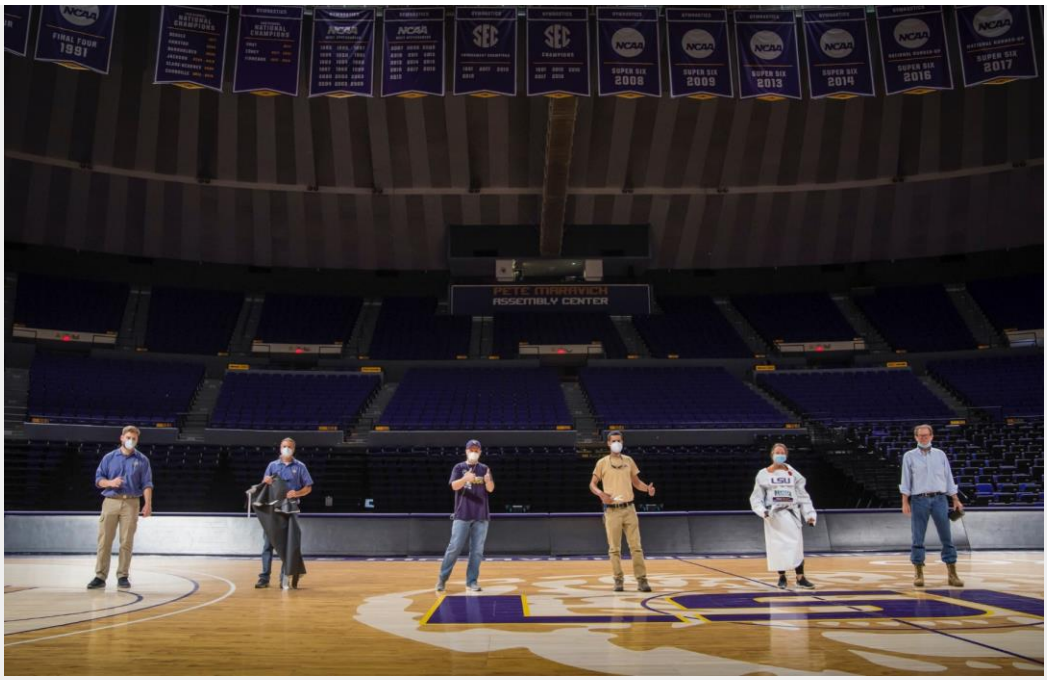
So, why do we want to study neutrons? They probe deeper. They interact relatively weakly with metal compared to X-rays. They interact strongly with hydrogen or oxygen. For medical applications, this is useful, as neutrons will be better for imaging bone-metal joints, where X-rays would lead to strong metal artifacts. Neutrons give high-quality information about surfaces, and they are very useful for looking at bone-metal implants, such as hip replacement joints. We hope to get samples from the LSU Vet School. Now, I have to be clear—you cannot use neutrons for imaging patients due to high radiation concerns. It will not be used for in-vivo imaging anytime soon. But materials scientists can use neutrons and neutron interferometry to look at tissues and metal-tissue interfaces ex vivo; and this could teach us a lot about metal implants in the body.

There are three key benefits of the work we're doing: One is determining the grating and detector distances that will bring the best visibility and sensitivity; when we build a simulator, this will help other researchers who work in this field. Number two, we will explore different dual gratings, some borrowed from Professor Butler's lab at LSU and see what results we get. Third, we hope our bone-metal imaging techniques can help improve the success rate of hip replacement surgeries around the world, and contribute to the knowledge of materials scientists who make hip replacements. Hip replacements are one of the most popular and fastest growing elective surgeries. But about five percent fail, and this is something we hope to help scientists reduce. If we get a sample from a failed surgery, we can see what went wrong; for example, if it cracked, how, where, etc. If we can help scientists make the interface between metal and bone more stable and more secure for the rest of a patient's life, they don't have to return to the hospital or do the surgery again."

2.8 Protecting the Protectors: LSU Kicks Off PPE Manufacturing in PMAC

Reproduced from an article by Ernie Ballard, LSU Media Relations
April 13, 2020

With support from the State of Louisiana, LSU began large-scale production of personal protective equipment, or PPE in the Pete Maravich Assembly Center, or PMAC, as part of its statewide response to support medical professionals on the front lines of the COVID-19 pandemic. The PMAC PPE production effort unifies LSU's innovation, research, expertise, assets and facilities into a single purpose-driven initiative: Protecting Louisiana's doctors and nurses through bold and creative efforts to fill shortages in critical equipment, specifically gowns and face shields.



LSU has begun large-scale production of personal protective equipment

(PPE) inside the Pete Maravich Assembly Center (PMAC).

Photo Credit: Yao Zeng

The entire LSU community is working together to support Louisiana's fight against COVID-19. Activating the PMAC in the very heart of campus as a medical emergency operation—as it was when LSU cared for victims of Hurricane Katrina 15 years ago—and developing a novel and safe production environment underscores LSU's complete commitment to its statewide mission.

Within the PMAC, LSU employees are actively working with physicians in New Orleans and Shreveport to develop and produce two types of critically necessary PPE: Heavy-duty, reusable gowns made from billboard vinyl donated by Lamar Advertising and Circle Graphics, and face shields with donated materials and design feedback from Baker Hughes.

"At every pivotal moment in our history, the LSU community has come together for the good of our state and our nation," said LSU Interim President Tom Galligan. "What's happening today is an example of our university's unwavering commitment to providing solutions to the most challenging problems facing society. I am proud of the outstanding and innovative work being conducted by our faculty, staff and students in the face of such great adversity."

"We are proud to see the response being rallied at LSU," said Louisiana Gov. John Bel Edwards. "Not only is the flagship ramping up PPE production and testing capabilities, but the Health Sciences Centers in New Orleans and Shreveport are doing a phenomenal job of treating and testing as well. The entirety of the LSU

family has responded to this health crisis and are making a difference for the people of Louisiana through their innovation and commitment."

The **gown project** began in the garage of LSU Medical Physics Program Director Wayne Newhauser. Working with Biomedical Engineering student Meagan Moore and in partnership with the Bella Bowman Foundation, Newhauser began developing prototypes for gowns and other PPE as shortages of the important gear made headlines across the nation. The university's COVID-19 response team assessed the gown design and determined it could be scaled, and under the directive of Interim President Tom Galligan, began assembling a cross-campus team to bring the operation to reality.

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2.9 Protecting the Protectors: LSU Team Supporting Physicians, Combatting Covid-19 by Creating Masks, Ventilator Parts

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March 30, 2020

LSU Biomedical Engineering senior Meagan Moore is never one to back down from a challenge, especially if it means helping others (**she created a cancer model to help personalize treatment last year**). So, why would the coronavirus pandemic be any different?

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While we have immense gratitude for the entire group of volunteers, we would like to especially recognize Meagan and Max for their efforts. Amid great turmoil and uncertainty, after shifting to online classes and having their normal lives as students completely upended, Meagan and Max rose to the challenge and put their community in front of their own concerns. We are thrilled that Dr. Newhauser nominated them for the Inspire Award, which recognizes students who have engaged in exemplary ethical conduct with a $1,000 scholarship.

In Dr. Newhauser's nomination, he noted that "The students showed initiative and commitment to a fledgling initiative to help healthcare professionals in their hour of need…they demonstrated exemplary ethical conduct by putting the needs of others before their own."

Meagan Moore, daughter of Michael and Kathryn Moore, is a senior in Biological Engineering. She is from Baton Rouge and as she continues her studies in Biological Engineering, she also serves as the Assistant Director of the STEM Lab at St. Joseph's Academy. Max Cole is a senior, studying Physics at LSU. He is from Dallas and the son of Michelle and Laurence Cole. This fall Max will pursue a Ph.D. in Medical Physics at LSU. We are pleased to recognize Meagan and Max's efforts with the Inspire Award and wish them well in their future endeavors.

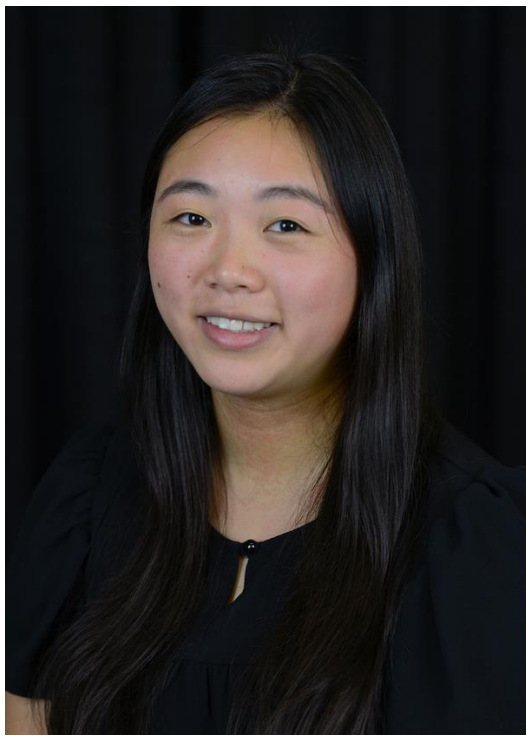
Meagan poses with a tool used in developing equipment.

Max tries on a sample face shield and gown.

Photo Credit: Yao Zeng

2.11 LSU Medical Physics Graduate Student Stephanie Wang Awarded the First Hogstrom Scholarship

Reproduced from an article by Mimi LaValle (LSU Physics) and Scott J. Miller (MBPCC)
June 2020



The LSU-MBPCC Medical Physics Program has announced graduate student Stephanie Wang as the first recipient of the recently established Kenneth R. Hogstrom Superior Graduate Student Scholarship in Medical Physics. Stephanie is an M.S. student whose thesis research investigates the potential of improved electron radiotherapy machines for treating post mastectomy breast cancer.

The scholarship was established in honor of LSU College of Science Professor Emeritus Kenneth R. Hogstrom's outstanding research, scholarship and mentorship of graduate students. The scholarship provides stipend support for an LSU medical physics graduate student performing innovative physics research in radiation oncology.

The program is a public-private partnership between LSU Department of Physics and Astronomy and Mary Bird Perkins Cancer Center (MBPCC). The education program's director, LSU Professor and Dr. Charles M. Smith Chair of Medical Physics Wayne Newhauser, noted "We are pleased to recognize Stephanie's success and her potential though the award of this scholarship named in honor of Dr. Hogstrom, who directed the medical physics program from 2004 to 2011. We anticipate that the scholarship will have an immediate impact on Stephanie's education and her early career. We also expect that her research project will lead to advances in health care for cancer patients here and elsewhere."

An endowed fund for the scholarship was established in 2015. Since then, a fundraising effort has produced over $500,000, including over $300,000 from donors and $200,000 in competitive matching grants awarded by the Louisiana Board of Regents. Because the scholarship fund is endowed, the program anticipates awarding one scholarship each academic year.

According to Wang, "My first goal after graduating with an M.S. degree in medical physics is to complete a two-year residency training program in therapeutic medical physics and then achieve professional certification by The American Board of Radiology. This will help me obtain a clinical medical physicist position, ideally in a hospital or cancer center with students or residents. I plan to be an active member of the American Association of Physicists in Medicine to help further my professional development and stay updated on new developments in the field so I can provide the best care to patients."

Wang is performing her thesis research project under the supervision of Dr. Robert Carver, a medical physicist at MBPCC and an adjunct assistant professor in the program. According to Dr. Carver, "Stephanie's recognition is so deserved and comes from a desire to further decrease the possibility of a secondary cancer, especially in younger women, a high-risk population since they have a long lifetime ahead of them. Her study of using novel electron radiotherapy machine technology with MBPCC's recently developed intensity modulated bolus electron conformal therapy (IM-BECT) has the potential to impact patients here at home, and also around the world."
Dr. Carver said that Stephanie's research project will generate preliminary data needed to apply for future research grants that will provide evidence necessary to translate this technology from the laboratory to clinical practice. Stephanie and Dr. Carver plan to share their findings by writing a research paper for publication in an academic journal.

As a highly acclaimed educator and researcher, Dr. Hogstrom has had a remarkable impact on the practice of radiotherapy. Hogstrom integrated teaching, research and clinical practice to investigate and advance areas at the forefront of radiation therapy research, including the use of beams of electrons, X-rays, neutrons and pions, as well as image-guidance, intensity-modulation, stereotactic and molecular targeted therapy techniques.

"One of the greatest phases of my career has been working with my colleagues at Mary Bird Perkins and LSU and establishing one of the most respected medical physics training programs in the country," said Hogstrom, who is LSU Department of Physics & Astronomy professor emeritus and senior medical physics advisor at MBPCC.

In 2004, Dr. Hogstrom and Todd Stevens, CEO of MBPCC, began a major revitalization and modernization of the medical physics partnership between LSU and MBPCC. The partnership leverages the education and research resources of LSU and the cancer expertise and facilities of MBPCC to train future medical physicists and to benefit patients receiving cancer care in southeast Louisiana. Today, the medical physics partnership offers M.S. and Ph.D. degree programs, a post-doctoral certificate training program, and a therapy physics residency training program. These programs attract applicants from around the world.

Dr. Jonas Fontenot, chief of physics and chief operating officer, radiation oncology, at MBPCC and an adjunct assistant professor in the Medical Physics Program, noted, "It is because of this type of support and the generosity of the community that we are able to continue advancing cancer care at such a rapid pace. We are also appreciative of the visionary work of Dr. Hogstrom. His leadership has created a legacy that will impact cancer care for generations to come, and Stephanie is one of the bright minds that will help propel this tradition of excellence in cancer care forward."

About the LSU Medical & Health Physics Program
The LSU Medical & Health Physics Program researches the applications of radiation technology for the health care, national defense and nuclear energy industries. This graduate program is nationally recognized, is accredited by the Commission on Accreditation of Medical Physics Education Programs and has a 100 percent placement rate of its graduates. The faculty have research expertise in advanced technology for photon, electron and proton radiotherapies, targeted therapy using chemo-irradiation, diagnostic imaging, nuclear medicine and radiation protection. Please visit **https://www.lsu.edu/physics/graduate-programs/medical-physics/welcome.php** for more information.

About Mary Bird Perkins Cancer Center
Mary Bird Perkins Cancer Center is a regional cancer care organization that has been fighting cancer for almost 50 years. The cancer care organization provides care at nine centers in Baton Rouge, Covington, Hammond, Houma, Gonzales, Zachary, and Natchez, Mississippi, and its service area encompasses Southeast Louisiana and Southwest Mississippi regions. For more information, please visit **www.marybird.org**.

2.12 LSU Medical Physics Graduate Student Ana Dieguez Awarded Second Hogstrom Scholarship

In June of this year, the second recipient of the prestigious Hogstrom Superior Graduate Student Scholarship was announced. Ana Dieguez, an MS student in our program, was selected and will begin receiving support from the scholarship later this year. The Hogstrom scholarship is described in detail in the preceding story. Here, we asked Ms. Dieguez to describe in her own words what this award means to her.

"From the moment when I joined LSU's Medical Physics Program, I felt encouraged by the faculty to find a research interest that would represent an innovative approach into a dilemma in our field. In Fall 2019, I reached out to Dr. Kip Matthews to discuss possible research topics for my master's thesis. Dr. Matthews had taught the Radiation Shielding class to me the prior semester; he presented to us areas where insufficient knowledge could potentially be limiting the quality of Shielding Calculations. When I talked to Dr. Matthews, we decided that VMAT Shielding Considerations was an area, with direct relevance to clinics like Mary Bird Perkins Cancer Center. This project is an assessment of whether the VMAT delivery technique is adequately addressed by the NCRP Report 151 guidelines for design of a LINAC vault's structural shielding. Report 151 was published before VMAT became a common treatment technique. As VMAT becomes the primary treatment approach for many types of cancer, we must be certain that existing and new treatment vaults provide suitable shielding. The main question of my thesis is whether the calculation methods and supporting data of Report 151 are sufficient to provide a satisfactory design for a vault dedicated to VMAT. This project will either confirm that existing Report 151 methods and data result in adequate designs or produce supplemental information by which we can be confident that new shielding designs are both safe and cost-effective. This topic is important to facilities such as Mary Bird Perkins Cancer Center, where appropriate radiation protection of staff and the public is crucial; importantly to me, this line of research represents what first inspired me to join the medical physics field: how to make effective and safe use of therapeutic radiation, allowing us to save lives without compromising quality. This project was envisioned by me, representing a new research direction for us, so obtaining funding was crucial. The Kenneth R. Hogstrom Superior Graduate Student Scholarship is the essential component that allows me to pursue this project as my Master's thesis; I am grateful to Dr. Hogstrom and all those who supported the creation of this Scholarship."

3 Honors and Awards

1. MS student Stephanie Wang received Hogstrom Superior Graduate Student Award. See story in this newsletter for details.
2. Dr. Jonas Fontenot selected as fellow of the AAPM, 2020.
3. PhD student Jingzhu Xu Received $5000 Coates Research Scholar Award, 2020.
4. PhD student Yibo Xie received $500 Roussel Family Graduate Student Award in Communication, 2020.
5. PhD student Xiaodong Zhao received $500 Roussel Family Graduate Student Award in Communication, 2020.

6. MS student Ana Dieguez selected for AY 2020-21 Hogstrom Superior Graduate Student Award. See story in this newsletter for details.
7. Physics undergraduate student Max Cole received LSU 2020 Inspire Award. See story in this newsletter for details.
8. Biological engineering undergraduate student Meagan Moore received LSU 2020 Inspire Award. See story in this newsletter for details.
9. Publishers Accolade from JACMP, "Modeling of the metallic port in breast tissue expanders for photon radiotherapy" by J Yoon, Y Xie, D Hiens, and R Zhang (19:3 205, 2018) was among the top 10% most downloaded papers between Jan 2018 and Dec 2019, Wiley, April 30, 2020.
10. Dr. R. Greg Hussey for Excellence in Physics Undergraduate Scholarship, Chloe DiTusa, (mentor: R Zhang), 2020

4 Grants

Our faculty received several new grants in the first half of 2020.

1. Dr. Dey received a grant for $227,680 from NSF for a project entitled "Neutron Imaging Interferometry for Non-Destructive Testing" (2020-2022).
2. Dr. Fontenot received a grant from Elekta for $59,234 for a project entitled "Stereotactic spine treatments on Versa HD delivery system and Monaco HD treatment planning system" (2020-2021).
3. Dr. Fontenot received a grant from Karnival Krewe de Louisiane entitled "Integration of automatic gating into deep-inspiration breath hold for radiation therapy of left-side breast cancer" (2020).

5 Medical and Health Physics Program in the News

5.1 LSU Professor Featured on Fox News for Professional Protective Equipment Efforts During Covid-19 Pandemic

Reproduced from the LSU Daily Reveille, by Jacob Mathews
April 28, 2020.

LSU Medical Physics Program Director Wayne Newhauser was interviewed on Fox News' "FOX & Friends First" to discuss the University's efforts to produce ventilator parts and personal protective equipment (PPE) for healthcare professionals on the front lines of the COVID-19 pandemic. The live interview was broadcast nationally on April 20, 2020. Fox News picked up the story as a part of a series titled "America Together" which highlights stories of communities performing acts of volunteerism and heroism to uplift viewers, according to Carolina Chao of Fox News.

Newhauser started these efforts in his garage as the LSU campus was closed. Scores of volunteers from LSU and the Louisiana community performed research and development on a highly compressed time scale. As the initiative grew, additional leaders stepped forward to scale up the scope and pace of production. Trey Bowman from the Bella Bowman Foundation, Greg Trahan from the LSU ORED, and Ross Reily from Lamar Advertising helped launch the system into being mass produced on the LSU campus.

Examples of PPE include gowns, face masks, ventilator parts, shields and other types of protective gear. By the time the mass production facility was shut down, more than 20,000 gowns had been produced.
When Newhauser started late March, he was assisted by volunteers, including students, faculty, staff, neighbors, and family members. Students enjoyed the opportunity to be involved in a real-world learning experience, with many of them contributing to the research and development at home to limit the number of volunteers present in any one area.

As production grew, the efforts were moved to campus and work was performed by LSU employees.
Newhauser and many other Louisiana residents believe this is the way Louisiana responds to a crisis, and that brings out the best in people. "Louisiana was settled by people were both extremely self-reliant but also community-oriented, and situations like this showcases these enduring strengths," Newhauser said.

5.2 Other News Items

1. "Facing up to friendly fire: why radiation oncology still neglects stray radiation", by Marric Stephens, 28 Feb 2020 https://physicsworld.com/a/facing-up-to-friendly-fire-why-radiation-oncology-still-neglects-stray-radiation/
2. "Interdisciplinary 3D Printing Project Has Real-World Impact". By David Raths12/17/19 https://campustechnology.com/articles/2019/12/17/interdisciplinary-3d-printing-project-has-real-world-impact.aspx
3. "Protecting the Protectors: LSU Team Supporting Physicians", Combatting COVID-19 by Creating Masks, Ventilator Parts. LSU College of Engineering, Libby Haydel, March 30, 2020, https://www.lsu.edu/eng/news/2020/03/meaganmoorefacemasks.php.
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14. "LSU making PPE for medical professionals fighting pandemic, Tom Galligan, Louisiana State University Interim President Joins America's Newsroom", Fox News America's Newsroom, April 15, 2020, https://video.foxnews.com/v/6149629292001?playlist_id=903354961001#sp=show-clips.
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6 Selected Publications

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7 Seminars and Presentations

1. Charles Zimmerman, "Integrated Model for Internal Radiation Field of a Low Earth Orbit Vehicle". HPS Midyear Meeting. January 26-29, 2020. Bethesda, MD.
2. Michael McMahon, "Nuclear Accident Simulation Study: Impact Of 2017 Protective Action Guides On State Emergency Response". HPS Midyear Meeting. January 26-29, 2020. Bethesda, MD.
3. Payton H Bruckmeier, "Treatment Planning Advancements: Efficiency, Consistency, and Quality". SWAAPM 2020, February 27-29, 2020, Grapevine, TX.
4. Jonas Fontenot, "Radiation Oncology Alternative Payment Model". SWAAPM 2020, February 27-29, 2020, Grapevine, TX.
5. David Perrin, "Venezia Advanced Gynecological Applicator HDR". SWAAPM 2020, February 27-29, 2020, Grapevine, TX.
6. Hayden Scott, "Development of 3D printed Immobilizers for Gamma Knife Treatments". 6th annual Discover Day at LSU. April 9, 2020, Baton Rouge, LA.

8 Ways You Can Support the Program Today

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- Call the LSU Foundation at 225-578-3811 or 1-800-452-7928 and donate by phone. Note that because of the pandemic and work-from-home orders, it may not be possible for us to answer these phone lines.

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  https://www.lsufoundation.org/s/1585/images/editor_documents/fillable_gift_form_180129.pdf

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KENNETH R. HOGSTROM SUPERIOR GRADUATE STUDENT SCHOLARSHIP FUND

As a highly acclaimed educator and researcher, Dr. Hogstrom has had a remarkable impact on students and practice in the field of radiotherapy.

Dr. Hogstrom has a passion for graduate education. He served 20 years as Medical Physics Program director at The University of Texas Graduate School of Biomedical Sciences at Houston and seven years as Medical Physics Program director in the LSU Department of Physics & Astronomy. He taught radiation physics classes, while mentoring young investigators on how to apply that knowledge such that their research could impact clinical radiation oncology. His greatest joy has been challenging and mentoring graduate students in their research. Over his 40-year career, Dr. Hogstrom supervised 20 MS and PhD students, served on the supervisory committees of another 35 students, and supervised 12 postdoctoral fellows.

Established in honor of his outstanding research, scholarship, and mentorship of graduate students, the LSU College of Science and Department of Physics and Astronomy have established the Kenneth R. Hogstrom Superior Graduate Student Scholarship in Medical Physics. This endowed scholarship will provide annual support for a MS or PhD student performing innovative research in radiation oncology physics.

We invite you to join us in honoring his deep commitment to and legacy in our field by giving to the Kenneth R. Hogstrom Superior Graduate Student Scholarship Fund. Our goal is to raise $100,000 in collegial support, which with gifts from other individuals and Mary Bird Perkins Cancer Center will leverage matching funds from the State of Louisiana Board of Regents to create the endowed fund.

For more information on the Kenneth R. Hogstrom Superior Graduate Student Scholarship Fund, please contact senior director of development for the LSU College of Science Emilia Gilbert at egilbe2@lsu.edu or 225-578-2321.

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