

2020-21 Neutrino



American Nuclear Society
Savannah River Section

Neutrino - February to July 2021 Edition

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Co-Chair's Message

Dear ANS-Savannah River Section,

After nearly a year of virtual meetings, the Section has started to transition back to in-person events. In May, a networking event was held at Topgolf and a technical meeting was held in June at Newberry Hall. It was great to see everyone in 3 dimensions again! During the June meeting, the Benjamin Scholarships were awarded to Jayme Still of Barnwell High School in the Technical College Category and Ekow Aidoo of Augusta Preparatory Day School in the University Category. Congratulations to Jayme and Ekow for their academic accomplishments with special thanks to our Scholarship Chair Kevin for his efforts during these challenging times.

As we move forward as an organization, Local ANS Sections are going to continue to adapt to new funding structures through the National organization. Fewer division affiliated stand-alone meetings are anticipated, resulting in fewer opportunities for Local Section support and sharing of “excess revenues”. The flexibility and creativity of the Section is expected to adapt through additional fundraising.

Finally, I'd like to express my gratitude and respect to all who work behind the scenes to make the Savannah River Section the successful organization it is. Members routinely use their time and talents to make the community a better place through educational outreach and advocating for a diverse, secure energy future. They are making a difference.

Greg Staack

ANS-SR Section Co-Chair, 2020-2021



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Virtual Technical Meetings

February 2021

On February 19, at noon, ANS-SR had the pleasure of learning about Noble Gas Nuclear Forensics from Dr. Steven Biegalski, Chair of Nuclear and Radiological Engineering and Medical Physics Program at Georgia Institute of Technology. Since the Partial Test Ban Treaty in 1963, nuclear explosion tests have largely been conducted in underground locations. To monitor the emissions from underground nuclear tests, the world community relies upon atmospheric monitoring for radionuclides among other technologies. The Comprehensive Nuclear Test-Ban Treaty (CTBT) incorporates radionuclide monitoring within International Monitoring System (IMS) with a focus on ^{131m}Xe , ^{133m}Xe , ^{133}Xe , and ^{135}Xe . It is expected that radionuclide monitoring will also be incorporated into the On-Site Inspection (OSI) protocols along with radioargon monitoring. This seminar focused on developments at The University of Texas at Austin that advance the field of noble gas nuclear forensics. Analysis was shown for both natural and anthropogenic signals and forensic methods for distinguishing between radionuclide sources will be discussed. A forensic assessment of radionuclide emissions from the Fukushima nuclear accident was presented and results showing the variability induced by underground radionuclide transport was detailed.



Detection Network

- The Comprehensive Nuclear-Test-Ban Treaty (CTBT) defines an International Monitoring System (IMS).
- The IMS consists of monitoring stations for:
 - Seismic
 - Infrasound
 - Hydroacoustic
 - Radionuclide

A diagram titled 'International Monitoring System (IMS)' showing a globe with various monitoring stations. Red dashed lines connect the stations to an 'International Data Center'. The stations are labeled: 'Seismic', 'Infrasound', 'Hydroacoustic', and 'Radionuclide'. The diagram also shows 'National Data Centers' and 'Regional Data Centers' connected to the International Data Center. A small inset map shows the location of the International Data Center in Vienna, Austria.

Steven Biegalski is the Chair of Nuclear and Radiological Engineering and Medical Physics Program at Georgia Institute of Technology. Early in his career, Dr. Biegalski was the Director of Radionuclide Operations at the Center for Monitoring Research. In this position Dr. Biegalski led international efforts to develop and implement radionuclide effluent monitoring technologies, supporting both U.S. national capabilities and international treaties. Prior to his current position at Georgia Tech, Dr. Biegalski was at the University of Texas at Austin for 15 years and held the position of Reactor Director for The University of Texas at Austin TRIGA reactor for over a decade. He has published over 200 peer-reviewed articles, three book chapters, and has advised 25 Ph.D. students to graduation.

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April 2021

On April 16, at noon, the Savannah River Section of ANS returned (virtually) to the SRS Museum in Aiken, SC. We heard from SRS Education Specialist Derek Berry on many Museum updates including:

- Visiting during Covid-19
- Plans to Establish & Build an Education and Outreach Program
- Future Isotope Production Exhibit in the Dibble Gallery
- Other news on Exhibits covering the History of SRS and the Cold War
- How to support the Museum & Ways to Volunteer opportunities.



The speaker, Derek Berry, is the Educational Specialist at the SRS Museum, responsible for creating and operating an educational and outreach program for the local community. Derek's goal is to create engaging programming for all ages, to connect locals to the stories of the Savannah River Site. As a teenager, Derek attended a lecture by Joe Lista, a SRP Photographer, at the Aiken Community Playhouse. This encounter sparked Derek's interest in DuPont's role in Aiken history. He studied at the College of Charleston and received a B.A. in Political Science and a B.A. in International Studies. In 2017, Derek became the Curatorial Assistant at the Savannah River Site Cold War Historic Preservation Program, where he helped digitize the SRS photographic archive. Derek has been involved in the SRS Museum since 2017 but only became an official part of the team in 2021, when he was hired as the new Educational Specialist.

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May 2021

On May 21, at noon ANS-SRS held a virtual technical meeting entitled Development of TerraPowers's Molten Chloride Fast Reactor to Enable Low-Cost, Economy-Wide Decarbonization featuring Dr. Brandon M. Chisholm, an R&D Engineer with Southern Company Services. The Molten Chloride Fast Reactor (MCFR) is an advanced nuclear reactor technology intentionally designed to combine the best aspects of liquid-fueled reactors, fast reactors, and molten salt reactors, resulting in superior performance, safety, and economic benefit. A Southern Company-led team was recently awarded Department of Energy funding to develop and execute a Molten Chloride Reactor Experiment (MCRE) within five years. The MCRE will be the first critical molten salt fast reactor and will prove fundamental technical aspects of MCFR technology while providing key data to support the design and development of the MCFR Demonstration Program. This presentation provided a discussion of MCFR technology, an overview of the MCFR Demonstration Program, and a breakdown of the current plans for MCRE and how it contributes to the end goal of a commercial MCFR.

Develop and demonstrate high potential advanced nuclear options that can provide the best value to the company & customers

- RIGHT TECHNOLOGY**
 - provide the backbone of a net zero economy – clean electricity, heat, hydrogen
 - address safety & sustainability
- RIGHT TIMELINE**
 - support decarbonization commitments & demands
 - replace potential retirements
- RIGHT COST**
 - competitive with ngcc+pcc and solar+battery
- BEST VALUE**
 - grow revenue in a rate neutral way
 - be options positive – expand the market past electricity

The Venn diagram consists of three overlapping circles: a green circle labeled 'no carbon', a red circle labeled 'stable low cost', and a blue circle labeled 'high reliability & resiliency'. The intersections of these circles represent the combined benefits of each attribute.



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June 2021 – First In-Person Technical Meeting Since Covid-19 Outbreak

ANS-SRS was thrilled to have an IN-PERSON technical dinner meeting on June 24th. The meeting was held and well attended at Newberry Hall, Aiken, SC. The topic was “Atomic-Scale Journey through the Nuclear Fuel Cycle” The presenter was Professor Lindsay Shuller-Nickles, from Clemson University. In this meeting, we put on our ‘atomic-scale lenses’ for an adventure through the U.S. nuclear fuel cycle. With particular emphasis on nuclear waste forms, we explored the development of our current inventory of used nuclear materials in the U.S. and consider future changes in the nuclear fuel cycle from a waste management perspective.

Before the technical presentation Kevin O’Kula made presentation of the Benjamin Scholarship recipients. The information is provided in a later section of this newsletter. This was the Section’s first in-person dinner meeting since February 2020.



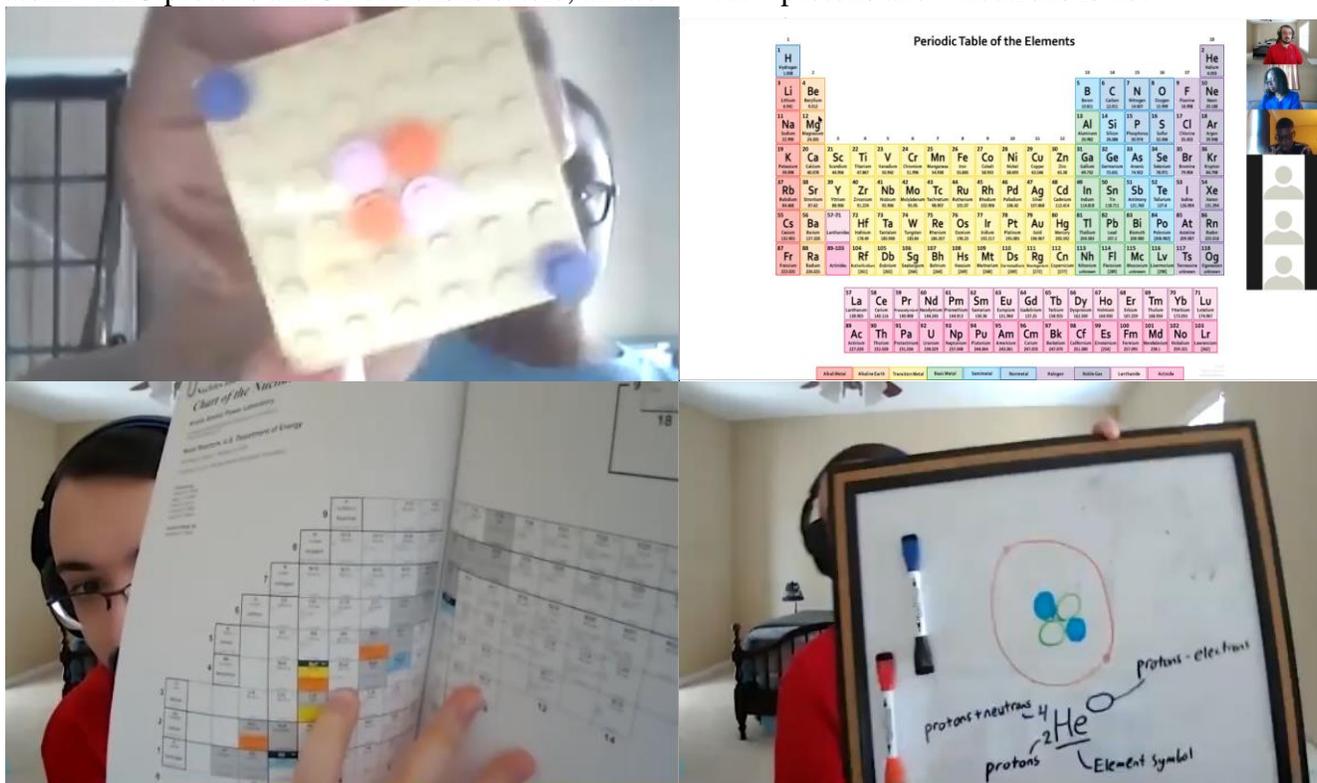
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Outreach and Education

Outreach

Outreach had several students participating in a hands-on activity after the introduction to the atom lesson over Zoom. This particular instance took place on March 19th of this year. For this lesson, teachers are sent the kits ahead of time, which consist of a flat, square Lego piece and single pieces in three different colors that can be attached to the base plate to make Bohr's Model style atoms. The kits would be passed out in class or ahead of time depending on whether I presented to a classroom, or to individual students (as was the case here). The lesson plan walked students through a brief history of discovering the atom, the main aspects of the three subatomic particles, and how differences in protons, neutrons, and electrons make everyday objects behave differently, with some discussions on what we can do in different fields once we know about atoms.

For the activity, we all started by making a Helium-4 atom to get a sense of how to make an atom based on shorthand notation, then the students were free to make their own atoms. Once the shorthand notation is written for it, it's checked in the Chart of the Nuclides to see if it's stable. In this way, the students get to make the atom themselves, and find out from what their classmates made that while an atom with 3 protons and 3 neutrons is stable, an atom with 4 protons and 4 neutrons is not.



Student showing his model of a Helium atom, the Periodic Table, Graham Jones looking up Li-6 and a hand drawing of a Helium atom

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Education

The Educator Grants Program (EGP) provides grants to local teachers to help fund science-related curriculum in their classrooms. In addition to ANS-SRS, other sponsors include CNTA, Huntington Ingalls Industries, and the Savannah River National Laboratory. The grants, each about \$500, are used to fund projects that promote an increased understanding of science, technology, engineering, and math (STEM); atomic and nuclear fundamentals; radiation and nuclear materials safety; and applications of nuclear technology. The 2021 grant winners are:

- Angela Virella, 6th grade ELA and social studies, Jackson STEM Middle School;
- Kristina Istre, 8th grade physical science and STEM, A.R. Johnson Health Science and Engineering Magnet School; and,
- Donita Legoas, 6th grade earth science and STEM, A.R. Johnson Health Science and Engineering Magnet School.

With the project “*We Will Cross That Bridge...When We Build It,*” Virella will help give students the opportunity to design, build, and construct various bridges using a variety of materials. In the process, students will also be able to apply Math, Science, ELA, and Social Studies standards to the learning process.

“This grant will allow students to have a real-world application to 21st century skills in all core subject areas,” Virella said. “Students will be able to design and create structures to scale and create working budgets and application of real business skills.”

Istre’s project, “*Energy of the Future!*”, will allow students to work in cooperative peer groups to build a hydrogen fuel cell car while experimenting with the process of using solar energy to split water into hydrogen and oxygen.

Legoas’ project, “*Solar, Wind, Water, and Nuclear, Oh My!*”, will introduce students to the world of nonrenewable and renewable energy. Students will investigate to see how turbines work, how solar energy converts sun energy to mechanical movement, and how homes can use various means of energy conservation and clean energy resources.

“Students will learn the path of energy from its source to its final destination where it powers their cell phones and game systems they love so dearly,” Legoas said. The sponsors are excited to grow this educator grants program to facilitate more educational outreach by the organizations and local educators.

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Up and Atom Breakfast Meeting

On June 23, at Newberry Hall, CNTA sponsored the Up & Atom Breakfast. Workforce Development – Short-Term, Long-Term, Nuclear, and Beyond was the topic. Dr. Forrest Mahan, President of Aiken Technical College, discussed Aiken Technical College's initiatives in the nuclear field, welding, and other non-nuclear programs that benefit SRS and the region. A native of South Carolina, Dr. Mahan has spent more than 20 years in the South Carolina Technical College System. Over the years, he has also been very active in the South Carolina Technical Education Association and served on its board from 2000 to 2016 in the roles of president-elect, president, past-president, and technology coordinator. Dr. Mahan received a bachelor's degree in history from the College of Charleston, and a master's degree in history and a Ph.D. in higher educational administration from the University of South Carolina.



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Section Networking Activities

ANS-SRS TOPGOLF Networking Event

On May 2, ANS-SR took over two bays at the Augusta TOPGOLF complex for a spirited time of long-range drives interspersed with food, beverage and good conversation. We were emerging from our almost year long hiatus of in-person events with an outdoor activity geared towards getting our younger members back out and about! Fourteen young professionals came out on a Sunday to get back into the “swing” of things and a good time was had by all. Shout out to fresh face Sterling Bash for being our best golfer of the afternoon!



Savannah River Section members and guests after gearing up for next year’s Masters

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ANS-SRS Summer Networking BBQ

About twenty-five ANS SR members, family, and guests braved the humidity, heat, and threat of thunderstorms to enjoy the culinary skills of Madeleine Waller and Graham Jones for an afternoon BBQ at the Boyd Pond Park in Aiken on Saturday, July 31, 2021. Along with enjoying burgers, hot dogs, and with all the fixings, the intergenerational, family-friendly event had folks enjoying lawn games, spirited conversation and a bit of soccer, and welcoming new members to ANS SR on both sides of the Savannah River.

Hats off to the Coordination and Planning team for the event that included Kiah Griffith, Maeley Brown, Graham Jones, and Madeleine Waller.



Part of the crowd during the ANS SR BBQ Networking Event

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Coordination & Planning Team's Kiah Griffith, Maeley Brown, and Master Chefs Graham Jones and Madeleine Waller about ready to call it a day after cleanup on July 31.



Debate during BBQ on which heat is better – Dry-Richland vs. Wet-Aiken

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Benjamin Scholarship Fundraiser

We have a limited number of black ANS SR polo shirts to support our Benjamin Scholarship fund. These are high-end, "Dri-Fit" technology Nike shirts, identical to the ones given to the past ANS President, Marilyn Kray, in her visit to the Savannah River Section in October 2019. The iconic lithium atom Savannah River Section symbol with three peach electrons is over the left front (see below).

Shirts are available in women's sizes (S, M, L, and XL) and men's sizes (S, M, L, XL, 2XL, and 3XL).

- Send \$50 check payments to ANS SR, PO Box 7001, Aiken, SC 29804. Include size & address, and a phone number that we can reach you if there are size or availability issues.
- Pay \$55 per shirt using PayPal
https://www.paypal.com/donate?hosted_button_id=ZSKULU2NMR8LC. You can add your size and women's/men's preferences in the "add a note" portion of the payment page (see attached screenshot for note location).
- Pay \$55 via card, please contact ANS-SR admin by email ans.savannahriver@gmail.com or phone 706-394-0999.

Support our Benjamin Scholarship efforts for 2022 and beyond!



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Benjamin Scholarship Winners

The ANS-SRS awarded two 2021-22 Benjamin Memorial Scholarships to Central Savannah River Area students at a June 24th dinner meeting at Newberry Hall. The Benjamin Scholarship students for this year are Jayme Still of Barnwell High School in the Technical College Category, and Ekow Aidoo of Augusta Preparatory Day School in the University Category. Each student received a \$2,500 Scholarship Award.

The Benjamin Scholarships are given to help defray first-year college costs and are provided in the memory of its long-time member, Dr. Richard (Dick) Benjamin. The award is now in its eighth year and is for students expressing academic and career interests in science, technology, engineering, and mathematics (STEM) fields, and particularly those wishing to major in a field associated with nuclear science and technology.

The near-term plans of the two Scholarship winners are in keeping with the STEM core areas intended for support through the Benjamin Memorial awards. In August of this year, Mr. Still will begin his work at Orangeburg-Calhoun Technical College in the field of Electrical Instrumentation. At the presentation ceremony, Mr. Still was joined by his parents, Amber and Jason Still, and his sister, Allison.

The University Category Scholarship recipient, Mr. Aidoo, will pursue Materials Science and Engineering at the Massachusetts Institute of Technology. On the evening of the ANS awards meeting, he had already started a summer session at MIT, and so was represented at the Scholarship ceremony by his parents, Mary Arthur and Daniel Aidoo, and a visiting cousin, Ben Osei-Poku.

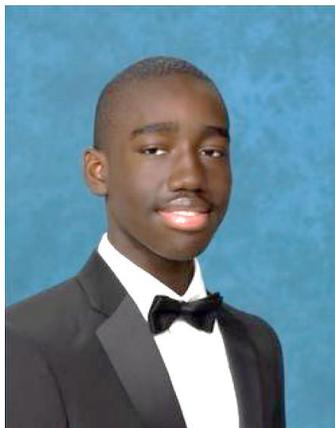
Mr. Aidoo later emailed ANS SR to express his gratitude. He wrote, "I am so sorry that I could not attend the Benjamin Scholarship Award Ceremony, but I thank you and the ANS for sacrificing your resources to help me pay for college. I assure you that you will not regret choosing me as this year's winner, for I intend to pursue my studies with the effort that I have displayed throughout high school. I am told you treated my family with the utmost hospitality at the awards ceremony, and for that, I am deeply grateful. As my mother has told you, I promise to update you on my progress throughout college."

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Benjamin Scholarship Winners (continued)



ANS SRS Benjamin Scholarship winners for 2021. Left to right: Jason Still (Jaime's father), Jayme Still (Technical College Scholarship winner), Amber Still (Jaime's mother); Daniel Aidoo (Ekow's father), Ben Osei-Poku(accepted the University Scholarship for his cousin, Ekow Aidoo), and Dr. Mary Arthur (Ekow's mother).In the foreground is Jayme's sister, Allison. (Photo by Phil Cupp)



Ekow Aidoo, University Scholarship winner (Photo used with parents' permission)

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Benjamin Scholarship Winners (continued)

Commendation Award Winners

In addition to the Scholarship awards, four students are being recognized at the runners-up level through Benjamin Commendation awards. Students receiving the Commendation Award are:

- Alexis Davis (Evans High School) attending the University of Georgia and planning to major in biology
- Makena Griffis (Fox Creek High School) attending Charleston Southern University and pursuing a STEM major
- Jasmine Sampson (Aiken High School) attending Clemson University and intending to pursue a math or science major
- Anna Summers (Aquinas High School) attending Virginia Tech's School of Neuroscience.

Several of the awardees responded to news of their recognition:

Griffis: "Thank you so much for the wonderful news! I am so humbled and ecstatic for this amazing opportunity."

Davis: "I would like to thank the Savannah River Section of the American Nuclear Society for the Commendation Award and I truly appreciate the recognition by the Committee."

Summers: "Thank you so much!! I'm am so grateful for this award!"

Scholarship Given in Memory of Dr. Richard Benjamin

The ANS Savannah River Scholarship is named for Dr. Richard Benjamin (1925-2013), who was a mentor to many nuclear science and technology professionals in the Aiken-Augusta area for over four decades. He received his B.A. in Engineering from Lamar University, M.S. in Nuclear Engineering from Southern Methodist University, and earned his PhD in Nuclear Physics from the University of Texas in 1965. After a three-year post-doctoral study at the Swiss Federal Institute of Technology,

Dick came to the Augusta area in 1968 with the acceptance of employment at the Savannah River Laboratory (now Savannah River National Laboratory). He worked in many technical areas during his Savannah River Site career, most notably being the Reactor Physics, Atmospheric Technologies, and Advanced Planning Groups, and the Accelerator Production of Tritium Project. During his long and illustrious ANS career, he was active with the Fuel Cycle and Waste Management Division and the Environmental Sciences Division, and was a chair for each division at different times in his career.

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Benjamin Scholarship (Continued)

In June 1992, Dick represented ANS at the first United Nations Framework Convention on Climate Change held in Rio de Janeiro, Brazil. Dr. Benjamin was co-director of the local Tasters Guild, a wine and food appreciation society, and was an avid supporter of the Augusta Opera and the Augusta Choral Society. He also enjoyed hunting and helped found the Aiken Dove Club. In 1972, he became a co-founder of Wine World in North Augusta



Dr. Richard (Dick) and Sally Benjamin, circa early 2000s

Upcoming Events

John Dewes, International Atomic Energy Agency (IAEA) August 26, 2021 – North Augusta, SC

Our first 2021-2022 meeting will be an in-person dinner meeting featuring a virtual guest speaker, John Dewes, from the IAEA in Vienna. John will graciously Zoom with us at 1:00 AM Austria time and at 7:00 PM EDT in the U.S., and give a presentation entitled, “A Yankee in the Hapsburg Court.” John worked 25 years with SRS and SRNL, and then later with INL, before assuming his current position with the IAEA.

The position Mr. Dewes holds at the IAEA supports HEU minimization efforts around the world. His work involves repatriation of HEU from various countries, use of LEU for Mo-99 production, and other related topics. John will discuss the ongoing work at the IAEA as well as life as a foreigner in Vienna.

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American Nuclear Society President Steven Nesbit
September 30, 2021 – Newberry Hall, Aiken, SC

The 67th President of the American Nuclear Society, Steven P. Nesbit, will be the in-person speaker to the ANS Savannah River Section and guests at 6:00 PM, Thursday, September 30, 2021, at Newberry Hall in Aiken. Steve's presentation is entitled, "Used Nuclear Fuel and High-level Radioactive Waste Management: Past, Present, and Future." Mr. Nesbit's abstract notes, "Managing and disposing of used nuclear fuel and high-level radioactive waste has proven to be one of nuclear technology's thorniest issues. It is generally acknowledged to be a political rather than technical problem, but the US program to address it is at a standstill." Steve Nesbit spent substantial portions of his career involved in various aspects of spent fuel management, and he will discuss the history, status, and current prospects for the issue. He will also summarize ongoing ANS activities in the area.



S.E.E.D. Day
October 9, 2021 – USC Aiken

A promotional graphic for S.E.E.D. Day. At the top, it says "The Ruth Patrick Science Education Center Presents" in blue cursive. Below that are four icons: a red bug, an orange atom, a blue rocket, and a green rocket. The text "S.E.E.D." is in large, bold, black letters. Underneath, it says "Science Education Enrichment Day" and "Explore. Discover. Imagine." in a smaller font. To the right, there is a photograph of three children (two boys and one girl) working on a project with a small robot on a table. Below the photo, it says "UofSC Aiken" in blue and red, "October 9, 2021" in black, and "10am-3pm" in black. To the right of the date, it says "SAVE the DATE!" in yellow and red. At the bottom, it says "The CSRA's Largest STEM Festival" in blue cursive.

The 36th annual Science Education Enrichment Day (S.E.E.D.) is occurring on Saturday, October 9, 2021 at USC Aiken. This will be an in-person event like past years before the pandemic. ANS will have tables to exhibit nuclear science demonstrations for the students attending. We hope you will plan to join us when the call goes out for volunteers later this summer.

Classes are starting back up in-person, and school policies are only

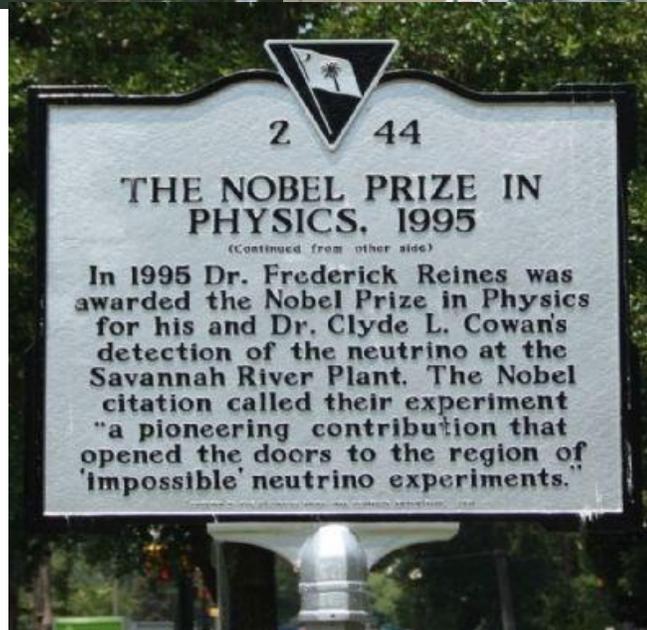
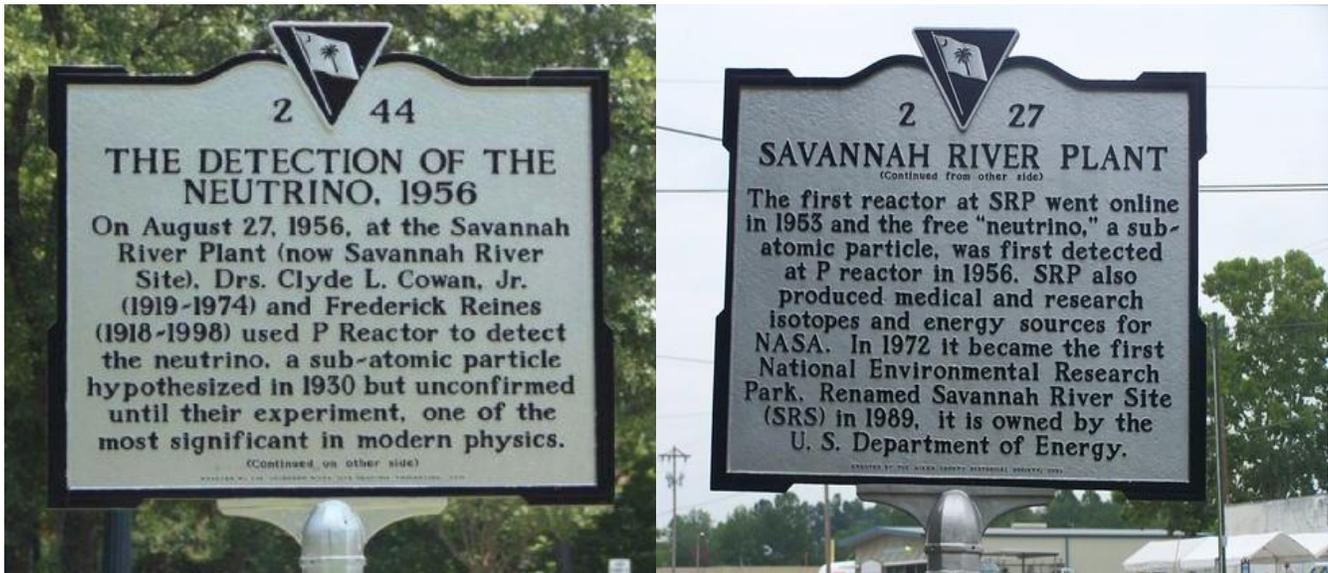
limiting visits from volunteers who are not fully vaccinated. The ANS Outreach program will work with (preferably) vaccinated volunteers on setting up days with teachers and developing classroom activities that limit commonly touched objects that go along with the demonstrations. Reach out to Graham Jones for more details.

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Discovery of the Neutrino

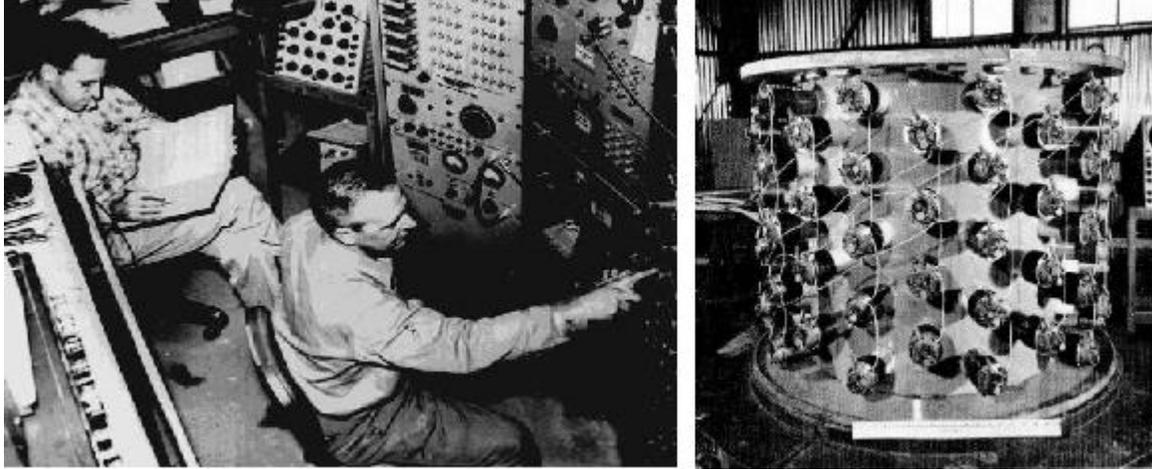
In the December 2020 Nuclear News magazine, an article can be found on the history of the Neutrino. The article mentions that Drs. Clyde Cowan and Frederick Reines did their Neutrino work at the Savannah River Plant, P Reactor. As seen below there are signs on the Site to commemorate this major accomplishment. As a matter of fact, the name of this very newsletter is in honor of this discovery.

This dynamic duo originally started working at Los Alamos on H bomb research. During this research they determined they could use a nuclear reactor instead of a nuclear explosion to hunt for evidence of the elusive particle. This led them to continue their work at the Savannah River Plant where the P Reactor was very new and ideal for the task. The 1995 Nobel Prize in Physics was awarded to Dr. Reines for their joint discovery after Dr. Cowan had passed away. See pictures below for more details.



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Discovery of the Neutrino: cont.



Dr. Reines (left) and Dr. Cowan (right) shown above working at the Savannah River Plant, P Reactor