SHAPE 2022
Symposium on Horizons in Astronomy and Physics Education

Department of Physics and Astronomy

University of North Carolina at Chapel Hill

30 April 2022

SYMPOSIUM SCHEDULE

9:30-10:40 Presentations

- 9:30 - 9:40 Prof. Laurie McNeil (UNC-CH): *Welcome and Logistics*
- 9:40 - 10:10 Dr. Greg Sloan (Space Telescope Science Institute): *The James Webb Space Telescope*
- 10:10 – 10:40 Mr. Jeffrey Cohen (Bridge Diagnostics, Inc.): *Digging holes, hanging over dams, and taking data: A tale of being a physics major in civil engineering*

10:40 - 11:00 Break (optional breakout rooms)

11:00 - 12:00 Presentations

- 11:00 - 11:30 Prof. Akaa Daniel Ayangeakaa (UNC-CH): *Nuclear structure aspect of neutrinoless double beta decay--the search for neutrino mass*
- 11:30 - 12:00 Dr. Alexis Knaub (American Association of Physics Teachers) *Diversity, Equity, and Inclusion for Physics Learning Space: Programs and Resources for K-12 and Postsecondary Physics*

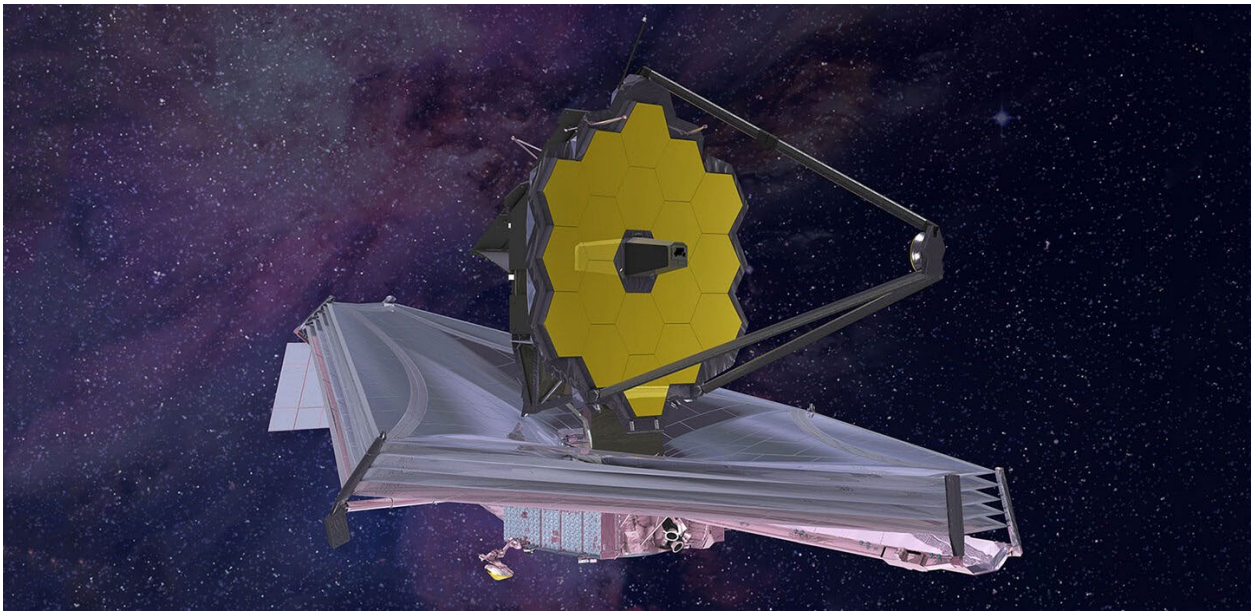
12:00 - 1:30 Lunch (optional breakout rooms)

1:30 – 2:30 Prof. Akaa Daniel Ayangeakaa (UNC-CH): *Virtual Tour of the Triangle Universities Nuclear Laboratory*

The James Webb Space Telescope

Dr. Greg Sloan (Space Telescope Science Institute)

The James Webb Space Telescope was launched on Christmas Day, 2021. JWST has a primary mirror almost three times larger than the Hubble Space Telescope, and it is optimized for the infrared. NASA puts telescopes in space because the Earth's atmosphere limits a telescope's resolution and blocks most wavelengths of light from reaching telescopes on the ground. With JWST's infrared capabilities, we can look back to the edge of the Universe when the first galaxies were forming, peer into dust clouds where stars are born, and study objects cooler than stars, like exoplanets. JWST has successfully completed a complex set of deployments, and it is now in the process of commissioning all of the cameras, spectrometers, and other instruments on board. So far, the mission has gone as well as we could have hoped, and it promises to deliver some amazing science.



Artist's rendering courtesy of NASA

Greg Sloan graduated from Yazoo City High School in Yazoo City, Mississippi, then journeyed north to Northwestern University for college. He earned his Ph.D. out west at the University of Wyoming, where he was trained as an infrared astronomer and developed an interest in studying the spectra from stars and the dust around and between them. In Wyoming, he met his future wife, Caren Cooper, who, after a round-about journey that took him to both coasts of the U.S. and Australia, brought him to North Carolina. Along the way, he spent 15 years at Cornell University on the team supporting the Infrared Spectrograph on the Spitzer Space Telescope (where he and Caren raised two girls). He is now an adjunct professor at the University of North Carolina while working full-time for the Space Telescope Science Institute in Baltimore, Maryland. At STScI, he's a member of the team responsible for MIRI, the Mid-Infrared Instrument, on the James Webb Space Telescope. He's the lead for MIRI's calibration and also coordinating the calibration of all JWST instruments during normal science operations.

Digging holes, hanging over dams, and taking data: A tale of being a physics major in civil engineering

Mr. Jeffrey Cohen (Bridge Diagnostics, Inc.)

The pursuit of a degree in physics can already be such a daunting endeavor, and it is only compounded by the challenges in figuring out what path to take upon graduation, especially when it seems so many of those paths mean going even further in your education. Many students can get on-board with four more years of school in seeking their bachelor's degree, but to add six, eight, ten more years of discipline, focus, and stress on top can feel like too high a price to pay for people who simply want to solve more interesting problems and puzzles in the world over push forward the entirety of the field with a novel discovery. This presentation offers some insight into the value of obtaining "only" a bachelor's degree in physics in a world that too often gives the impression that a Ph.D. is a critical requirement to personal enrichment and gainful employment. In the course of presenting this value, one of the many pathways available to physics graduates will be illustrated in following the various adventures (and misadventures) of one such graduate as they navigate the civil engineering world with its hard hats, dirty jobs, outdoor offices, lightning strikes, and alligators.

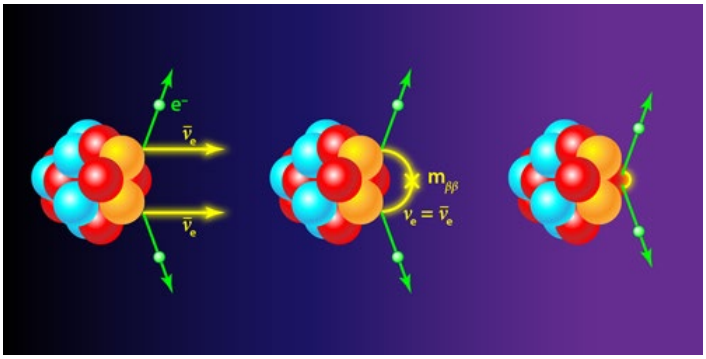
When other kids growing up wanted to be astronauts, police officers, and firefighters, Jeff Cohen wanted to be a mail carrier. He somehow got it in his head that having all the information was important, so being the person delivering letters full of it seemed about right. He also admired the kind of person who would brave rain, snow, sleet, and hail to give people the information they needed. While he ended up getting into physics at Chapel Hill instead of the postal service in his hometown of Mooresville, NC, his career has very much been one built around this general pursuit of knowledge. He has worked in the infrastructure inspection world for a little over a decade where he has hung over the side of a dam to gather acoustic data, endured driving rain and searing heat to find buried concrete with a radar system, and spent more time than he'd like behind a computer screen crunching numbers to get people the answers they need to keep dams, bridges, and other structures safe.

Outside of work, Mr. Cohen spends most of his time with his wife, Amanda, telling her more than she likely cares to hear about concrete and resonance frequencies while they go on hikes, work on crafts, or write children's stories. Fortunately, his young daughter, Amelia, was quite the engaged listener to his science lectures as an infant and carries on his experimentalist spirit daily under the careful supervision of their cat, Joan.

Nuclear structure aspect of neutrinoless double beta decay--the search for neutrino mass

Prof. Akaa Daniel Ayangeakaa (UNC-CH)

Neutrinoless double-beta (0νββ) decay is one of the most promising experimental phenomena capable of probing the fundamental properties of the neutrino. The observation of this hypothetical weak-interaction process would signal a violation of total lepton number conservation and establish the Majorana nature of the neutrino. It will also provide experimental access to the absolute neutrino mass scale, provided the nuclear matrix elements (NME) mediating the decay are reliably known. These NMEs are not experimental observables and thus can only be determined numerically. Presently, results of nuclear structure calculations of the NMEs are found to differ by up to a factor of 2 or 3, depending on the methodology. Experimental input from a nuclear structure perspective to constrain these calculations is, therefore, essential as this would allow models to be selected or developed based on reproducible benchmarking criteria. In this talk, I will present results from a high-precision Coulomb excitation measurement aimed at providing experimental data as input to theoretical models used in calculating 0νββ NME.



APS/Allen Stonebraker

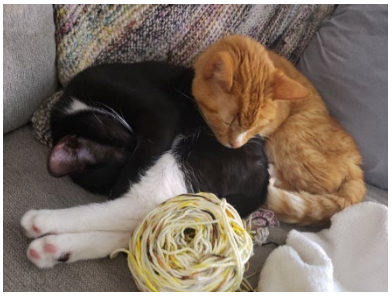
My name is Akaa Daniel Ayangeakaa and I am an Assistant Professor in the Department of Physics and Astronomy at the University of North Carolina at Chapel Hill. I am an experimental Nuclear Physicist, and I am interested in understanding how nuclear shapes evolve in proton- and neutron-rich systems and quantifying the impact of the evolution on global nuclear properties such as mass, binding energy, decay modes etc. I graduated from the University of Notre Dame in 2013 with a doctorate degree in Experimental Nuclear Physics, after which I served as a Postdoctoral Fellow for three years at the Argonne National Laboratory located just outside of Chicago. Prior to joining UNC-CH, I worked briefly as an Assistant Professor at the United States Naval Academy in Annapolis, MD. I also have a master's degree in Radiation and Environmental Protection from the University of Surrey, in the United Kingdom and a bachelor's degree in physics from Benue State University in Nigeria. I enjoy playing badminton, board games, especially Settlers of Catan and building puzzles.

Diversity, Equity, and Inclusion for Physics Learning Space: Programs and Resources for K-12 and Postsecondary Physics

Dr. Alexis Knaub (American Association of Physics Teachers)

The importance of Diversity, Equity, and Inclusion (DEI) has become even clearer recently. From looking at the numeric data regarding which students pursue physics to learning about the experiences of people with marginalized identities, working on DEI matters is important so everyone can thrive and have positive experiences with physics. Many physics educators want to create learning environments that are welcoming, but creating such environments can be challenging. DEI is a broad area of various identities and our knowledge regarding good practices is ever changing. Knowing what to do can be overwhelming. Fortunately, there are many programs and free resources available to support physics educators of all levels to include DEI elements in the physics learning environments. This talk highlights many available ways that physics educators, from K-12 to postsecondary educators, can work on DEI matters in their classrooms. These include both larger endeavors that require more commitment to actions one can take in their own classroom.

Dr. Alexis Knaub is currently based in Michigan but grew up in PA and spent considerable time in MA. She works on variety of projects focused on postsecondary physics/STEM education as a researcher, consultant, external evaluator, and project manager. One of her favorite things about her work is that she gets to apply her skills and experiences to different contexts, so she is constantly learning and meeting new people. Her cats, particularly her orange cat Chub, often appear in Zoom meetings, virtual talks, and webinars. Chub turns 17 in September 2022, has lived with Alexis for almost 15 years, and was declared a “distinguished physicist.” Her other two cats, Luka (almost 3) and Penelope Luka (1), have only lived with Alexis for almost a year, and are still figuring out their disciplinary homes. More info on Alexis can be found at alexis.science.



Virtual Tour of the Triangle Universities Nuclear Laboratory

Prof. Akaa Daniel Ayangeakaa (UNC-CH)

The Triangle Universities Nuclear Laboratory (TUNL) is a nuclear physics research facility located on the campus of Duke University. Scientists from Duke, UNC-CH, NCSU, and NCCU as well as from around the world work together on a wide range of nuclear physics experiments. In this virtual tour you will see two facilities at TUNL: the Tandem lab (build in 1965) and the High-Intensity Gamma-Ray Source (HIGS) at the Free Electron Laser Laboratory (built in 1994). You will see the laboratory and hear from the scientists about the work they do and how they do it. You will also hear some of the history of how the laboratory came to be, and what its future holds.