3Q 2018 Newsletter

An Official Publication of the Health Physics Society's Accelerator Section

"From the President"

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NON-US AND NON-HPS COLLEAGUES – PLEASE READ: I want to welcome you as your new president. We had a great meeting this year in Cleveland, and the attendance was very good. We welcomed new speakers and young scientists from several national laboratories. Your presence is very important for our section, and the support that the national laboratories have given to our section through the presence of their scientists is awesome.

In the coming year, we want to improve our outreach to as many fellow colleagues as possible. If you know anyone that might have an interest in accelerators, please ask them if they would like to receive the quarterly newsletter. Ted Liang, our newsletter editor, has done a magnificent job putting together interesting stories from our peers and colleagues across the accelerator community.

Regarding the section business, the Nominating Committee was able to secure nominations for all required positions late in the summer after the HPS Annual Meeting. The ballot went out with a roster of strong candidates. Please if you haven't yet take a minute to vote and help us elect our great candidates at the link provided here.

The site is open for voting until October 12, 2018. After the election results are released, the board will be working in a proposal to change the term of service for several different positions before the next annual meeting in Orlando.

The proposal to consider is to align our positions' term lengths with HPS, meaning most of the positions for our Accelerator Section would be evaluated for a 2 year term. Stay tuned for more discussions to come.

Finally, I want to let you know we are very excited about the next annual meeting in Orlando in 2019. At the moment, numerous accelerators are performing upgrades to their light sources, such as SLAC and APS to name a few. We would like to hear from them and others in Orlando as well. The physicists at these accelerator facilities have looked into many interesting issues, and at Orlando meeting, it would be a great opportunity to understand what is coming up out of these machines in 2021 and so forth. We are working hard to line-up some great speakers for Orlando. Please join us and start thinking about your contribution to the next meeting. In August SLAC hosted the Accelerator Safety Workshop, where we had the opportunity to meet colleagues from different accelerator facilities around the world and hear their views. We hope that some of these peers will come and join us in Orlando.

In conclusion, I would like to thank our past president Vashek Vylet for his hard work. It has been a pleasure working with him.

HPS 52nd Midyear Meeting

San Diego, California
February 17-20, 2019

Link to webpage for more information.

"Meet the Accelerator Section Student Awardees from the 63rd Annual Meeting"

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This year I had the opportunity to participate in our section's selection committee for the H. Wade Patterson Memorial Award and the Lutz Moritz Memorial Award, which are awarded at the annual meeting to student posters and presentations. If you have not had the opportunity yet, I encourage you to read more about our section's prestigious awards in "Awards for Accelerator Health Physics" by Ralph Thomas and learn about the legacy they carry to the future generation of aspiring health physicists.

As a student myself not too long ago at Georgia Tech, I highly encourage students interested in pursuing a career in health physics to apply for these prestigious awards in the coming year. Without further ado, I would like to introduce you to our awardees this year in no particular order and would also like to thank both Ye Eun and Kevin for contributing to this article!

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This year's recipient of the H. Wade Patterson Award is Kevin Liu. Kevin hails from Houston, TX where he grew up, studied Nuclear Engineering at the University of Michigan, and worked in the Radiological Health Engineering Lab for Professor Kimberlee Kearfott. Kevin is currently a graduate student enrolled in the Medical Physics M.S. program at Columbia University. He is performing his M.S. research on small field dosimetry at the Columbia University Medical Center under Dr. Cheng-Shie Wuu.

The poster topics he presented at the 2018 HPS Annual Meeting were on the design of a modular beam shaping assembly for boron neutron capture therapy (BNCT) using Monte Carlo and the calibration and statistical performance of optically stimulated luminescent dosimeters (OSLDs). The BNCT poster presented the Monte Carlo results on the neutron flux spectrum, using a D-D neutron driven source, measured at the exit of the proposed modular beam shaping assembly. The OSLD poster seeks to provide a technical basis for the precise calibration and statistical performance of OSLDs that were irradiated using a ^{137}Cs source. He hopes to graduate within the next year and will pursue a career in Medical/Military Health Physics.

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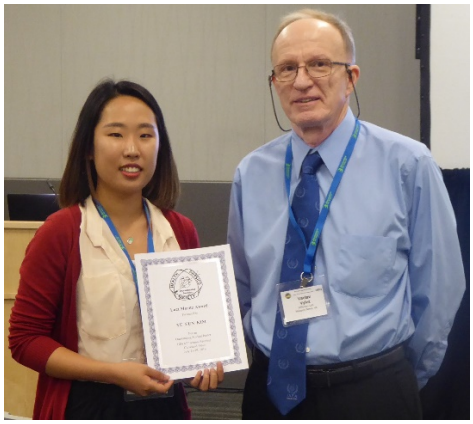
This year's recipient of the Lutz Moritz Award is Ye Eun Kim. Ye Eun studied biophysics at McMaster University and is currently finishing up her M.S. degree in health and radiation physics at McMaster University also. Her advisor is Dr. Soo Hyun Byun, whose research group focuses on the development of advanced radiation detectors and nuclear instrumentation for a variety of applications. Her research in particular is on the development of high efficiency neutron detectors using THick Gas Electron Multiplier (THGEM) technology. Using THGEM allows the fabrication of multi-element tissue equivalent proportional counters (TEPC) to be easy, which can increase the detection efficiency for low energy neutrons. Ye Eun graduated at the end of August and hopes to work in the nuclear industry as a health physicist.



"Protons Get Zippier in Neutron-Rich Nuclei"

Provided by Bob May, may@jlab.org
Jefferson Lab

The experiment took place in Jefferson Lab's Experimental Hall B. *Protons appear to get extra pep in their step when they're outnumbered by neutrons in the atom's nucleus.*

NEWPORT NEWS, VA – A new study carried out at the Department of Energy's Thomas Jefferson National Accelerator Facility has confirmed that increasing the number of neutrons as compared to protons in the atom's nucleus also increases the average momentum of its protons. The nuclear physics result, which has implications for the dynamics of neutron stars, has been published in the journal *Nature*.

The study involves short-range correlations, a phenomenon in which protons and neutrons, or nucleons, may pair up briefly inside the nucleus. This brief pairing imparts the two partners with high momentum.

Earlier research found that nucleons prefer to pair up with nucleons of a different type (for instance, protons prefer neutrons and vice-versa). The research, which only measured protons, had also hinted that a greater fraction of protons than neutrons may pair up in neutron-rich nuclei, thus giving the protons a higher-average momentum than neutrons. "What differentiates this study from earlier ones is that this is the first time we detect the neutron," says Meytal Duer, a graduate student at Tel Aviv University in Israel who is the lead author on the paper and who led the analysis effort. Including the neutron in the study, she says, also allowed the nuclear physics researchers to quantify the short-range correlations effect.

Duer and her colleagues re-analyzed data from an experiment conducted in 2004. In the experiment, the Jefferson Lab Continuous Electron Beam Accelerator Facility produced a 5.01 GeV beam of electrons to probe nuclei of carbon, aluminum, iron and lead. "When the electron comes in and hits the nucleus, we have struck a proton or a neutron. We detected the scattered electron and the scattered proton or neutron," Duer explains. "This is the first study to measure both protons and neutrons in short-range correlations and compare the high-momentum fraction carried by each."

The researchers found that when they compared the lightest nucleus, carbon, to the progressively heavier and neutron-rich nuclei of aluminum, iron and lead, the fraction of high-momentum protons went up.

"When we've got 50 percent more neutrons in the nucleus, we've also got 50 percent more high-momentum protons than we had before," says Or Hen, an assistant professor of physics at MIT and spokesperson for the data mining collaboration. Hen explains that this may be a consequence of the pair preference phenomenon exhibited by short-range correlations. That is, protons and neutrons both prefer to pair with particles different from themselves by 20 to 1.

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In neutron-rich nuclei, the few protons will have more pairing opportunities than the plentiful neutrons.

“A main result of this paper is that as the nucleus becomes more and more neutron rich, the pairing probability of neutrons saturates, while the pairing probability of protons grows,” he says. Lawrence Weinstein, a lead coauthor and Professor & Eminent Scholar at Old Dominion University, says the result of that pairing preference has now been confirmed and quantified for the first time by this new finding. “As you add neutrons to the nucleus, the fraction of neutrons that are high momentum stays the same, but the fraction of protons at high momentum increases by 50 percent,” he says. “Put another way, it looks like when you add neutrons to a nucleus, it makes the protons move faster.”

The result also has implications for the dynamics of neutron stars, which are made up of about five percent protons. Due to their high average momentum as compared to neutrons, the protons may have an out-sized effect on neutron star structure. The researchers say the next step is to move forward with new experiments that may be able to get at least ten times as much data on a wider range of nuclei, as well as continuing their efforts to scrutinize the data that’s already been collected for more insights into these mysterious nucleon pairings and how they influence nuclear structure.

The analysis was carried out as part of the Jefferson Lab Hall B Data-Mining project, which is supported by DOE’s Office of Science. The research was also supported by the National Science Foundation, the Israel Science Foundation, the Chilean Comisión Nacional de Investigación Científica y Tecnológica, the French Centre National de la Recherche Scientifique and Commissariat a l’Energie Atomique the French-American Cultural Exchange, the Italian Istituto Nazionale di Fisica Nucleare, the National Research Foundation of Korea, and the UK’s Science and Technology Facilities Council.

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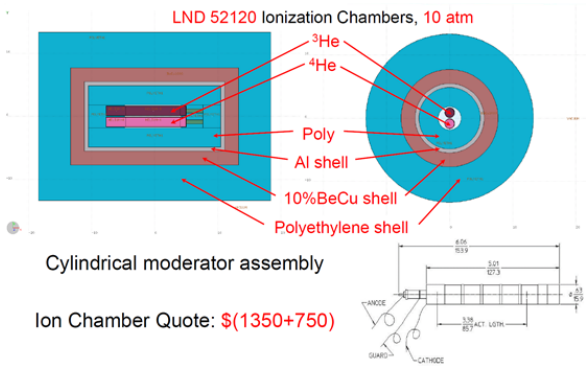
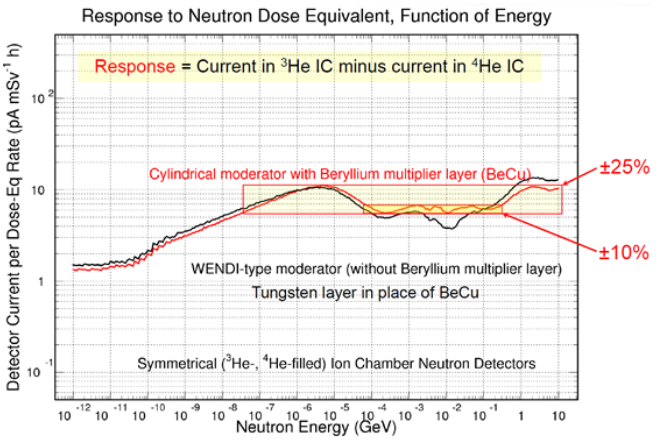
“Neutron Detector for Use in High Energy Neutron and Photon Radiation Fields”

Pavel Degtiarenko, pavel@jlab.org
Jefferson Lab

The “NDX” extended-range neutron detector is under development at JLab for operations requiring neutron dose rate measurements in the conditions of heavy neutron and photon radiation, including the radiation fields produced by high-energy electron and ion accelerators.



The novel design (U.S. patent pending), modeled in FLUKA, includes the new type of neutron moderator with the layer of beryllium copper material improving and equalizing the dose rate response to higher energy neutrons, and the new type of neutron-sensitive element made of the two small ion chambers, filled with ^{3}He and ^{4}He gas at the same pressure.



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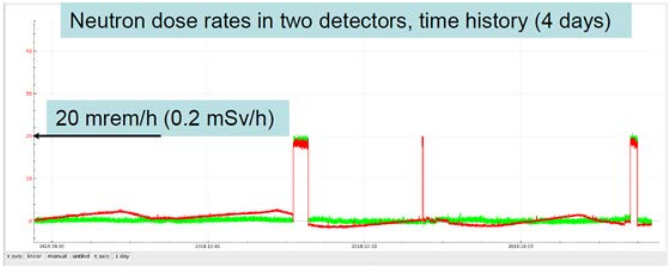
Captured moderated thermal neutrons produce measurable current in the ^{3}He ion chamber, and photons produce symmetrical response in both. A sensitive electrometer-type current readout is used, with a long-term stability better than 0.1 pA.

Two prototype detectors have been assembled, tested, and calibrated at JLab, exhibiting characteristics close to expectations in terms of sensitivity to neutrons and photons, and in terms of stability. The currents in ^{3}He and ^{4}He ion chambers agree within 10% in photon-only irradiation field. The calibration of the ^{3}He - filled ion chambers in the test neutron fields resulted in the values of the calibration coefficients of about 11 mrem/h (0.11 mSv/h) per pA. The long-term stability in about a month-long observation is found to be within 5 mrem/h (0.05 mSv/h), with much better short-term stability.



The photon radiation fields compared to the same-level neutron fields are suppressed by a factor of about 100, and their contribution is evaluated. The dynamic range of the detector corresponds to the expected large dynamic range generally accessible to ion chambers (5-6 orders of magnitude).

In the nearest future we plan to install the detectors in one of the experimental Halls at JLab for the first set of real measurements in the heavy radiation conditions up to a few kilorem/h (tens of Sv/h), characteristic to the multi-GeV electron beam scattering and interactions in the experimental targets.

"2019 HPS Annual Meeting: In the Heart of 'Where It's Happening'"

Howard Dickson
HPS Current News

Greetings to all Health Physics Society (HPS) members and other interested parties. Planning for the next HPS annual meeting is well underway. The Local Arrangements Committee (LAC) for the 2019 annual meeting held its organizational meeting in St. Petersburg on 21 September.

Most of you already know that the 2019 HPS Annual Meeting will be held in Orlando, Florida, 7–11 July, with the Hilton Orlando as the headquarters hotel. We will be located right in the heart of "where it's happening" on Destination Parkway just off International Drive. That means we will be close to a number of features and events rated highly by tourists. Think Sea World, Universal Orlando, Walt Disney World, iDrive 360, and many more.

The LAC is planning several surprises and innovations to supplement the traditionally favorite meeting features. The goal is to make the Orlando meeting the best annual meeting we have had, and we believe that goal is achievable. After all we are only getting prepared to host the best International Radiation Protection Association Congress ever in Orlando in 2024.
