LSU/MBPCC Medical Physics and Health Physics Newsletter

January 2015

Academic Programs

Vol. 1, No. 1

Notable:

Dr. Charles M. Smith visited the Medical Physics Program at LSU on August 18 to receive a program update and discuss future activities.

Dr. Rui Zhang submitted a K01 proposal to Agency for Healthcare Research and Quality, entitled: Impact of advanced technologies of radiotherapy on the incidence of radiogenic side effects in post-mastectomy breast cancer patients.

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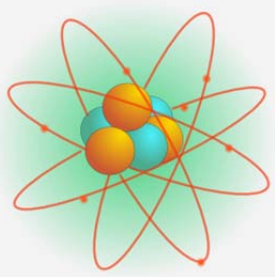
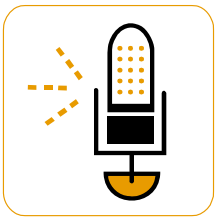




Announcements

- Dr. Joyoni Dey joined the Medical Physics Program faculty in August 2014 as Assistant Professor!
- Medical Physics Program has begun the search for a Tenure-track Assistant Professor.
- Dr. Jonas Fontenot has been awarded (Elekta) Industry Grant.
- LSU LIFT Grant awarded to Dr. Guang Jia, Dr. Kenneth Matthews, and Dr. Wei-Hsung Wang.
- New Monte Carlo Class offered.

Industry Collaborations Continue

The science and technology of radiation therapy has advanced dramatically since its inception more than a century ago. In the long term, the progress in the field includes relatively rare paradigm-shifting scientific discoveries (such as the discovery of radiation), inventions (such as particle accelerators), translational work (such as the development of a compact linear accelerator suitable for radiation therapy), and technological refinements and enhancements. Each of these activities is essential to the advancement of patient care.

Our medical physics faculty have a long tradition of collaborating with colleagues in industry to improve the quality and safety of radiation treatments. These research collaborations typically lead to improved treatment systems, early adoption of emerging technologies, and better treatments for our cancer patients. In addition, collaborative projects with industry provide opportunities for students to perform research projects under the mentorship of our clinical faculty.

An example of a particularly fruitful collaboration is the Sponsored Research Agreement between Elekta and MBPCC. This partnership, initiated in 2010 by Dr. Ken Hogstrom (Professor Emeritus (LSU) and Senior Physics Advisor (MBPCC)), includes research and development that will enable Elekta to substantially improve their electron beam treatment delivery system. In 2015, this partnership was formally renewed under the leadership of Dr. Jonas Fontenot, (Adjunct Professor (LSU) and Associate Director of Academic Physics (MBPCC)). The 3-year award will focus on completing the electron therapy research begun in 2010, as well as new projects, including stereotactic body radiation therapy and time-resolved computed tomography to improve treatments of moving tumors. The research team includes several faculty and five graduate students.

Featured Article: LSU professor receives cancer research grant

"We found Dr. Newhauser, and he has over 20 years of experience with proton and photon radiation. He is equally as passionate about doing this project. And it just kind of all came together."

The Bella Bowman Foundation, a Baton Rouge organization aimed at supporting pediatric brain cancer research, awarded a $75,000 grant to medical physics professor Wayne Newhauser.

Trey and Kim Bowman created The Bella Bowman Foundation after their daughter lost her life to brain stem necrosis, a rare side effect from the proton radiation she received for brain cancer. The Bowman's established the foundation to help families of children suffering from brain cancer and to further research and education on radiation necrosis.

Trey Bowman said he discovered Newhauser from an article on Newhauser's Department of Defense grant to research ways to improve the health outcomes of pediatric cancer survivors.

"It was almost like it was heaven sent when I was reading it," Trey Bowman said. "We found Dr. Newhauser, and he has over 20 years of experience with proton and photon radiation. He is equally as passionate about doing this project. And it just kind of all came together."

Newhauser, who worked at MD Anderson, said he found the Bowman's story compelling.

"At first, my reaction was 'well I don't know anything about that, but let me look into it,'" Newhauser said. "So I did, I got some literature and read up. It turns out that this radiation necrosis is actually a very similar issue to second cancer. So most of my work had been on trying to reduce the risk of second cancers. But I would say about 90 percent of that is applicable to this radiation necrosis research."

The relationship between the Bella Bowman Foundation and the Medical Physics program started in 2013 with an initial grant of $25,000. Newhauser completed his first study on possible causes of radiation necrosis in June 2014.

Newhauser has used the grants provided by the Foundation to fund stipends for the graduate students who assist in his research.

"Typically what happens when someone like the Bowmans, reach out to us, we try to match that in some way with some of our internal program funding, I had a couple of grants in this area," Newhauser said. "We had a lot of stuff in place, and what that meant was for that additional donation that they made they were allowed to get a lot of bang for their buck."

The LSU Medical Physics program is a joint program with the Mary Bird Perkins Cancer Center in Baton Rouge. The partnership was created to combine the clinical environment of MBPCC with the research and education resources at the University.

Newhauser's research utilizes the University's supercomputers to do computer simulations to predict the risks of cancer treatment. Newhauser said computer simulations eliminate many restrictions found in clinical trials like time and patient availability.

"We've reduced the length of time of doing one of these studies from 15 to 30 years down to two to three years," Newhauser said. "We're actually the only group in the world who's done complete full body reconstructions for the screening of spinal radiation."

Trey Bowman said they are optimistic about their continuing partnership with the Medical Physics program and Newhauser's research.

"If we can change the treatment algorithm favorably for one child and have a positive impact, then we say mission accomplished," Trey Bowman said.

Article from:
The Daily Reveille
September 9, 2014
http://www.lsureveille.com/daily/lsu-professor-receives-cancer-research-grant/article_3870429c-37bf-11e4-ab01-001a4bcf6878.html?mode=story

Recent Publications

J. P. Gibbons, et al. Monitor unit calculations for external photon and electron beams: Report of the AAPM Therapy Physics Committee Task Group No. 71, Med Phys 41(3), 2014.

Wang, H. and Vassiliev, O.N. "Microdosimetric characterization of radiation fields for modelling tissue response in radiotherapy," Int J Cancer Ther Oncol 2(1): 1-10 (2014).

Wang, H. and Vassiliev, O.N. "Radial dose distributions from protons of therapeutic energies calculated with GEANT4-DNA," Phys Med Biol 59: 3657- 68 (2014).

Newhauser, Wayne, Jones, Timothy, Swerdloff, Stuart, Zhang, Rui, and Newhauser, Warren. Anonymization of DICOM Electronic Medical Records for Radiation Therapy. Computers in Biol and Med., 53 134-140, 2014.

O.N. Vassiliev, A model of the radiation-induced bystander effect based on an analogy with ferromagnets. Application to modelling tissue response in a uniform field, Physica A: Statistical Mechanics and its Applications, Volume 416, 15 December 2014, Pages 242-251

Zhang R, Howell R, Taddei PJ, Giebeler A, Mahajan A, Newhauser WD. A comparative study on the risks of radiogenic second cancers and cardiac mortality in a set of pediatric medulloblastoma patients treated with photon or proton craniospinal irradiation. Radiother Oncol, at press.

Newhauser WD and Zhang R, The physics of proton therapy, Phys Med Biol. (accepted)

Tuuri G, Durham HA, Matthews II KL, and Zanovec M. Behavioral predictors of quantitative ultrasound broadband attenuation score in young adult caucasian women. Gazzetta Medica Italiana (accepted)

Alvarez D, Hogstrom KR, Brown TAD, Matthews II KL, Dugas JP, Ham K, and Varnes ME. Impact of IUdR on Rat 9L Glioma Cell Survival for 25-35 keV Photon-Activated Auger Electron Therapy. Radiation Research (accepted)

Featured Article:

LSU's Guang Jia Uses LIFT Grant to Revolutionize Industrial Air Purifiers

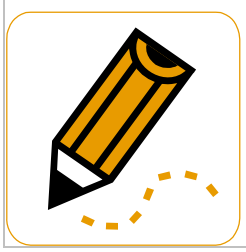
It's practically a scientific fact that there are few things more beautiful than a Louisiana sunrise. With the sun slowly peeking through stately oaks casting a shimmer on the University Lakes, it's hard to imagine a world where this magnificent view of nature cannot exist.

But in Beijing and many provinces in China, the inability to view a sunrise is a reality they already face. In 2012, Guang Jia, associate professor in LSU's Department of Physics & Astronomy took a trip home to China that became the inspiration for his latest research.

"In the morning you couldn't see the sun, so they use a big TV to broadcast the sunrise. This is in the capital," Jia said. "And Beijing is where the least air pollution is. If you take the train to my hometown, the pollution gets worse and worse."

Jia received his PhD in Medical Physics from Ohio State University. When he made the move to Baton Rouge to become part of the LSU family, he noticed a difference in the air quality that many long-time Tigers have become accustomed to.

"Here after rain, you can smell something in the air. And there are the chimneys, so we can see it. Heavy industry complicates air quality in Louisiana," Jia said. "My background is medical physics, so I'm working with x-rays, and the x-ray can ionize particles. And then I suddenly thought, 'We can apply this to a mechanism for an air filter.'"



That thought formed into a design, and now that design is being brought to life. With colleagues Kenneth Matthews in Physics & Astronomy and Wei-Hsung Wang in the Center for Energy Studies, Jia was awarded a LIFT2 Grant this summer, providing Jia with $22,145 to build a prototype and collect data. The LIFT2 Grant Program was created by the LSU Board of Supervisors to help "Leverage Innovation for Technology Transfer" across all campuses of the LSU System with the goal of bringing academic research to market. A total of 15 grants were awarded. **(continued on page 4)**

Featured Article (cont'd)

Dr. Guang Jia

Jia's air filter design demonstrates his specialization in x-ray technology. The device would be placed over the top of a chimney of a chemical plant. A low-energy x-ray would ionize the pollutant particles traveling through the chimney, and electrode collecting plates would catch the particles instead of releasing them into the atmosphere.

Giving the pollutants a charge and utilizing collecting plates is how similar products work now, only instead of an x-ray, they use large electrostatic poles that are not easily adaptable to each worksite.

"This concept is simple," Jia explained. "We don't need to design this big machine- just an x-ray source and a collecting plate- so we can easily put it on top of every chimney, ideally."

But what really makes Jia's design marketable is its ability to be modified.

"We can design it using a different x-ray and different power based on the chimney size and also based on the chemical component of the pollutant. We can fine tune the x-ray energy, so you can individualize it," Jia said.

Jia couldn't ask for a better testing ground for his new project and research. As Louisiana leads the nation in oil and gas industries, it also pays the price.

"I at least think the Louisiana [air] quality does not need to be bad, even with lots of industry. We don't need to suffer from the pollution," Jia said.

Risk of radiation exposure is always a concern when working with x-ray technology. The product Jia designed for chimneys uses a low dose of radiation, but the use of this technology warrants his expertise as a medical physicist.

Featured on COS website: http://science.lsu.edu/News+Events/Calendar/2014/item72904.html

Student News

Medical Physics PhD student, Paul Maggi, has been selected to attend the 2-week United States Particle Accelerator School (USPAS) at Old Dominion University in January 2015.

His selection includes an award of funds to cover registration and lodging. The USPAS provides national graduate-level educational programs in the science of particle beams and their associated accelerator technologies. The USPAS course will enhance Paul's PhD project, which is to develop a real-time electron energy spectrometer for use as a quality assurance, commissioning, and research tool for radiation therapy. The knowledge gained through the school will provide guidance for more effective utilization of the spectrometer, including development of methods to tune the operating performance of linear accelerators.

Paul Maggi

New to the Program:

Joyoni Dey, Assistant Prof.

Kesava Kalluri, Postdoc

Dmitry Shumilov, Postdoc

Jianhua Lu, Postdoc.

Wenhua Xu, Postdoc

Renovations Near-complete at MBP

It's an exciting time at Mary Bird Perkins – Our Lady of the Lake Cancer Center with a more than $23 million renovation and expansion project underway to enhance the patient experience and provide the highest level of comprehensive care for patients and their caregivers.

This project, which includes modernizing building systems and expanding areas for additional enhanced services, is slated for completion in spring 2015.

For more information on the renovation and expansion and for a detailed look at each floor, visit: www.mbpolol.org/renovations.

Front view of MBPCC when renovations are complete

Accreditation and Program Statistics

The LSU/MBPCC MS Degree in Medical Physics is accredited by CAMPEP through December 31, 2016. The LSU/MBPCC PhD Degree in Physics (Medical Physics) was originally accredited by CAMPEP for 3 years; on April 9, 2014, it was granted a two year extension through December 31, 2016.

CAMPEP granted inaugural accreditation for the LSU/MBPCC Certificate Program for post-doctoral fellows in 2014, which will also expire on through December 31, 2016.We anticipate an on-site review of the program during the 2016 reaccreditation process.

12 students enrolled in the MS program. 1 will defend in Dec. 14. Four others will defend in summer 2015. There are currently 9 enrolled in the Ph.D. program. 2 PhD students began in the Fall semester, one more student will begin in Jan 15.

Recent degree completion rates for the MS degree are: 5 in 2011, 8 in 2012, and 7 in 2013, and 6 in 2014. For the PhD degree, there was one graduation in 2011 with the next graduation expected in 2015. Additional statistical data available at:

http://www.phys.lsu.edu/newwebsite/graduate/medphys_briefhistory.html

Featured Article:

LSU Fulbright Scholar Examines Cancer Care Disparities in Croatia

LSU medical physics student Lydia Wilson has been on a journey of a lifetime. In October 2014, she began a nine-month stay in Croatia where she is studying disparities in radiotherapy cancer treatment as part of the Fulbright U.S. Student Program.

The Chicago native fell in love with the country after travelling there with her grandparents as a teenager. Her grandfather was born in Croatia and a number of her relatives reside on the Croatian Island of Korčula.

"Ever since I was a kid I wanted to live there," said Wilson, who spent more than a year preparing her Fulbright application.

Harald Leder, director of LSU Academic Programs Abroad, guided her through the arduous application process.

"Ms. Wilson's preparation was exemplary. The process is very involved and requires a lot of dedication and detailed work, apart from the academic excellence," said Leder.

While in Croatia, Wilson is observing medical physicists and therapists at five radiotherapy centers in Croatia, but most of her time is spent at the Zagreb Cancer Clinic located in the country's capital city.

Her research focuses on treatments for the five most common cancers: breast, prostate, lung, colorectal, and anal. Croatia's incidence rate of cancer is nearly equal to that of the United States, but Croatia's cancer mortality rate is almost twice as high.

"In America we raise lots of money to support cancer research and treatment. I want to make sure that everyone has access to quality cancer treatment, whether they are in the U.S. or a developing country," said Wilson.

Months into her stay, Wilson has observed that the treatment disparities are numerous and of many different types and causes.

"It is hard to really quantify what the exact disparities are, but I am seeing differences in treatment practices that new developments have improved upon," said Wilson.

"Some barriers to adopting more current treatment options are lack of funding, disharmony among the resident medical physicists, and a shortage of medical physics training programs, which in turn leads to a shortage of trained medical physics staff well versed in the latest treatments.

Unfortunately, a lot of the issues boil down to the current economic situation in Croatia, which is not good," said Wilson.

Initially, Wilson's Fulbright experience was to end in June, but it has been extended to December. She will be returning to the U.S. for Christmas and will start working on her PhD at LSU in the spring.

"I plan to keep in touch with the incredible physicists I've met and continue to help them with the exciting work they're doing to develop medical physics training programs, gain official recognition of medical physics as a health care profession, and implement regulations and monitoring so that the regulations are followed," said Wilson.

"The drive and perseverance to push towards better, safer, and more accessible treatments here is just incredible and inspiring. At the very least, it's something that I will always remember and that will definitely help me as I move forward with my work away from Croatia. If they can keep working towards a better tomorrow in Croatia when faced with so much opposition from the strangest places, surely I can overcome whatever I'm faced with."

Article From:
The Pursuit, 2014
Official Magazine of the LSU College of Science

http://issuu.com/djenkins1/docs/the_pursuit-2014/20

"The drive and perseverance to push towards better, safer, and more accessible treatments here is just incredible and inspiring."

Lydia Wilson