NPSS NEWS

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2021 IEEE Nuclear and Space Radiation Effects Virtual Conference Finalizing Plans

Steve McClure
General Chair

Janet Barth
Chair, RESG

Teresa Farris
Vice Chair, Publicity,

The 58th Nuclear and Space Radiation Effects Conference will be held virtually, July 16th–23rd, 2021. The conference is sponsored by IEEE Nuclear and Plasma Science Society (NPSS) with guidance provided by the Radiation Effects Steering Group (RESG). Steve McClure, Jet Propulsion Laboratory, is the General Conference Chair, and Janet Barth, NASA (retired), is RESG Chair. Corporate supporters of the conference include The Aerospace Corporation, CAES, EMPC, IR HiRel Products—an Infineon Technologies Company, Jet Propulsion Laboratory, L3Harris, NASA NEPP, Radiation Test Solutions, Renesas, SkyWater Technology, and Southwest Research Institute.

The NSREC organizing committee has worked hard to offer an interesting venue and outstanding program for this year's conference and will continue the tradition of previous Nuclear & Space Radiation Effects Conferences by offering a Technical Program, a Short Course that precedes the Technical Program, a Radiation Effects Data Workshop, and an Industrial Exhibit. Engineers, scientists, and managers from around the world who are interested in radiation effects will attend.

SHORT COURSE

The Short Course Chair is Dr. Marta Bagatin, University of Padova, Dept. of Information Engineering. The theme of the 2021 course is *Challenges and Opportunities for Radiation Hardening in Advanced Technologies*.

Marta Bagatin received a Ph.D. in Information Science and Technology in 2010 from the University of Padova, Italy. She is now a Senior Assistant Professor in Electronics at the University of Padova. Her research interests are focused on the experimental study, analysis, and modeling of radiation effects and reliability issues on electronic devices for space, nuclear, and terrestrial, dependable applications. She actively collaborates with space agencies, semiconductor manufacturers, research institutes, and universities all over the world. Marta is the author or co-author of 4 book chapters, 70 papers published in peer-reviewed journals, more than 80 presentations at international conferences on reliability and radiation effects in electronics, and editor of one book. The results of her work were recognized with 10 awards at NSREC and RADECS conferences. Marta served in the technical committee of conferences such as NSREC, RADECS, and IRPS, and she contributes as a reviewer for several IEEE journals.

Presentations and speakers for the four sessions are:

HARDENING TECHNIQUES FOR DIGITAL CIRCUITS
Dr. Balaji Narasimham,
Broadcom

CONFERENCES Continued on PAGE 2

NSREC Continued from PAGE 1

HARDENING TECHNIQUES FOR ANALOG AND MIXED-SIGNAL CIRCUITS
Dr. Daniel Loveless,
University of Tennessee at Chattanooga

HARDENING TECHNIQUES FOR IMAGE SENSORS
Dr. Vincent Goiffon,
ISAE-SUPAERO, University of Toulouse

SYSTEM-LEVEL HARDENING—WHAT COULD GO WRONG, AND HOW TO MAKE IT RIGHT
Kay Chesnut,
Raytheon Intelligence & Space at Raytheon Technologies

TECHNICAL PROGRAM

The Technical Program Chair, Brian Sierawski, Vanderbilt, and his committee have assembled an outstanding set of technical papers that are organized into 9 oral sessions and a poster session. Papers presented in the NSREC technical sessions are expected to be submitted for publication after the conference in the January 2022 issue of the *IEEE Transactions on Nuclear Science* (TNS), subject to the standard TNS peer review process.

The Poster Session Chair is Ted Wilcox, NASA GSFC. The Data Workshop Chair is Helmut Puchner from Infineon Technologies.

The Technical Program Session Chairs are:

Basic Mechanisms of Radiation Effects
Chair: Marc Gaillardin, CEA

Dosimetry
Chair: Arto Javanainen, University of Jyväskylä

Hardness Assurance Technologies, Modeling, and Testing
Chair: Amanda Bozovich, Jet Propulsion Laboratory

Hardening by Design
Chair: Li Chen, University of Saskatchewan

Radiation Effects in Devices and Integrated Circuits
Chair: John Bird, Radiation Test Solutions

Photonic Devices and Integrated Circuits
Chair: Scott Davis, Aerospace Corporation

Single-Event Effects: Mechanisms and Modeling
Chair: Gilles Gasiot, STMicroelectronics

Single-Event Effects: Devices and Integrated Circuits
Chair: Nadia Rezzak, Microchip Technology

Space and Terrestrial Environments
Chair: Alex Hands, University of Surrey

The 48st IEEE International Conference on Plasma Science (ICOPS21) September 12th–16th, 2021, Virtual

The 48th IEEE International Conference on Plasma Science (ICOPS 2021), which was originally planned to be held in Stateline, Lake Tahoe, Nevada, will now be a fully virtual conference because the safety and well-being of our conference attendees is our major priority. Such virtual conferences offer an excellent opportunity for professionals in the field of plasma science, as well as for students, for networking, presenting new results, exchanging new ideas, and making new friends from around the world while staying at your home or office without stressful, expensive, and tiresome air travel!

The conference also features a one-day mini-course entitled "Plasma Spectroscopy: The Full Spectrum from X-rays to Radio Waves."

Our organizing committee is working very hard to expand the experience of the successful virtual ICOPS 2020 and further promote ICOPS spirit with an attractive and excellent scientific program and organization. We are planning to increase the number of plenary and invited speakers, attendance of young professionals including graduate students, participation of female plasma scientists, and virtual networking. Invited and plenary papers will be published in a Special Issue of the *IEEE Transactions on Plasma Science*. In addition we continue our excellent previous experience with now virtual Women in Engineering (WIE) and Young Professional Symposium (YPS) events.

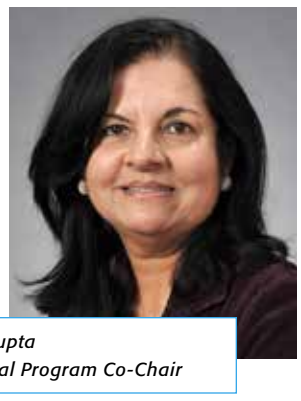
This is the first women-run ICOPS conference with the General Chair and two Technical Program Co-Chairs, all distinguished female members of the Plasma Science community. The General Conference Chair is Prof. Alla Safronova of the University of Nevada, Reno. Dr. Safronova is a nationally and internationally recognized member of the Plasma Physics and Pulsed Power community.

Prof. Alla Safronova
General Conference Chair

TECHNICAL PROGRAM

There are two Technical Program Co-Chairs for the ICOPS 2021 conference: Dr. Christine Coverdale (Sandia National Laboratories) and Dr. Arati Dasgupta (Naval Research Laboratory). These

Dr. Christine Coverdale
ICOPS Technical Program Co-Chair



Dr. Arati Dasgupta
ICOPS Technical Program Co-Chair

Technical Program Co-Chairs are committed to maintaining the high quality of papers presented at the conference.

They have assembled a diverse group of subject matter experts for their technical program committee and are looking forward to assembling a full four-day exciting program. Topics for this year include:

Basic Processes in Fully/Partially Ionized Plasmas
Basic Phenomena
Computational Plasma Physics
Space Plasmas
Partially Ionized Plasmas
Dusty & Strongly Coupled Plasmas
Plasma Chemistry

Microwave Generation and Plasma Interactions
Intense Beam Microwave Generation
Fast-Wave Devices
Slow-Wave Devices
Vacuum Microelectronics and THz Devices
Codes and Modeling
Non-Fusion Microwave Systems
Microwave Plasma Interaction
THz Sources, Radiation, and Applications

Charged Particle Beams and Sources
Plasma, Ion, and Electron Sources
Intense Electron and Ion Beams

High Energy Density Plasmas and Applications
Fusion (Inertial, Magnetic and Alternate Concepts)
Particle Acceleration with Lasers and Beams
Matter Under Extreme Conditions
Laser Produced Plasmas
Fast Z pinches
Astrophysical Plasmas
Plasma Material Interactions

Industrial, Commercial, and Medical Applications
Nonequilibrium Plasma Applications
High Pressure and Thermal Plasma Processing
Plasma Thrusters
Environmental and Industrial Applications
Plasma Medicine & Biological Effects

Diagnostics
Optical and X-ray diagnostics
Microwave and FIR diagnostics
Particle Diagnostics

Pulsed Power and Other Plasma Applications
Insulation and Dielectric Breakdown
Switching
Generators
Compact Pulsed Power and Applications

Abstract submission is currently open! Abstracts will be accepted until Friday, May 28th, 2021. Please submit abstracts online at: http://goto.unm.edu/icops2021

Accepted abstracts will be published in IEEE Xplore and must meet the IEEE standards of originality and quality. Please see the website for an abstract template and guidelines for abstract submission.

MINICOURSE

The conference features a one-day minicourse entitled Plasma Spectroscopy: The Full Spectrum from X-rays to Radio Waves. The excellent short course organized by the minicourse Chair Dr. Mark Johnston (Sandia National Laboratories) will be held on September 16, 2021, and is designed to complement the technical program of this conference. The collection of tutorial papers from the minicourse will be published in a special issue of the *IEEE Transactions on Plasma Science*. More information will be available on the conference website.

ADDITIONAL INFORMATION

For the latest ICOPS 2021 information (abstract submission, technical program, events, etc.), please visit the conference website at: http://goto.unm.edu/icops2021

To stay informed about what's happening at ICOPS 2021, join the mailing list, or ask a question by e-mailing us at icops2021@ieee.org.

On behalf of the entire organizing team, we look forward to seeing you all virtually at ICOPS 2021!

Professor Alla Safronova,
Chair of ICOPS 2021, can be reached by E-mail at alla@physics.unr.edu.

NUCLEAR & PLASMA SCIENCES SOCIETY NEWS

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Pulsed Power Conference/Symposium on Fusion Engineering Denver, Colorado 12th–16th December 2021

David Wetz
Pulsed Power General Chair

Kevin Freudenberg
SOFE General Chair

We are pleased to invite you to participate at the collocated 2021 IEEE International Pulsed Power Conference (PPC) and IEEE Symposium on Fusion Engineering (SOFE). This will be an **IN-PERSON** meeting given the projection of waning COVID-19 restrictions. Both conferences are fully (financially & technically) sponsored by the IEEE Nuclear and Plasma Sciences Society (NPSS). This is the second time the PPC and SOFE have collocated, the first being in 2015 at the Austin Downtown Hilton in Austin, Texas.

PPC has a history dating back to 1976 and this biannual conference provides a premier forum for the exchange and dissemination of technical information on pulsed power technology and engineering. The meeting is organized by the NPSS's Pulsed Power Science and Technology (PPS&T) subcommittee. Typically, more than 25 different countries submit abstracts and present papers, validating the truly international nature of the conference and its participants. The 3.5-day event consists of oral/poster presentations and technical discussions across all areas of pulsed power science, technology, and applications. SOFE is a bi-annual event that is organized and sponsored by the Fusion Technology Standing Committee (FTC) of the IEEE NPSS. The meeting highlights advances in magnetic and inertial fusion energy science and engineering.

The conference focuses in technical areas including fusion development in both large R&D experimental fusion reactor facilities and basic research in fusion concepts, systems, components and materials.

This collocated event will be held in Denver, Colorado, from December 12th–December 16th, 2021 which is postponed from the original dates of May 31st–June 4th, 2021 to encourage higher turnout and ensure the safety of all participants. It will be held at the Denver Downtown Sheraton hotel in the heart of downtown. Denver is in the South Platte River Valley on the western edge of the High Plains just east of the Front Range of the Rocky Mountains. Because of its elevation, it is known as the 'Mile High City' and offers majestic views of mountains and valleys for all visitors. It is the most populous city in the state of Colorado and offers amazing exposure to the great outdoors, while still having a bigcity feel. The Denver Downtown Sheraton is located just off the 16th Street Mall, offering world-class dining and shopping within easy walking distance. All conference attendees will enjoy free Wi-Fi internet access (both in the meeting spaces and in hotel rooms) for the duration of the event.

Due to the uncertainty COVID has introduced we are still working through many of the social details of the event but we hope that by December 2021, restrictions will be significantly reduced and the event will be very much like the technical conferences we are used to attending. We have many exhibitors already signed up and we expect to have our usual exhibitor participation whereby scientists, engineers, and students can review new products and components available to those designing high-voltage and pulsed-power systems. We encourage you to visit our website, https://uta.engineering/ppcsofe2021/, and join our email list to keep up with the latest information.

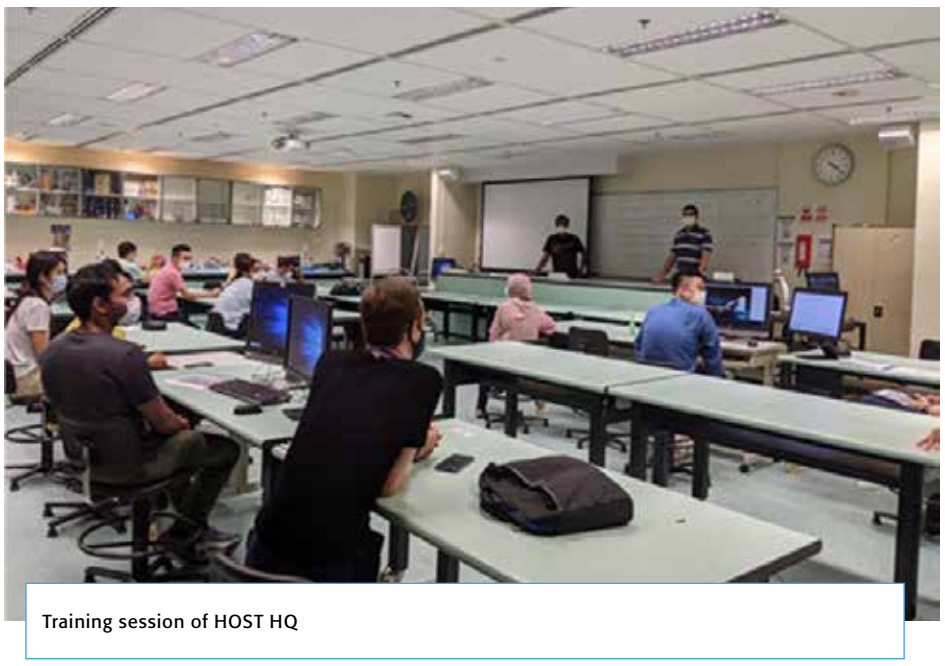
The PPC will be chaired by Dr. David Wetz, University of Texas at Arlington and Dr. John Mankowski, Texas Tech University, will be serving as Technical Program Chair. The SOFE will be chaired by Dr. Kevin Freudenberg, Oakridge National Laboratory, and Dr. Hutch Neilson, Princeton Plasma Physics Laboratory, will be serving as Technical Program Chair. Dr. Stephen Bayne, Texas Tech University, is the event Treasurer and Mrs. Lisa Boyd is the IEEE MCE Events Coordinator. If you have suggestions or wish to contribute to the conference, please contact us at either wetz@uta.edu or freudenbergk@ornl.gov. All the organizing committee hopes to give everyone a return to IN-PERSON events and looks forward to hosting you all in Denver, Colorado on December 12th–16th, 2021. Take care and be safe!

David Wetz, PPC General Chair, can be reached by E-mail at wetz@uta.edu; Kevin Freudenberg, General Chair of SOFE, can be reached at freudenbergk@ornl.gov.

Conference Report

Virtual ICOPS 2020 6th–10th December 2020

The 47th International Conference on Plasma Science (ICOPS 2020) together with the 2nd Asia-Pacific Conference on Plasma and Terahertz Science (APCOPTS 2020) was initially planned to be held onsite at Marina Bay Sands, Singapore from May 24th–28th, 2020. About one thousand abstracts were submitted by end January 2020, however due to COVID-19 it was decided to postpone the ICOPS 2020 to 6th Dec 2020 with an aim to still do it physically. However, as the COVID-19 situation worsened further it was decided in July 2020 to hold ICOPS 2020 as a fully virtual conference. Initially the IEEE Event Design and Production Team offered to organize the Virtual ICOPS 2020 using the On24 platform. However, on 23rd September 2020 they expressed their inability to do it. The ICOPS 2020 local organizing committee (LOC) then did a vigorous search for Virtual Conference service providers and finally awarded the contract to Cvent, whose platform was already being used by IEEE MCE for registration services for ICOPS 2020.



Training session of HOST HQ

Even with the virtual arrangement of the conference ICOPS 2020 received an overwhelming response with a total of 1264 abstracts being submitted initially and which was later reduced to about 1060 by the abstract submission deadline. More than 720 registered participants from around the world registered with about 700 papers presented at Virtual ICOPS 2020. The month of November was used by Cvent to provide training of the key personnel of the Local Organizing Committee and to cater for the logistics needed for the virtual conference.

Opening ceremony of ICOPS 2020 followed by Plenary Session 1. Speaker: Monica Blank; Session Chair: Joseph Schumer

For the conference, 15 Ph.D. students and six research staff from Nanyang Technological University (NTU) and Singapore University of Technology and Design (SUTD) were trained to host the virtual sessions (designated as Host HQ) and also to run them live on the Virtual Attendee Hub (VAH) platform of Cvent for viewing and participating in the talks. A four-day training comprising about 40 two-hour sessions was conducted one week before the actual conference to train plenary, invited and oral speakers.

The conference was organized for five days with each day mostly divided into four sessions comprising: plenary session, morning parallel session, poster session and evening parallel session. On one of the days (Tuesday, 8th December 2020) the morning parallel session was replaced by the Award Ceremony, Women in Engineering and Young Professional Networking Seminar. The Virtual ICOPS 2020 Opening Ceremony started with the remarks from General Chair Prof. Rajdeep Singh Rawat and the opening Plenary Session chaired by PSAC Chair

Continued on PAGE 4

Virtual ICOPS 2020

Continued from PAGE 3

Dr. Joseph Schumer. Each morning and evening consisted of a maximum of eight parallel sessions. In total 80 sessions were hosted virtually and run live on the VAH. These sessions included eight plenary sessions, 64 parallel sessions (this included invited talks and oral contributions), five poster sessions, an Award Ceremony, a Women in Engineering and a Young Professional Networking Seminar (YPNS). The plenary sessions included talks by Dr. Monica Blank, the 2020 NPSS PSAC Award winner and Dr Rodney Mason, the Birdsall Award winner. Professors Y Y Lau, Yitzhak Maron, Shuyan Xu, K. D. Weltman, Michael Johnston and Deng Jianjun gave excellent insight and overviews of research into their respective areas of expertise. There was also a Question-and-Answer session for all the presentations. This was done through VAH. The Host HQ of the session relayed the questions to the Session Chair who then asked the presenter the questions. Barring few, most of the sessions had 100% of the speakers present for their talks.

One of the highlights of the Virtual ICOPS 2020 was the Women in Engineering talk by Prof Jacky Ying, a renowned scientist and founding executive director of the Institute of Bioengineering and Nanotechnology, Singapore. She discussed how the role of women in the biomedical field has changed over the years.

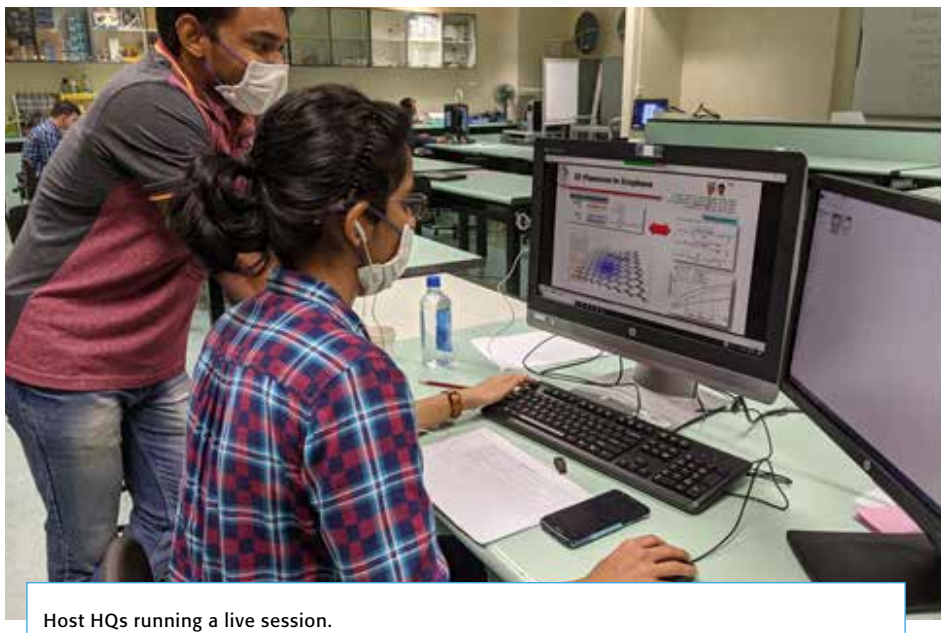
Dr Mark Lim chaired the session for YPNS where entrepreneurs from various technical fields gathered to provide an insight into what stakeholders typically look out for in their provision of support mechanisms to promising companies and enterprises.

The Award ceremony was held virtually and was chaired by Prof. Rajdeep Singh Rawat. Prof John Verboncoeur presented 2020 NPSS Charles K. Birdsall Award to Dr Rodney J. Mason and 2020 NPSS Early Achievement Award to Asst. Prof Peng Zhang. Dr Joseph Schumer presented the 2020 NPSS PSAC Award to Dr Monica Blank and Igor Alexeff Outstanding Student in Plasma Science Award to Alexander Rososhek. The outstanding poster award winners, Yang Cao, Do Thi Bich Hue, Jianan Wang, Gaurav Nayak and Nakul Nuwal were presented their awards by Professor Tim White, President of the Material Research Society of Singapore.

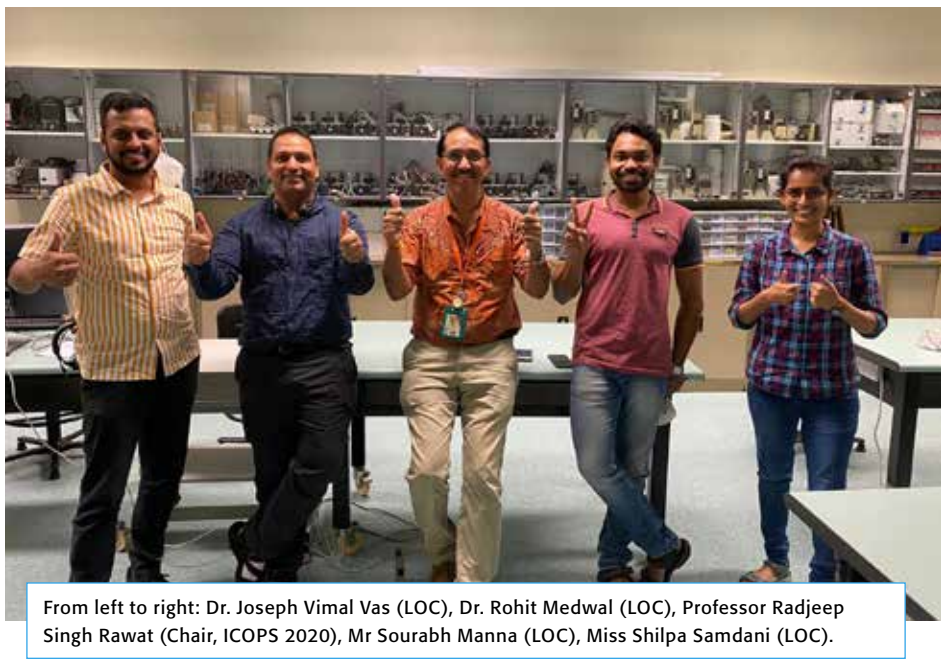
The Virtual Poster Sessions were another highlight of ICOPS 2020. The participants were given a virtual booth to set up and run live as they presented their posters during the sessions.

Virtual ICOPS 2020 with over 720 registered participants from about 40 countries with about 700 presentations was a huge success in the testing time of COVID-19. It owes its great success to the excellent teamwork of the Technical Committee Co-Chairs Dr. Mary Ann Sweeney and Associate Professor Chao Chang, all Technical Area Coordinators, Session Organizers/Chairs, Secretary Associate Professor Paul Lee, IEEE MCE Manager Ms. Lisa Boyd, Host HQ support students and staff, Cvent Team Manager Ryan Leo and Virtual Conference infrastructure support from the National Institute of Education, NTU, arranged by Ms. Cecelia Selvam. Sponsorship from the Institute of Physics Singapore, Plasma Innovation Labs, SUTD, Material Research Society Singapore and JOEL Asia Pte Ltd is gratefully acknowledged.

Prof Rajdeep Singh Rawat, who submitted this report, can be reached by E-mail at rajdeep.rawat@nie.edu.sg.



Host HQs running a live session.



From left to right: Dr. Joseph Vimal Vas (LOC), Dr. Rohit Medwal (LOC), Professor Radjeep Singh Rawat (Chair, ICOPS 2020), Mr Sourabh Manna (LOC), Miss Shilpa Samdani (LOC).

President's Report

Steve Meikle
IEEE NPSS President

In my March newsletter article, I touched upon the challenge of reimagining our conferences in a post-Covid world. The impacts of Covid-19 on our conferences will continue to be felt through 2021 when most will be held in virtual mode. However, with the rollout of vaccines well underway, conference organizers are anticipating the possibility of in-person or hybrid conferences in 2022 and beyond. It is very unlikely that we will return to the way things were pre-Covid and run our conferences as we used to. Indeed, given what we have learned over the past year about the possibilities of virtual conferencing and all it has to offer (not to discount the frustrations), why would we want to return to business as usual? At the least there will be greater awareness of social distancing and hygiene at in-person conferences. We can also anticipate that many will relish the opportunity to engage remotely by live streaming or view-on-demand, in order to avoid travel and save costs. This could be particularly attractive for colleagues, especially students, in developing countries who cannot secure funding support to attend in person. To find out what type of future conferences are preferred, we asked the following question in our recent member survey:

When we are able to return to in-person conferences, would you prefer:

1. Hybrid
2. In-person only
3. Alternate virtual and in-person if a yearly conference
4. Virtual only".

46% of respondents said they would prefer hybrid, narrowly beating in-person only with 41%. Less than 3% indicated they would prefer virtual only. It is important to point out that this is a poll of NPSS members, most of whom are regular attendees of at least one of our conferences. We can probably assume that the hybrid option would be at least as popular among non-members and those who have never attended an NPSS conference but might like to in the future, although we have no data on that at present.

While hybrid conferences bring opportunities to expand the reach of our conferences to new audiences, they also introduce a host of new challenges. How do conference organizers estimate well in advance the number who will attend in person versus remotely? That introduces uncertainty into the planning for venue space, food and beverage allowance and hotel blocks, not to mention the setting of registration fees, all of which have direct impacts on budgeting. Another important question is how do we ensure all participants have a positive experience, if not the same experience, of the conference? And how do we meet the expectations of our exhibitors who are so vital to the success of our conferences? These questions were discussed in depth at our March AdCom (virtual) retreat, the discussion being led by Susanne Kühn, our Conferences Committee Chair, and Lisa Boyd from IEEE Meetings Conferences and Events (MCE). We don't have all the answers at this stage but it was a very useful and insightful discussion. We will continue to consult with our membership, conference stakeholders more broadly, and IEEE colleagues on this important topic.

Another topic that we devoted considerable time to at our retreat was the future of the Instrumentation Schools and educational initiatives in general. For those who are not familiar with the Instrumentation Schools, this was an initiative brought to AdCom in 2014 by Patrick Le Dû (IN2P3-CNRS, Lyon, France) and Christian Bohm (Stockholm University, Sweden) to run a series of small hands-on workshops (typically <30 attendees) on radiation detection science in parts of the world where students have little or no opportunity to attend our conferences, specifically the IEEE Nuclear Science Symposium and Medical Imaging Conference. Since 2014, the Instrumentation Schools have been managed within the NPSS Transnational Committee by a group of very dedicated volunteers, mostly from the CANPS and Radiation Instrumentation Technical Committees, and funded by so-called "new initiatives" funding, i.e. funding external to our normal operating budget. In a few cases additional funding was also made available by the host organization. The Schools have been very successful at reaching new, enthusiastic student cohorts, expanding our reach globally (workshops have been held in Japan, Vietnam, South Africa and Malaysia, as well as virtual workshops in Jakarta and Dakar) and launching a new NPSS chapter in South Africa. At our March retreat, AdCom agreed that we want to place the Instrumentation Schools on a more secure, stable footing by funding them as an ongoing activity of NPSS, rather than as a year-by-year initiative with the uncertainty such initiatives are subject to. In general, this is the preferred pathway for successful initiatives. If they can be financially sustained, either on their own or through the operating budget, they may be transitioned to a core activity of the Society. We also decided to move them from the purview of the Transnational Committee into a new, soon-to-be-established Education Committee (EduCom). This will not only enable the Transnational Committee to focus on new initiatives to improve our global reach but also, through EduCom, place a focus on educational initiatives more broadly, which are key to the Society's five-year strategic plan. A small working group has been established to recommend the terms of reference and membership of EduCom. We will keep you updated on these developments in future newsletter articles and via the web site.

I encourage you to reach out to me or your elected representative(s) on AdCom and your Technical Committee Chairs with any ideas you may have on the issues discussed above, as well as any others you feel NPSS ought to address. We welcome your input. It is, after all, your Society.

Steve Meikle, IEEE NPSS President, can be reached by E-mail at steven.meikle@sydney.edu.au.

I SECOND THAT!

Honesty may be the best policy, but it is important to note that apparently, by elimination, dishonesty is the second-best policy.

George Carlin

SO, THEY ARE NOT THAT SMART

Success is a lousy teacher. It seduces smart people into thinking they can't lose.

Bill Gates

BUT NOT SUFFICIENT

Man's capacity for justice makes democracy possible, but it is man's inclination to injustice that makes democracy necessary.

Reinhold Niebuhr

March 3rd, 2021 Members Survey

Vesna Sossi
IEEE NPSS Vice President/President-elect

The Nuclear and Plasma Sciences Society has eight standing technical committees reflecting its main technical fields of interest:

- The Computer Applications in Nuclear and Plasma Sciences Committee (CANPS)
- The Fusion Technology Committee (FTC)
- The Nuclear Medical and Imaging Sciences Committee (NMISC)
- The Particle Accelerator Science and Technology Committee (PAST)
- The Plasma Sciences and Applications Committee (PSAC)
- The Pulsed Power Science and Technology Committee (PPST)
- The Radiation Effects Committee (REC)
- The Radiation Instrumentation Technical Committee (RITC)

The Chair of each committee is by default part of the NPSS Administrative Committee (AdCom), the body that oversees the operations of NPSS; in addition, there are 16 voting **AdCom positions** available to elected members of the society with 15 to be distributed among the technical committees and one allocated to the Transnational Committee. Our bylaws dictate that these positions **are allocated** in a manner that maintains representation among AdCom membership **in proportion to the technical interests of the NPSS membership**, as determined by periodic surveys to be conducted at least every five years to reflect current members' interests. As the last survey was conducted in late 2014 with results presented in 2015, a survey was due in 2021.

While assessing the technical and scientific interests of the members of our society was the primary goal, we included questions about the members' opinion of the **Newsletter**, an important communication tool across all our technical areas, and some questions about **other aspects of the society's activities** to identify weaknesses and strengths. This information will be used to collectively consider changes where required, and further build on the strengths. We sincerely thank all of you who took the time to complete the survey and shared your opinions. Everybody's input and participation are extremely valuable to keep our society active and vibrant. And for those of you who are interested in taking an even more active role in the society, there are many opportunities for volunteering https://ieee-npss.org/make-a-difference-get-involved/ and please consider contributing to the Newsletter for topics that are of interest to the Society's members.

RESULTS

(a) Distribution of Technical Areas interest votes according to the March 3, 2021 survey: number of seats on AdCom.

Members were asked to **rank their technical area (TA) of interest from 0 – 5**, with 5 being the highest score. They were not asked to normalize the votes to a common sum.

The link to the survey, run by Eventclass, was sent to all the NPSS members and **676 responses** were received.

The input to the analysis was calculated in two different ways:

1. Sum of points across responders for each TA.

2. The votes across TA for each member were normalized to 1, essentially each member was given one vote. These weighted numbers were then summed for each TA.

For each method, the sum numbers obtained for each TA were divided by the lowest number across TAs (=1 seat) and rounded to the closest integer. When this procedure did not result in the total number of seats (15), the TAs whose numbers were closest to the threshold for one extra seat where allocated one more seat.

Both methods gave the same results labelled as 'new' in table1. The current numbers are included for comparison. The new seat distribution will be implemented in 2022 and will thus impact the up-coming election of new AdCom members.

	CANPS	FTC	NMISC	PAST	PSAC	PPST	REC	RITC
NEW	2	1	2	2	2	2	2	2
Current	1	1	2	1	3	2	3	2

Table 1. Distribution of AdCom seats according to the members' expression of interest. Increases relative to current distribution are highlighted in red, decreases in green.

(b) Results from the rest of the survey.

(i) Newsletter

» Do you read the NPSS Newsletter ? (687/687 answered)
- Yes ..... 83.3 %
- No 16.7%

» Why don't you read the NPSS Newsletter? (115/687 answered)
- I don't find it interesting 26.9%
- I am not aware of it 26.1%
- I forget and would like a reminder when a new issue becomes available 26.2%
- N/A 18.3%

» If the newsletter became available in the electronic form only would you consider this: (687/687 answered)
- The preferred option 61.9%
- A shame, but I can 'live with it' 34.1%
- Very disappointing and I would no longer read it 4.1%

» Do you feel that your needs for information about NPSS activities and opportunities are being met by the Newsletter? (687/687 answered)
- Yes 73.9%
- N/A 17.5%
- NO 8.6%

» Would you like to see more information on upcoming NPSS- sponsored conferences? (567/687 answered)
- Yes 72.5%
- No 19.0%
- N/A 8.5%

» Would you like to see more articles about NPSS member activities? (567/687 answered)
- Yes 66.1%
- No 33.9%

» Would you like to see more overview articles covering the technical areas of NPSS? (567/687 answered)
- Yes 81.8%
- No 13.8%
- N/A 4.4%

» How would you rate the technical quality of the Newsletter? (687/687 answered)
- High 55.3%
- Medium 23.1%
- N/A 11.1%
- Very high 9.0%
- Low 1.5%

(ii) Demographics of responders (all responses were anonymous) on an individual level (687/687 answered)

» Do you work in:
- Academia 46.1%
- Industry 16.4%
- Government 15.7%
- Retired 12.8%
- Consultant 4.4%

» In which region do you live:
- Europe (Region 8) 21.5%
- Asia-Pacific (Region 10) 14.0%
- Western US (Region 6) 13.8%
- Southwestern US (Region 5) 12.7%
- Southeastern US (Region 3) 9.8%
- Northeastern US (Region 1) 8.4%
- Eastern US (Region 2) 7.4%
- Central US (Region 4) 6.6%
- Canada (Region 7) 3.1%
- Caribbean, Central and South America (Region 9) 2.8%

iii. Comments on NPSS in general (687/687 answered)

» What do you find the most valuable about NPSS?
- Technical content 75.1%
- Publications 57.8%
- Networking 45.4%
- Ability to participate in conference organization/other volunteer activities 31.3%
- Opportunities for Professional/Career development 19.7%
- Educational/outreach activities including WIE and YP 14.4%
- Communication between IEEE/NPSS governing bodies and members 12.2%
- Chapters activity 8.2%

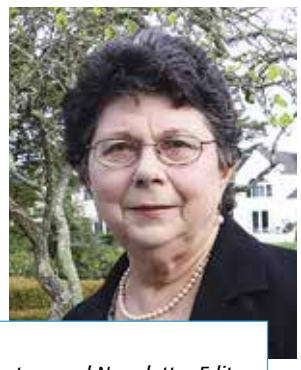
» What do you find least valuable/should be improved?
- Chapters Activity 34.1%
- Opportunities for Professional/Career development 22.0%
- Communication between IEEE/NPSS governing bodies and members 21.4%
- Educational/outreach activities including WIE and YP 14.8%
- Networking 14.8%
- Ability to participate in conference organization/other volunteer activities 9.0%
- Publications 7.7%
- Technical content 6.6%

iv. Conference format

» When we are able to return to in-person conferences would you prefer:
- Hybrid 45.7%
- In-person only 40.7%
- Alternate virtual and in-person if a yearly conference 10.9%
- Virtual only 2.7%

Vesna Sossi, the IEEE NPSS Vice President/President-elect, can be reached by E-mail at vesna@phas.ubc.ca.

Secretary's Report



Albe Larsen
IEEE NPSS Secretary and Newsletter Editor

The NPSS Administrative Committee held its first meeting of 2021 by Zoom on March 6th. Finance and Communications committee meetings were held on Thursday, March 4th and we held a virtual retreat on March 5th. As in our past virtual meetings the number of reports presented was limited and many reports were either posted or recorded for private viewing.

As you can see from Vesna Sossi's article above, there was a strong showing in favor of converting this newsletter to an electronic format. Our graphic design firm is working on software selection and it is hoped that we will make the transition no later than the beginning of 2022. Ideally, however, we are hoping to make the conversion by the September 2021 issue. We'll keep you updated as we move forward. We hope the new format will allow greater flexibility and interaction capabilities.

Our new President, Steven Meikle, introduced the Society Performance dashboard that allows assessment of how a society is performing in a number of areas in relation to impact on field, things to help a career, networking possibilities and technical resources in relation to such things as our conferences, publications, humanitarian efforts and other.

The IEEE financial picture looks strong, in large part, as reported by TAB Finance Commmittee, due to underspending in 2020 as a result of reduced travel and other underspending. In 2021 there may be a healthy surplus resulting from one-off insurance claims, while the 2022 picture is a bit murky. The 50% of surplus allowed for project spending is being examined by an ad hoc committee, and another ad hoc is looking at the overall health of societies and councils, especially those on the watch list. Other activities will include discussions on publications, especially in regard to open access publishing.

Ralf Engels, our Society Treasurer, reported that NPSS is doing well on conference closures and is looking at the financial implications of in-person, virtual and hybrid meetings. The hybrid option was preferred in our survey but will be the most expensive. On the other hand, it does permit people to attend who otherwise might not be able to pay the travel costs. Note that all conference treasurers must use the budget tool, and that budgets that are more than 15% different from the approved budget, must submit a new budget for approval. A final working budget is due two months before a conference opens, and a preliminary closing budget is due a month after the conference ends. Overall, the NPSS is stable financially. Publications are doing well, and conferences are in the black.

Membership has, however, dropped during the pandemic and recruiting is difficult. Sal Portillo, our Membership Committee chair, is looking at new ways to recruit new members. And NPSS has added two new Student Branch Chapters. See the report below about the new chapter in Costa Rica.

And three new Distinguished Lecturers have been added to the roster, Vesna Sossi, Dimitris Visvikis and Audrey Corbeil Thierrien. See the Distinguished Lecturers page on our web site: https://ieee-npss.org/distinguished-lecturers/. Here you will find the full list of our Distinguished Lecturers as well as titles of talks they are prepared to present. Remember that for our Chapters and Student Branch Chapters, funds are available to support these lectures. In 2020, typically a large number of lectures were given, although most were presented virtually.

Also remember that, even though it may seem early, it isn't really too early to start preparing Class of 2023 Fellows nominations. In 2021 we honored three new Fellows out of 12 nominees, and the nominations for the Class of 2022 closed on March 1, so think of who you might nominate for the Class of 2023. The nominee must be a senior member in good standing of IEEE but the nominator does not need to be a Fellow. And if you need help or have questions about preparing a nomination, Dr. Jane Lehr (jmlehr@unm.edu) and her committee are available to give you guidance. NPSS has many extraordinarily qualified members who should be recognized.

As you have read in an earlier newsletter, IEEE Smart Village has been restructured and John Nelson of IAS is the new head. Our liaison, Ray Larsen, continues on the Management Board. He reports that ISV has started over 170 standalone projects and has trained close to 12,000 students, In total 628 new businesses have been launched, and one of the Nigerian programs is getting close to the goal of reaching a million people! However, the need for electricity, education, entrepreneurship training, along with clean water, sanitation and health care remain challenges for many – in order of a billion people, So, if you are interested, visit the ISV web site https://smartvillage.ieee.org/, and volunteer.

2020 and 2021 have presented challenges to both our Young Professionals and Women in Engineering programs. However, both have managed to support programs at our virtual conferences as well as WIE programs at our Instrumentation Schools.

Our Publications Chair, Paul Dressendorfer, reports that our journals are doing well. Open Access is being watched and IEEE has launched 15 Accelerated Gold OA journals. However, two have published no papers and 11 published fewer than 45 papers in 2020.

ADCOM ACTIONS

» AdCom approves that NPSS will cover the $1,450 Administrative Fee for the Technical Co-sponsorship of RADECS 2021. Motion from Radiation Effects TC: passed. 24 Y, 0 n, 0 A.

» AdCom approves continuing the process to establish the NPSS Fund in the IEEE Foundation. Motion from the Finance Committee. 22 Y 0 N, 1 A.

» AdCom approves the NPSS Nominations Committee consisting of the eight TC Chairs and the NPSS Nominations Committee Chair.

» It was moved and seconded that the revised Constitution and Bylaws be accepted as presented. 24 Y, 0 N, 0 A.

Following the meeting, the Constitution and Bylaws have been presented to and accepted by TAB.

Albe Larsen, IEEE NPSS Secretary and Newsletter Editor, can be reached by E-mail at a.m.larsen@ieee.org.

New AdCom Member

Roger Raman
AdCom member–Fusion Technology

Dr. Raman holds a B.A.Sc. in Chemical Engineering from the University of Toronto, M.Eng. in Engineering Physics from McMaster University, an M.S.A.A. in Aerospace Engineering and Ph.D. in Plasma Physics both from the University of Washington. Upon graduation, the Canadian Fusion Fuels Technology Project hired him for developing an advanced fueling system known as Compact Toroid Injection. Since 1999 he has been employed by the University of Washington to develop a solenoid-free plasma start-up system known as Coaxial Helicity Injection. He is an expert in both areas. He has been on long-term assignment to PPPL (1999 to present), where he developed the CHI concept on the NSTX experiment. He subsequently helped to deploy the CHI system on the QUEST ST at Kyushu University in Japan for the purpose of developing reactor-relevant capability of CHI. More recently he has been involved in the development of a fast time response tokamak disruption mitigation system known as the Electromagnetic Particle Injector (EPI). Dr. Raman has been an active Physics Operator on NSTX and was the Experimental Run Coordinator for the 2006 and 2009 NSTX Run campaigns, and before graduate studies was also trained as a Reactor Shift Engineer for the NRU fission Research Reactor at the Atomic Energy of Canada Limited. His primary interest is to help identify and develop promising new reactor-relevant systems that can help simplify the spherical torus and tokamak reactor designs.

Roger Raman can be reached by E-mail at rraman@pppl.gov.

Technical Committees

NUCLEAR MEDICAL AND IMAGING SCIENCES

Roger Fulton
NMISC Chair

At the time of writing (mid-April 2021), here in Australia, we are very fortunate to have the Covid-19 outbreak largely under control and have returned to an almost normal life. There are also promising signs of a return to normal emerging from the UK. However, we are conscious that the outbreak is still extremely serious and even gaining pace in many other countries of the world. I sincerely hope you and your loved ones are healthy and safe. Let us hope that the current vaccination efforts and control measures will allow us to return to face-to-face meetings in the near future.

Meetings, Conferences and Events (MCE)

By now you will be aware that the 2021 NSS/MIC/RTSD in Yokohama will be delivered virtually. Uncertainty regarding the delivery mode of planned conferences creates many difficulties for organizing committees. IEEE MCE (Meetings, Conferences and Events) were extremely helpful with contract negotiations in the lead up to the 2020 NSS/MIC/RTSD in Boston. NMISC has had some initial discussions with MCE about whether it could play a beneficial role in future conference site selection and contract negotiations given its expertise in these areas, and further discussions are planned.

Joint Oversight Committee (JOS)

Following a vote by NMISC members in late January, Dr Larry Zeng's term as an NMISC JOS representative was extended for a further term (2021-2022) in consideration of the disruption of JOS tasks during 2020 due to the pandemic. We thank Larry for accepting this nomination.

AWARD RECIPIENTS

It is a great pleasure to congratulate the following recent NPSS Award recipients from our NMISC community.

IEEE NPSS Edward J. Hoffman Early Career Development Grant

Émilie Gaudin, Université de Sherbrooke, Canada. This award was offered for the first time in 2021 and is made possible by a generous donation to IEEE Foundation from Carolyn Hoffman. Émilie intends to use the award funds to explore the feasibility of achieving 100 ps coincidence timing resolution with the LabPET II fully pixelated detector configuration.

IEEE NPSS Early Achievement Award

André Kyme, University of Sydney, Australia. Andre received his award for seminal contributions to motion tracking and correction in emission computed tomography and the development of methods that enable preclinical imaging of awake, freely moving animals.

Congratulations Émilie and André on your outstanding achievements!

Upcoming Deadline for 2021 NMISC Awards

The deadline for nominations for the 2021 round of NMISC Awards is July 15th, 2021. These awards are the Edward J Hoffman Medical Imaging Scientist Award (for an individual in recognition of outstanding contributions to the field of medical imaging science), the Medical Imaging Technical Achievement Award (for a mid-career individual who has made significant and innovative technical contributions in the field of medical imaging science), and the Bruce Hasegawa Young

Investigator Medical Imaging Science Award (for a young individual in recognition of significant and innovative technical contributions to the field of medical imaging science). Please give some thought to nominating a colleague, or encouraging those around you to nominate deserving candidates. There are many well-qualified candidates in our midst! Further information and nomination forms can be found at

https://ieee-npss.org/technical-committees/nuclear-medical-and-imaging-sciences/#the-edward-j-hoffman-medical-imaging-scientist-award-award-description.

With best wishes,
Roger Fulton
NMISC Chair.

Roger Fulton, Chair of the Nuclear Medical and Imaging technical Committee, can be reached by E-mail at roger.fulton@sydney.edu.au

PULSED POWER SCIENCE AND TECHNOLOGY

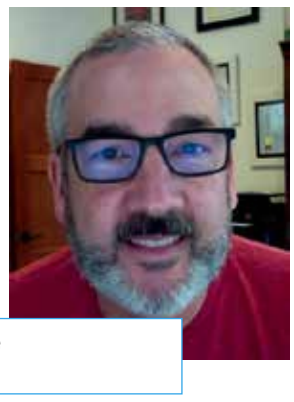
David Wetz
PPST Chair

We hope this newsletter finds everyone healthy and doing well. Back in December, I wrote an article for the March NPSS newsletter where I said that I hoped the COVID vaccine would be widely rolling out by March and now as I write this towards the end of March, it is thankfully becoming a reality. Because of this, we are forging ahead with our planning for the collocated 2021 Pulsed Power Conference (PPC) and Symposium on Fusion Engineering (SOFE) that will be hosted IN-PERSON at the Downtown Denver Sheraton in Denver, Colorado on December 12 – 16, 2021. We are optimistic that things will be much better in December, to the level where we are confident that we will be able to safely host the event IN-PERSON. The PPC will be chaired by me, Dr. David Wetz from the University of Texas at Arlington (UTA), and SOFE will be chaired by Dr. Kevin Freudenberg from Oak Ridge National Laboratory (ORNL). We have a great organizing committee in place and look forward to the great collaboration an in-person meeting affords. Visit the conference website, https://uta.engineering/ppcsofe2021/, for more information. Please plan to attend and help us to maintain the rich history and reputation of both valuable technical conferences.

This newsletter will come out after the deadline for 2021 PPST member nominations, but each year the PPST elects four new committee members for a term lasting four years. Please consider nominating yourself or one of your peers to run for one of these seats. If you would like to nominate yourself or someone else, please send an email to wetz@uta.edu. We hope everyone has a great summer and we hope to see you in Denver in December 2021.

David Wetz, Chair of the Pulsed Power Science and Technology Committee, can be reached by E-mail at wetz@uta.edu.

RADIATION INSTRUMENTATION STEERING COMMITTEE



John Valentine
RISC Chair

As the highly effective COVID-19 vaccines begin to immunize the world, there is beginning to be hope that the end of this very difficult time is coming. We sincerely look forward to the time when we can all congregate to share each other's companionship and technical expertise. As we begin this transition, Radiation Instrumentation conferences will also begin transitioning back to in-person or hybrid (accommodating both in-person and virtual attendees). Plans for all in-person conferences have contingencies for transitioning to virtual to accommodate the public health status of the COVID-19 pandemic. Check conference web sites early and often to get the latest updates on these plans.

The 2021 IEEE Symposium on Radiation Measurements and Applications (SORMA West 2021—http://sormawest.org/) will be fully virtual and is being planned for a two-week period (weekdays only) of May 17th–28th. Each day will consist of about four hours of sessions to, as much as possible, accommodate all time zones. In addition, to encourage interactivity of conference attendees, the oral sessions will focus on Questions and Answers, managed by the Session Chairs. Poster sessions will also attempt to leverage the virtual format as best possible. A virtual exhibit hall will host companies seeking to interact with conference attendees.

The 7th International Conference on Advancements in Nuclear Instrumentation Measurement Methods and their Applications (ANIMMA 2021 – www.animma.com) is currently planned for June 21st–25th as a hybrid conference (accommodating both in-person and virtual attendees). In-person attendees will gather in Prague, Czech Republic. A decision regarding whether to go fully virtual will be made in early May. Check the conference website for updates.

To increase the likelihood of an in-person conference, SCINT 2021 has been postponed to 2022 and renamed. SCINT 2022 https://web.cvent.com/event/66cab405-2615-464f-85c9-5be76bb271d0/summary will be held September 19th–23rd, 2022 in Santa Fe, NM, USA.

An early decision was made to hold the 2021 Nuclear Science Symposium and Medical Imaging Conference in the virtual format. Similar to the decision for the 2020 NSS/MIC going from being hosted in Boston, MA, USA to virtual and the Boston-hosted conference being deferred to 2024, with the 2021 NSS/MIC going virtual we have deferred the Yokohama, Japan hosted conference to 2025. We plan to restart our normal site selection process later this year and will focus on identifying an outstanding site for 2026.

Beyond our Radiation Instrumentation conferences, July 15th, 2021 is the deadline for submitting complete nomination packages for the Radiation Instrumentation annual awards:

» The Radiation Instrumentation Early Career Award (RIECA) is given to a young investigator in recognition of significant and innovative technical contributions to the fields of radiation instrumentation and measurement techniques for ionizing radiation. The prize consists of US$1,500 and an engraved plaque. The past recipients of the RIECA can be found on the Radiation Instrumentation Technical Committee (RITC) web page http://ieee-npss.org/technical-committees/radiation-instrumentation/.

» The new Emilio Gatti Radiation Instrumentation Technical Achievement Award (RITAA) recognizes a mid-career individual who has made significant and innovative technical contributions in the field of radiation detectors, radiation instrumentation, and/or nuclear electronics, and/or measurement techniques for ionizing radiation. The prize consists of US$2,000 and an engraved plaque.

» The prestigious Glenn F. Knoll Radiation Instrumentation Outstanding Achievement Award (RIOAA) is given to an individual in recognition of outstanding and enduring contributions to the field of radiation instrumentation. The prize consists of $3,000 and an engraved plaque. The past recipients of the RIOAA can be found on the RITC web page http://ieee-npss.org/technical-committees/radiation-instrumentation/.

Finally, nominations for a 2022-2024 Radiation Instrumentation Steering Committee (RISC) Member-at-Large terms are now open. RISC manages the Radiation Instrumentation Technical Committee and its conferences. These three-year terms enable people to become active in IEEE and to guide the future of RITC. Please send nominations to RISC Secretary Merry Keyser (MerryKeyser@ieee.org). The nomination deadline is June 1, 2021.

More information on the Radiation Instrumentation Technical Committee is available at https://ieee-npss.org/technical-committees/radiation-instrumentation/

John Valentine, Chair of the Radiation Instrumentation Steering Committee, is with Lawrence Berkeley National Laboratory and can be reached by phone: +1(510)486-4920; mobile +1(619)371-0016; or E-mail: jdvalentine@lbl.gov.

FREE THINKING

The difficulty lies, not in the new ideas, but in escaping from the old ones, which ramify, for those brought up as most of us have been, into every corner of our minds.

John Maynard Keynes

Functional Committees

AWARDS

Society Awards

Stefan Ritt
IEEE NPSS Awards Chairman

I'm happy to report that the 2021 NPSS Society Awards have been decided. This year we have 12 winners, which have been chosen by the NPSS Awards Committee consisting of all eight Technical Chairs, plus two subcommittees for the Barker Award and the Knoll Awards. Big congratulations to all winners also from my side. We had very strong nominations, and it was not an easy job. This year we also awarded for the first time the new IEEE NPSS Edward J. Hoffman Early Career Development Grant, which just recently has been established through the IEEE Foundation. You will find below the biographies of all 2021 award winners. I encourage you to read one or the other. If you know a colleague or student who is as outstanding as one of our winners, please consider nominating her or him for our 2022 round of awards, which has a deadline of January 31st, 2022. All the application forms can be found on the IEEE NPSS web site at https://ieee-npss.org/awards/npss-awards/.

Stefan Ritt, Chair of the IEEE NPSS Awards Committee, can be reached by E-mail at stefan.ritt@psi.ch.

Merit Award

Dr. Ronald Schrimpf

Ron Schrimpf
2021 Merit Award Recipient

Ron Schrimpf is the Orrin Henry Ingram Professor of Engineering and Director of the Institute for Space and Defense Electronics at Vanderbilt University. He received his B.E.E., M.S.E.E., and Ph.D. degrees from the University of Minnesota and was a professor at the University of Arizona for ten years, before joining Vanderbilt in 1996. His research is related to semiconductor devices, particularly radiation effects and reliability. The projects on which he works include semiconductor-device design and simulation, atomic-scale analysis of radiation-induced defects, application and development of design and simulation tools for radiation effects, total-dose and single-event effects in electronic devices and circuits, and development of radiation-effects and hardness-assurance test methodologies. Ron has received three of Vanderbilt's highest awards: the Chancellor's Cup (given for "the greatest contribution outside the classroom to undergraduate student-faculty relationships in the recent past"), the Harvey Branscomb Distinguished Professor Award (given "to recognize, and thereby to encourage in others, that combination of talents and achievements which we identify as desirable in the University faculty member: creative scholarship; stimulating and inspiring teaching which results in learning of a high order; and service to students, colleagues, the University at large, and society at large", and the Chancellor's Award for Research (recognizing excellence in research, scholarship, or creative expression). He has served as the President of the IEEE Nuclear and Plasma Sciences Society, Chair of the Radiation Effects Steering Group, and Chair of the Nuclear and Space Radiation Effects Conference. He received the NPSS Early Achievement Award and was elected a Fellow of the IEEE in 2000. Ron was the first Faculty Head of House for Memorial House in Vanderbilt's residential college program for first-year students: The Martha Rivers Ingram Commons. As one of the founding Heads of House, he was involved in defining the direction of the first-year experience at Vanderbilt, which has been recognized nationally. As part of the Commons experience, Ron led and resided in Memorial House with his wife, Kathy, and eighty first-year students.

Citation: For contributions to the understanding of radiation effects in semiconductor devices and integrated circuits.

Richard F. Shea Award

Craig Woody

Craig Woody is a Senior Physicist at Brookhaven National Laboratory. He received his B.A., M.A. and Ph.D. from John Hopkins University in 1973, 1974 and 1978, respectively. He carried out his thesis

Continued on PAGE 8

Functional Committees Continued from PAGE 7

Craig Woody
Richard F. Shea Award Recipient

research in high energy particle physics at the SLAC National Accelerator Laboratory, and after one year as a postdoc at Stanford, he joined Brookhaven Lab in 1979 where he has remained ever since. His interests are mainly in developing detectors for nuclear and particle physics and he has also worked on several projects in medical imaging. He is an IEEE Fellow and a Fellow of the American Physical Society. He has served on AdCom in numerous capacities since 2004, including as NPSS President from 2009-2010, as an elected member from RITC from 2006-2008 and 2018-2021, as Nominations Chair from 2011-2012, and as Awards Chair from 2013-2016. He has also served on the IEEE Technical Activities Board Awards and Recognition Committee (TABARC) from 2011-2016, and served as TABARC Chair and a member of the IEEE Awards Board from 2014-2015. He has served several times on RISC, from 2001-2003 and again from 2013-2015, and as RISC Chair from 2004-2005. He also served on the RISC/NMISC Joint Oversight Committee from 2009-2014 and as the Joint Oversight Committee Chair from 2006-2008. He has been a regular attendee of the NSS/MIC for more than 45 years and served many times as a convener, session chair, reviewer and Short Course instructor. He was General Chair of the 1998 NSS/MIC in Toronto, Deputy NSS Chair in 1997 in Albuquerque, Treasurer in 2007 in Hawaii, Workshop Chair in 2016 in Strasbourg, NSS Co-Chair for the 2018 NSS/MIC in Sydney and again as NSS Co-Chair in 2021 which was originally planned for Yokohama.

Citation: *For outstanding contributions and service to NPSS over many years in the fields of radiation instrumentation and medical imaging, and for leadership roles in the Nuclear Science Symposium, RISC, AdCom and TAB.*

Early Achievement Award

Dr. Andre Z. Kyme

Andre Kyme
2021 Early Achievement Award Recipient

Dr Andre Kyme received his B.S. in Physics from the University of New South Wales, Sydney, Australia, in 2001, M.S. in Physics from the University of Wollongong, Wollongong, Australia, in 2004, and Ph.D in Physics from the University of Sydney, Sydney, Australia, in 2012. He is currently a senior lecturer in the School of Biomedical Engineering at the University of Sydney. After completing a Cassen Postdoctoral Fellowship at the University of California Davis from 2014-16, Dr Kyme returned to the University of Sydney where he now leads a research group in biomedical imaging. His research focuses on developing enabling technologies for motion tracking and correction in medical imaging, MRI-compatible robotics for imaging and therapy applications, and artificial-intelligence-based image analytics and quantification.

Dr Kyme receives the 2021 NPSS Early Achievement Award for contributions to motion tracking and correction in emission computed tomography and the development of methods enabling preclinical imaging of awake, freely moving animals. He solved a series of major technical challenges, including the development of motion tracking methods with submillimetre accuracy and high sampling rates, handling refraction of multidirectional optical motion tracking signals, and demonstrating the practicality of marker-free tracking using computer vision methods adapted from field robotics. His work has won numerous awards but more importantly has opened up new research applications for small animal PET in the neurosciences. Dr Kyme is currently working with the University of Sydney and UC Davis teams to develop a high-resolution DOI-enabled "open-field" brain PET scanner with integrated motion tracking for simultaneous imaging and behavioral studies on freely moving mice.

Citation: *For contributions to motion tracking and correction in emission computed tomography and the development of methods that enable preclinical imaging of awake, freely moving animals.*

IEEE Magne "Kris" Kristiansen Award

for Contributions to Experimental Nuclear and Plasma Science

Dr. Frank Hegeler

Frank Hegeler
2021 Magne Kristiansen Award Recipient

Dr. Frank Hegeler works at the Naval Research Laboratory (NRL), in Washington, DC, where is serves as Head of the Pulsed Energy Technology Section in the Plasma Physics Division. He received a Diploma in Electrical Engineering from the Fachhochschule Wilhelmshaven, Germany, in 1989, and a M.S. and Ph.D. in Electrical Engineering from Texas Tech University in 1991 and 1995, respectively. He was a Visiting Associate Professor at Kumamoto University, Kumamoto, Japan, from 1995-1997, and a Postdoctoral Researcher and then a Research Assistant Professor at the University of New Mexico, Albuquerque, NM, from 1997-2000, before joining NRL in 2000. His areas of expertise are in repetitive pulsed-power systems, electromagnetic launchers, excimer lasers, electron beam generation and propagation, high-power microwave sources, plasma diagnostics, nonthermal atmospheric-pressure plasma reactors, and high voltage dielectric breakdown. He has authored or coauthored more than 100 publications.

Frank is a Senior Member of IEEE, and he has been volunteering in the NPSS and Dielectrics and Electrical Insulation Society (DEIS) communities for many years. He served as the General Chair of the 2010 International Power-Modulator and High-Voltage Conference (IPMHVC), as DEIS Vice-President in 2012-2013, President from 2014-2015, and Past-President from 2016-2017, Associate Editor of the TDEI from 2007-2017, IPMHVC Executive Committee Vice Chair from 2014-2018 and Chair since 2019, NPSS Pulsed Power Science and Technology Technical Committee Member from 2017-2020, NPSS Ad-Com Member at-Large from 2018-2021, IEEE TPS Senior Editor of the Electromagnetic Launch Topic since 2018, and as Treasurer of the upcoming 2023 Pulsed Power Conference.

Citation: *For critical contributions to the development and application of high-power, repetitively pulsed, electron-beam and pulsed-power systems.*

Edward J. Hoffman Early Career Development Grant

Émilie Gaudin

Émilie Gaudin
2021 Edward J. Hoffmann Early Career Development Grant Recipient

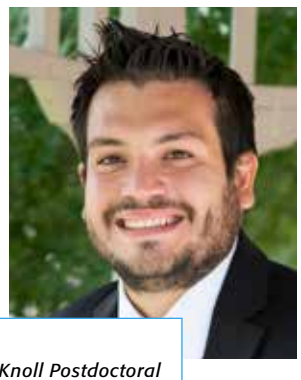
Émilie Gaudin is a postdoctoral researcher currently working at the Sherbrooke Molecular Imaging Centre of Université de Sherbrooke, QC, Canada under the supervision of Prof. Roger Lecomte and Réjean Fontaine, in collaboration with Prof. Georges El Fakhri of the Gordon Center for Medical Imaging, Massachusetts General Hospital and Harvard Medical School. She received a B.Sc. degree in Physics from Université de Nantes, France, in 2012 and travelled to Canada to complete an M.Sc. in Medical Physics at Université Laval, in 2014 and a Ph.D. in Radiation Sciences and Biomedical Imaging at Université de Sherbrooke, QC, Canada in 2020.

Her research focuses on the development of the LabPET II technology, a positron emission tomography (PET) detection platform featuring truly pixelated detectors with individual readout electronics, which was designed to become a generic building block for high-resolution PET scanners from mouse to human brain. The next challenge Émilie wants to address with the NPSS Edward J. Hoffman Early Career Development Grant is to implement ultra-fast detectors in an updated version of the LabPET II platform to improve small lesion detectability in the human brain.

Émilie has presented her research work at every IEEE NSS/MIC meeting since 2015. She has already published eight peer-reviewed papers, four NSS/MIC conference proceedings and over thirty-five conference presentations. She received four international awards for best oral or poster presentations at SNMMI, WMIC and NSS/MIC, and two IEEE NPSS Paul Phelps Continuing Education Grants for recognition of contributions to the fields of nuclear and plasma sciences.

Glenn F. Knoll Postdoctoral Award

Luis Stand

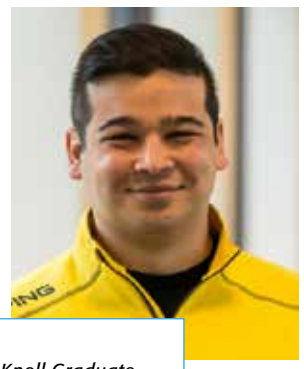


Luis Stand
2021 Glenn F. Knoll Postdoctoral Award Recipient

Luis Stand received his Ph.D. in Energy Science and Engineering in 2018 from the Bredesen Center at the University of Tennessee, where he specialized in the crystal growth and characterization of scintillator materials for radiation detection applications.
He is now a post-doctoral research associate in the Scintillation Material Research Center at the University of Tennessee, where he discovers and develops new scintillator materials for medical imaging and national security applications. Dr. Stand currently has 40+ publications, and at this time holds ten issued patents, with several additional U.S. patent applications pending. He has been, among other things, the driving force behind the invention and development of the new scintillator, europium doped KSr2I5 – an exceptionally proportional, high light yield scintillator with some of the best energy resolution ever measured in a scintillator.

Glenn F. Knoll Graduate Student Award

Michael Hua



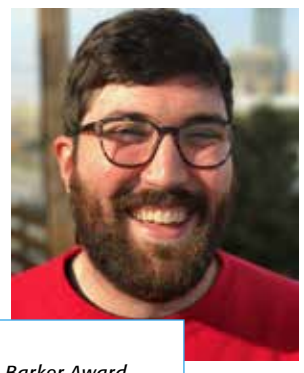
Michael Hua
2021 Glenn F. Knoll Graduate Student Award

Michael Hua is from the University of Michigan's Department of Nuclear Engineering and Radiological Sciences. He established the IEEE NPSS student branch chapter at the University of Michigan and is involved in numerous outreach efforts for elementary, middle, and high school students. He researches neutron noise measurements for nuclear nonproliferation and safeguards, criticality safety, and fundamental data. In addition to being a Fellow of the National Science Foundation Graduate Research Fellowship Program for his Ph.D. studies, Michael is an associate of the Consortium for Verification Technology, and the Consortium for Monitoring, Technology, and Verification.

Robert J Barker Graduate Student Award

for Excellence in Pulsed Power Applications

Zachary Shaw



Zachary Shaw
2021 Robert J. Barker Award Recipient

Zachary Shaw received his Bachelor's (2015) and Master's (2017) degrees from Texas Tech University in Lubbock, TX, and will graduate this May (2021) with his Ph.D. in Electrical Engineering from the same institution. Mr. Shaw has conducted research at The Center for Pulsed Power and Power Electronics since 2015 under Dr. Andreas Neuber on pulsed power and high-power microwave topics. Current research interests include microwave-plasma interaction, the multipactor effect, physical layer encryption via pulsed antenna arrays, and the effects of internal fields within structures experiencing lightning attachment. His most recent body of work centers on multipactor formation within rectangular waveguide structures at S and X-Band frequencies; an AFOSR sponsored MURI program administered through Michigan State University. The multipactoring electrons were directly detected with high temporal resolution via a custom-designed Electron Multiplier Tube (EMT) setup. It was found that the field distribution within the waveguide structures in the dominant TE10 mode allows for multipactor to occur even at high input powers (upwards of 4 MW with a 5.5 mm test gap). As the power increases, multipactor conducive regions are pushed towards the sidewalls of the waveguide structure such that

the second crossover point of secondary electron emission from the waveguide walls becomes essentially meaningless in practical applications. Mr. Shaw currently has his sights set on moving into linear induction accelerator technology as he transitions into the professional world and holds this award as a high point in his early career.

NPSS Graduate Scholarship Awards

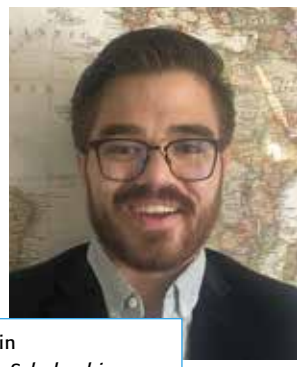
Sneha Banarjee

Sneha Banarjee
2021 Graduate Scholarship Award Recipient

Sneha Banerjee received the B.S. degree in Electronics and Communication Engineering from West Bengal University of Technology, India, in 2012 and the M.S degree in Radio Physics and Electronics from the University of Calcutta, India, in 2015. She is pursuing her PhD degree in Electrical and Computer Engineering at Michigan State University. Her current research interests include quantum tunnelling in metal-insulator-metal junctions, electron emission, and contact engineering.

She is a recipient of Michigan Institute of Plasma Science and Engineering (MIPSE) Graduate Fellowship Award in 2020-2021, the 2020 MIPSE Graduate Student Symposium Best Presentation Award, and the 2020-2021 Michigan State University Electrical Engineering Outstanding Graduate Student Award. Sneha was also the Founder of IEEE Nuclear and Plasma Sciences Society Student Chapter at Michigan State University (Feb 2020) and serves as the President since its creation.

Matthew Durbin



Matthew Durbin
2021 Graduate Scholarship Award Recipient

Matthew Durbin has been awarded a 2021 IEEE Nuclear and Plasma Sciences Society (NPSS) Graduate Scholarship Award for his research contributions to the radiation detection community. Matt graduated with a B.S. in Physics from the University of Texas at Austin in 2017 and he is now working towards his Ph.D. in the Ken and Mary Alice Lindquist Department of Nuclear Engineering at Penn State University. His research is focused on data analysis methods, primarily for directional gamma-ray detection. He has assembled an NaI-based detector array and has implemented machine learning algorithms to analyze the data. His work on feature engineering is leading to improved angular resolution and is also impacting other applications, such as pulse-shape discrimination. Several of his analysis methods have already been made available to the community for use through GitHub. His work has been presented in three peer-reviewed journal publications and eight conference proceedings as a first author. He has also co-authored two publications and several additional conference proceedings. Matt was awarded the Valentin T. Jordanov grant to attend the 2019 IEEE Nuclear Science Symposium and Medical Imaging Conference.

Mariia Gorchichko

Mariia Gorchichko
2021 Graduate Scholarship Award Recipient

Mariia Gorchichko received the Specialist Degree from the National Research Nuclear University "MEPhI" in Moscow, Russia, in 2016, and her Master's degree in Electrical Engineering from Vanderbilt University in 2019. From 2014-2017, she was a Trainee, Engineering Technician, and Research Engineer with JSC Russian Space Systems, Moscow, Russia. In these positions, she developed a FPGA-based bus controller, designed and performed gamma-irradiation tests, and developed and calibrated SPICE models and macro-models to account for the effects of total-ionizing-dose (TID) effects on microelectronics for use in space systems. During her Master's and Ph.D. research at Vanderbilt, Mariia has performed original studies of the TID response, low-frequency noise, and random-telegraph noise of MOS devices with complex architectures and nanoscale dimensions. Mariia has been author or co-author of eight peer-reviewed journal articles. Mariia has presented her work at several international conferences, including the IEEE Nuclear and Space Radiation Effects Conference (NSREC), and was co-author of the Outstanding Student Paper of the 2019 NSREC.

George N. Tzintzarov

George Tzintzarov
2021 Graduate Scholarship Award Recipient

George N. Tzintzarov received the Bachelor's and Master's of Science degrees in electrical engineering from the Georgia Institute of Technology in 2016 and 2020, where he is currently pursuing the Ph.D. degree in electrical engineering. He is advised by Dr. John D. Cressler, and his research focuses on the effects of radiation on silicon-photonic systems. Mr. Tzintzarov was awarded an NSF Graduate Research Fellowship in 2018 and has received numerous awards from the Georgia Institute of Technology and the IEEE, including the Love Family Foundation Award in 2016 (the highest honor Georgia Tech gives to a student) and the IEEE NPSS Phelps Continuing Education Grant in 2020. He has also been the recipient of the 2018, 2019, and 2020 Best Paper Awards from the IEEE NPSS Nuclear and Space Radiation Effects Conference (NSREC).

His notable contributions to the field include the first experimental analysis of optical single-event transients (OSETs) in integrated silicon waveguides, and the electrical-to-optical single-event transient propagation in an integrated Mach-Zehnder Modulator.

Tzintzarov has accumulated over 1,000 hours of conducting radiation experiments at world-class radiation facilities such as the 88-inch cyclotron at Lawrence Berkeley National Laboratory, focused X-ray microbeam at Argonne National Laboratory, and focused high-intensity lasers at the US Naval Research Laboratory. The results of these testing campaigns are used to analyze the survivability of current technologies and engineer future technologies to function in extremely high radiation-intense environments, such as those found around Jupiter's radiation belts.

PLASMA SCIENCE AND APPLICATIONS (PSAC)

Award Nominations

Nominations are currently being accepted for the 2021 Plasma Science and Applications Award sponsored by the Plasma Science and Applications Committee (PSAC) of the IEEE Nuclear and Plasma Sciences Society (NPSS). The purpose of the award is to recognize individuals who have made outstanding contributions to the field of plasma science through the impact of their research, development of new applications, contributions over a technical or pedagogical career, or through professional service to the IEEE and plasma science community. The $3000 cash award and plaque will be presented at the 2022 International Conference on Plasma Science (ICOPS). Nomination forms are available electronically at https://ieee-npss.org/technical-committees/plasma-science-and-applications/ and must be submitted by October 01, 2021. Additional information can be obtained from Chao Chang, PSAC ExCom Awards Subcommittee Chair by email at changc@xjtu.edu.cn.

Igor Alexeff Outstanding Student in Plasma Science Award

Nominations are currently being accepted for the 2021 Igor Alexeff Outstanding Student in Plasma Science Award sponsored by the Plasma Science and Applications Committee (PSAC) of the IEEE Nuclear and Plasma Sciences Society (NPSS). The purpose of the award is to recognize outstanding student contributions to the field of plasma science and technology. The award is open to any full time undergraduate or graduate university student in plasma science; the nominees will be judged based on their research contributions, their educational accomplishments, and the quality and significance of their publications and patents. The $2000 cash award and Certificate will be presented at the 2022 International Conference on Plasma Science (ICOPS). Nomination forms are available electronically at https://ieee-npss.org/technical-committees/plasma-science-and-applications/ and must be submitted by October 01, 2021.

Chao Chang, Awards Subcommittee Chair for PSAC ExCom can be reached by E-mail at changc@xjtu.edu.cn.

2020 IEEE NUCLEAR AND SPACE RADIATION EFFECTS CONFERENCE AWARDS

It is a longstanding tradition of the IEEE Nuclear and Space Radiation Effects Conference to recognize the Outstanding Conference Paper and the Outstanding Data Workshop Presentation from the previous conference. In recent years recognition has also been given to the best paper presented by an IEEE Student Member, who must also be the first author. The awards process recognizes high quality and important work and also encourages authors to produce presentations and manuscripts of high technical quality, clarity of presentation, and significance to the community.

It is our pleasure to announce the award winners from the 2020 NSREC. Their awards will be presented at the 2021 Virtual Conference.

2020 Outstanding Paper Award

George N. Tzintzarov, Adrian Ildefonso, Jeffrey W. Teng, Milad Frounchi, Albert Djikeng, Prahlad Iyengar, Patrick S. Goley, Ani Khachatrian, Joel Hales, Ryan Bahr, Stephen P. Buchner, Dale McMorrow, and John D. Cressler, Optical Single-Event Transients Induced in Integrated Silicon-Photonic Waveguides by Two-Photon Absorption.

2020 Meritorious Paper Award

Giulio Borghello, Federico Faccio, Gennaro Termo, Stefano Michelis, Sebastiano Costanzo, Henri D. Koch and Daniel M. Fleetwood, Effects of Bias and Temperature on the Dose-Rate Sensitivity of 65 nm CMOS Transistors.

2020 Outstanding Student Paper Award

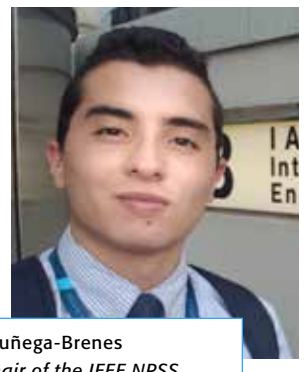
George N. Tzintzarov, Adrian Ildefonso, Jeffrey W. Teng, Milad Frounchi, Albert Djikeng, Prahlad Iyengar, Patrick S. Goley, Ani Khachatrian, Joel Hales, Ryan Bahr, Stephen P. Buchner, Dale McMorrow, and John D. Cressler, Optical Single-Event Transients Induced in Integrated Silicon-Photonic Waveguides by Two-Photon Absorption.

2020 Outstanding Data Workshop Presentation Award

J. Pritts, S. Wender, J. George, T. Fairbanks, J. O'Donnell, Energy-Dependent Single-Event Effects in Power MOSFETs from a Broad-Spectrum Neutron Beam,

CHAPTERS

The Only Nuclear & Plasmas Sciences Society Chapter in Latin-America



Sebastian A. Zuñega-Brenes
Author and Chair of the IEEE NPSS Student Branch Chapter, TEC

Located in the beautiful highlands region of Costa Rica is the Institute of Technology of Costa Rica (TEC). TEC is one of the most important universities in regard to Science and Technology in the region with all their career programs certified by national and/or international agencies.

The only Plasma Laboratory with a Stellarator and a Spherical Tokamak in Latin America is located at TEC. The functional Stellarator (SCR-1) was built completely in Costa Rica and the Tokamak (MEDUSA-CR) was a donation of the University of Wisconsin-Madison. The NPSS-TEC chapter is linked to the Plasmas Laboratory and our main goal is the scientific investigation of plasma and its benefits.

Plasma discharge at SCR-1. Plasmas Laboratory, TEC.

In September 2020, the new board of directors of the NPSS-TEC chapter emphasized the importance of the cooperation between national and international chapters. As result, we have hosted more than 20 national and international technical lectures in the last three months of 2020. In NPSS-TEC, our scientific investigation program is based on the Sustainable Development Goals (SDGs) and how Plasma can support the achievement of most of them. These range from the purification of water and air thanks to the Reactive Oxygen & Nitrogen Species (RONS) to the next electricity source for humanity: Nuclear Fusion.

Plasmas and their benefits in several applications have been interesting for people from every background and age. In our country, the word "Plasma" is linked to Dr. Franklin Chang Díaz (a famous Costa Rican - NASA ex-astronaut) who is

Functional Committees

Continued from PAGE 9

connected with a rocket that uses plasma for space purposes. When we are trying to explain in a lecture: what is plasma? this "brain link" to Dr. Chang is an advantage because this topic generates emotion and patriotism since Dr. Chang is considered by the communities as a "national hero."

International Introductory Lecture to the Institute of Technology of Hermosillo, November 2020, Mexico

Through our scientific information desemination program, many of the NPSS-TEC student expositors who today present lectures nationally and abroad; were trained in a 2019 summer program at the Max-Planck-Institut für Plasmaphysik (IPP), the Leibniz Institute for Plasma Science and Technology (INP) and the University of Rostock. That seminar was possible thanks to Dr. Iván Vargas, Msc. Eng Carlos Otárola, Dr. Laura Barillas, Ph.D., Katja Fricke, Dr. Humberto Trimiño and Prof. Dr. Juergen Kolb. Also, most of the expositors are Research Assistants in the Plasmas Lab at TEC.

To focus on our chapter goals, we need the support of everyone as multidisciplinary work is a must. In a famous quote it was so clearly said, "two brains think better than one." We are glad that the response of the people had been wonderful and have shown sincere interest, beyond our imagination. At the beginning of this year, we launched a recruitment campaign since we knew that the chapter had the potential to grow. That campaign was successful since more than 250 people showed an interest to enroll in the chapter. With these human resources, we are convinced that big projects can be scheduled and managed properly in the months ahead.

And what about our international expectations? Why not? Our chapter is looking forward to intensifying the plasma information spread beyond our borders. Being the only chapter in Latin America means that we can do scientific education in the same language as more than 420 million people since Spanish is the second most spoken language in the world. So, we do not have time to lose!

Plasma science is an opportunity for many people, we must give that opportunity!

Lecture: Plasmas in medicine, agriculture and as a generator of biointerfaces

2019 Summer Plasmas program picture at Leibniz Institute for Plasma Science and Technology (INP), Greifswald, Germany. Students from the Plasma Laboratory, TEC (blue shirts), Dr. Laura Barillas (left, purple shirt), PhD. Katja Fricke (middle, pink shirt) and Msc. Eng Carlos Otárola (right at the back)

RAISED EYEBROWS?

Language was invented to ask questions. Answers may be given by grunts and gestures, but questions must be spoken. Humanness came of age when man asked the first question.

Eric Hoffer

Liaison Reports

Edl Schamiloglu
IEEE NPSS EAB Liaison

EDUCATIONAL ACTIVITIES BOARD

Here are some updates from the IEEE Educational Activities Board following its February 26, 2021 Meeting. The Key Goals of EAB for 2021 are:

- Launch/expand the IEEE TryEngineering Volunteer STEM Portal
- Launch the IEEE Academies
- Continued revenue growth: CE courses, partnerships, sponsorships
- Expand the IEEE Learning Networks (ILN) use and content
- Increase member value via the IEEE Teaching Excellence Hub
- TryEngineering Summer Institute registration success
- Continued improvements to volunteer engagement
- Address serving a world emerging from COVID-19 quarantines

Edl Schamiloglu, IEEE NPSS EAB Liaison, can be reached by E-mail at edls@unm.edu.

WOMEN IN ENGINEERING

Jakarta, Indonesia WIE Event

After the successful virtual Radiation Instrumentation School organized by the University of Indonesia, Jakarta in November 2020 https://indico.cern.ch/event/954199/ the organizer Prof Supriyanto Ardjo Pawiro proposed the planned WIE event to be postponed to a later date to allow the organization of a longer session focused on nuclear medicine. The session took place virtually on February 17th, 2021 from 1 pm-6 pm Jakarta time . A peak attendance of 124 was recorded. Attendees via Zoom came from various scientific communities comprising: Students (57); Clinical Medical Physicists (27); Nuclear researcher (18); University Lecturers (5); Nuclear regulators (2);Women in nuclear sciences (2). Other participants came from Malaysia (13) and Vietnam (1), with an average of 50% female attendees.

The welcome address was given by Dr. Rokhmatuloh M.Eng. (Dean, FMIPA University of Indonesia, followed by the President of IEEE Nuclear and Plasma Science Society, Prof Steven Meikle (Sydney University ,Australia)

The introduction to the IEEE Women in Engineering Society (WIE) was given by the NPSS WIE liaison, Prof Cinzia DaVia (Univ Manchester, UK and Stony Brook University, US)

https://ieee-npss.org/women-in-engineering-wie/

The program then continued with presentations delivered by eminent NPSS women scientists from the NPSS Nuclear Medical and Imaging Sciences community together with local speakers.

- *PET/CT/MRI applications : opportunities and Challenges*, Professor Vesna Sossi (University of British Columbia , Vancouver, Canada), Vice President of NPSS.
- *Trends and Challenges in Quantitative Diagnostic Imaging shape the landscape of Precision Medicine*, Professor Dimitra Darambara , (Royal Cancer Hospital, London UK).
- *Software challenges and emerging trends in PET/CT imaging (including AI)*, Dr. Mitra Safavi-Naeini, (NSTLI Human Health, Australia).
- *Clinical application of PET/CT in Indonesia*, Yustia Tuti, MD, (FANMB).

Finally, concluding remarks, discussion and a closing session, chaired by Mrs. Nur Rahmah Hidayati, M.Sc., (national nuclear agency of Indonesia) the National Nuclear Energy Agency of Indonesia, completed the event.

This successful event generated wide interest and proposals were made that it might be followed by a future full-week-long, women speakers only, Nuclear Medical School to be organized by the NPSS international radiation instrumentation program for education and training.

Patrick Le Dû, who submitted this report, can be reached by E-mail at patrickledu@me.com

Article

Radiation Detection and Instrumentation in the Nuclear Science and Security Consortium

By Jason Hayward, Bethany Goldblum, Kai Vetter, Chuck Melcher, and Mariya Zhuravleva

For the third time, the Department of Energy's National Nuclear Security Administration announced a grant award of $25M for the Nuclear Science and Security Consortium (NSSC) to train the next generation of nuclear security experts and perform research and development in the fundamental and applied sciences supporting the nation's nuclear security mission.

With the University of California Berkeley as the lead institution, partner universities include the Air Force Institute of Technology, George Washington University, Michigan State University, North Carolina State University, Texas A&M University, University of California Davis, University of Illinois Urbana-Champaign, University of Nevada Las Vegas, University of New Mexico, and University of Tennessee Knoxville. These academic institutions work in collaboration with five U.S. DOE National Laboratory partners—LANL, LBNL, LLNL, ORNL and SNL. The effort is led by Prof. Jasmina Vujic, professor and former chair of the UC Berkeley's Department of Nuclear Engineering. Other Universities with leading roles include the University of Tennessee, Michigan State University, the University of Nevada Las Vegas, and the University of Illinois.

The new consortium will carry out research in in five focus areas organized by two main themes: **fundamental nuclear sciences**, which includes nuclear physics and nuclear data, nuclear chemistry and radiochemistry, and nuclear materials science; and **applied nuclear science and engineering**, which includes radiation detection, nuclear chemical engineering and nuclear engineering. Linking these research focus areas are two crosscutting activities: computing and optimization for nuclear applications, and education in nuclear science, technology, and policy.

Originally established in 2011, the NSSC has already create a pattern for success in research and development of radiation detection and instrumentation, for example, advancing concepts and technology development for detector materials, detector development and characterization, and radiation imaging and advanced detection concepts.

For example, in detector materials, one important goal is to develop inorganic crystals having energy resolution < 3% at 662 keV while being able to fabricate large size single crystal detectors (> 1 inch in diameter). Graduate student Daniel Rutstrom (see Fig. 2) has been primarily researching a novel family of high energy resolution halide scintillator compounds of the type A_4BX_6 (A = alkali metal; B = alkaline earth metal; X = halogen), specifically Cs_4SrI_6 (see Fig. 2) and Cs_4CaI_6[1,2,3] that were discovered at the Scintillation Materials Research Center at the University of Tennessee. This work consists of optimizing crystal growth parameters using the vertical Bridgman technique and improving performance through various compositional engineering strategies.

Also working in detector materials, Josh Smith is developing a process for the synthesis of transparent polycrystalline ceramic scintillators relevant for nuclear security applications. Polycrystalline ceramic scintillators are a potential alternative offering a cheaper, quicker synthesis method compared to single crystal growth. The reduced time and costs in synthesizing ceramic scintillators offers an opportunity to produce scintillators in large, near net shapes without the concerns for bulk dopant segregation that is common in Bridgman and Czochralski growth method. Recent studies of a family of Li-containing garnet compounds for use in Li-ion solid electrolyte applications have created an interest in their potential to be developed into transparent ceramic dual-mode scintillators. In particular, $Li_5La_3Ta_2O_{12}$ (LLTaO) shows promise as an efficient dual-mode scintillator due to its high Li content, high density, non-hygroscopicity, high effective-Z and intrinsic tantalate self-trapped exciton emission. A flexible alkoxide sol-gel method has been developed in collaboration with Los Alamos National Laboratory for the synthesis of LLTaO powders that are then consolidated via uni-axial hot pressing. A 15% molar excess of Li is included during powder synthesis to compensate for Li-volatility at the high temperatures during powder synthesis and initial consolidation. High density, near single phase, translucent un-doped, Eu-doped, Ce-doped, and Pr-doped LLTaO ceramics have been produced.[4]

In the area of detector development and characterization, NSSC students and faculty have collaborated with Sandia National Laboratories (SNL) and Oak Ridge National Laboratory (ORNL) to develop a compact kinematic neutron imager—the Single Volume Scatter Camera (SVSC)—for source search, localization, and imaging. This effort has produced advances in photodetectors, readout electronics, image reconstruction algorithms as well as detector material characterization methods.[5] The first SVSC prototype (see Fig. 3) was demonstrated by University of Tennessee PhD graduate Micah Folsom at ORNL. This design consisted of slabs of plastic scintillator wherein the interaction positions of individual neutron interactions are encoded via an optical coded aperture method.[6]

At the University of California, Berkeley, the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory has been used to measure the proton light yield of a variety of commercially-available fast plastic organic scintillators considered candidates for the SVSC prototype.[7,8] The team employs a broad spectrum neutron beam, an array of organic scintillators (shown in Fig. 4), and np elastic scattering kinematics in a double time-of-flight technique to obtain the scintillator response to recoil nuclei over a continuous wide energy range. The team has also measured the neutron response of the EJ-254 boron-loaded plastic scintillator from Eljen Technology,[9] a water-based liquid scintillator attractive for neutrino monitoring technologies,[10] and a variety of formulations of a novel organic glass scintillator developed by SNL.[11,12] These data are critical inputs for the modeling and simulation of scintillator-based detection systems useful for both basic and applied science.

The University of California, Berkeley is also driving the development and demonstration of new concepts in radiation detection and imaging specifically by utilizing the enormous advances in computer vision. Compact gamma-ray imaging and neutron mapping systems are combined with contextual sensors providing radiological maps that are embedded in the three-dimensional environments and can be deployed on unmanned aerial and ground systems such as drones and robots or in hand-portable configurations. Their multi-sensor, 3D Scene Data Fusion concept provides new means in the detection, mapping, and visualization of nuclear and radiological materials, critical in areas such as proliferation detection and emergency response. One example of this work is real-time free-moving active coded mask 3D gamma-ray imaging, where PhD graduate Daniel Hellfeld made many significant contributions.[13] 3D Scene Data Fusion provides operators, experts, and the public powerful tools to assess and visualize radiological materials in three-dimensions and in real time. Complementing this research are developments to explore advanced radiation imaging concepts relevant for future arms-control agreements and a new generation of fast radiation detectors to study and characterize ultra-fast nuclear processes.

University of Tennessee Ph.D. graduate Angela Moore researched the use of list mode data acquisition (LMDA) with traditional neutron coincidence counting systems as well as the development and testing of modern signal processing electronics. These electronics were integrated into an existing Uranium Neutron Collar (see Fig. 5) at ORNL without modifying the system footprint, and traditional coincidence counting analysis methods were extrapolated for LMDA to analyze these signals. By implementing new electronics on each ^3He tube within the system, paired with the use of LMDA for simultaneous multichannel acquisition, the analysis of additional signals was shown to provide a greater physics-based understanding of the counting system for characterization as well

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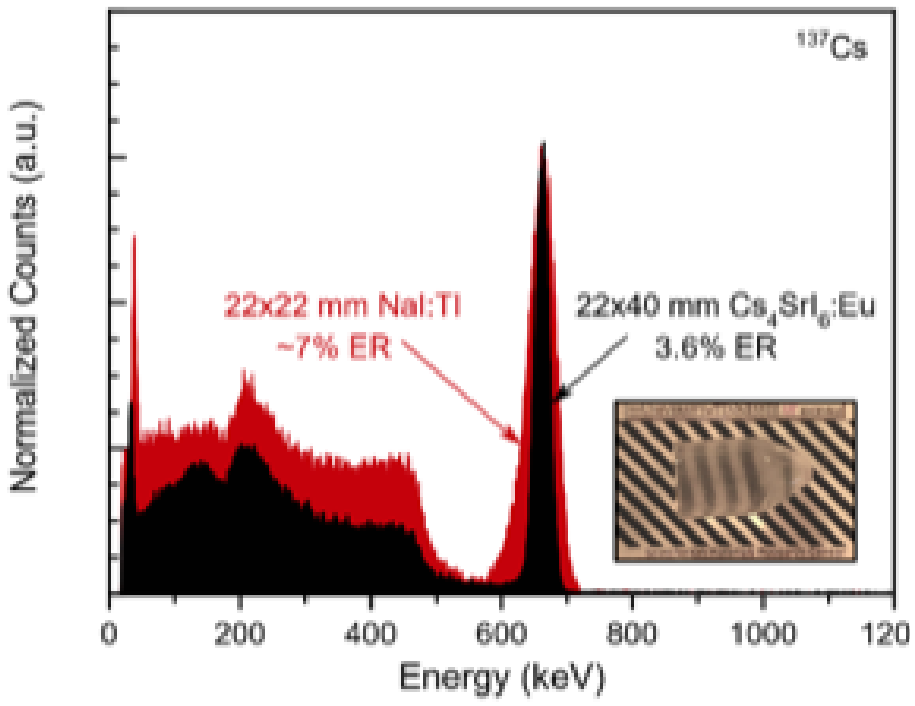

Fig. 2. Pulse height spectrum of Cs_4SrI_6:Eu compared to NaI:Tl measured with a 662 keV 137Cs source. Inset: Photo of a Cs_4SrI_6:Eu crystal.

Fig. 3. Micah Folsom holds Single Volume Scatter Camera used to image a Cf-252 source and reconstruct its neutron spectrum. Coded aperture imaging of the scintillation light is used to localize neutron scatters in plastic scintillator.

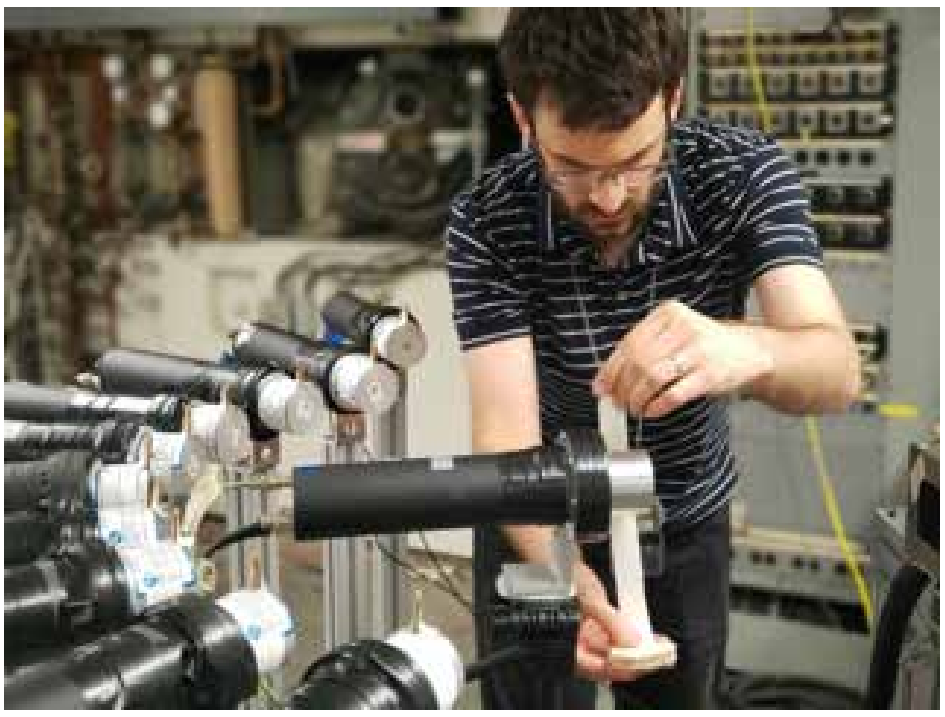

Fig. 4. NSSC Fellow Thibault Laplace and the organic scintillator array in Cave 5 at the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory.

Fig. 1. Sealing an evacuated quartz ampoule loaded with raw material in preparation for crystal growth at the Scintillation Materials Research Center.

Article Continued from PAGE 11

as supporting novel count rate–based source spatial response measurements for fresh fuel assemblies.[14] Non-ideal behavior determination in the system electronics,[15] neutron die-away time, detection efficiency, system dead time, and absolute source measurements were investigated using these methods.

The NSSC has already placed more than 130 postdoctoral and staff hires in the national labs and other government agencies.

Jason Hayward, who submitted this article on behalf of his colleagues, can be reached by E-mail at jhayward@utk.edu

Fig. 5. New coincidence electronics designed for nondestructive assay instruments, here retrofitted to a Uranium Neutron Collar, for characterization with list mode data acquisition readout.

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