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Dean’s Scholar

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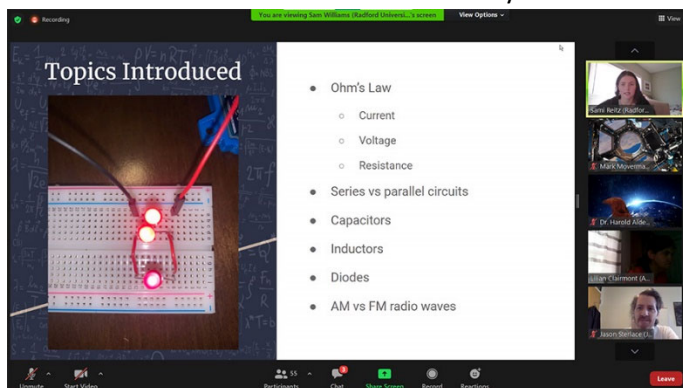
### 2022 Dean’s Scholar – Saving the Planet!



Sami Reitz was named the  
Physics Department’s 2022  
Dean’s Scholar in recognition of

her academic performance, research experience, and outreach efforts. Sami is from St. Louis and came to Radford University on a volleyball scholarship. Sami will receive her B.S. in both Physics and Chemistry, and will pursue her PhD at Northwestern University in Physical Chemistry due to her interest in both fields.

Sami has been a Physics laboratory TA, a REASLIE Student Mentor, and an officer in the SPS. She was on the annual SPS trip to the Green Bank Radio Observatory in January of 2020, just prior to COVID-19. During these last 2 covid-dominated years, she helped lead the SPS in two outreach events. In these remote events, she instructed high school students as they built their own AM radios from kits supplied through our SPS (via their successful Marsh White Grant Award). Sami was also part of the SPS team that presented their outreach work at the April 2021 Spring Meeting of the Chesapeake Section of the American Association of Physics Teachers.



Sami has been on the Dean’s List every semester, has been the Big South Volleyball Player of the Week, and has twice been a Summer Bridge TA. In 2020 she instructed more than 2 dozen Bridgers remotely with “Sami’s World of Electronics” (image above). In 2021, she helped the 20 in-person Bridgers build Arduino-based “Martian environmental sensors” as well as rockets that they all launched.

Sami has worked on various research projects in her time here. She participated in an NSF Research Experiences for Undergraduates (REU) program at Virginia Tech, studying neutrino production in astrophysical situations. This fed her interest in astronomy and astrophysics, and could relate to her work in graduate school.

Sami also was a member of the 2021-2022 year-long Arctic Geophysics cohort. She developed a diode laser-based instrument for measuring relative concentrations of particulates in the atmosphere. She successfully deployed this a number of times on and near the sea ice in Utqiagvik, Alaska, in late February, 2022.



Sami mentored other students extensively. She was a REALISE Student Mentor (REALising Inclusive Science Excellence) for 2 years, helping to break down barriers for non-majority students who would like to pursue science careers. She is the PHYS 309 – Electronics Laboratory TA and is a calm voice when her charges a frustrated with the finicky circuits that just won’t work.

She did all of this while playing volleyball all 4 years, while maintaining an impressive GPA, and participating in research in both physics and chemistry. We look forward to Sami’s continued successes as she heads to Northwestern University this fall.

### Welcome Dr. Riddhi Mehta

Dr. Riddhi Mehta is our new Special Purpose Instructor of Physics. Dr. Mehta received her PhD in Physics from Purdue University. Her thesis was a theoretical study of highly-magnetized neutron stars called magnetars, and was titled "Magnetohydrodynamics of magnetars' high-energy and radio emissions: A simulation study."



Dr. Mehta's research experience and interests are in the application of plasma physics in astrophysical settings, in particular, studying astrophysical shocks and magnetically confined spheromaks (toroidal shaped plasma around a neutron star). She is also interested in exploring the physical mechanisms behind high-energy and radio emissions from one class of rotating neutron stars called magnetars, particularly, analyzing their giant flares using the astrophysical code PLUTO.

Her High-Energy Theoretical Astrophysics research involves studying high-energy, namely X-ray and gamma-ray emissions, and radio emissions from one class of rotating neutron stars called magnetars possessing extreme surface magnetic fields. She is interested in analyzing magnetar giant flares and their afterglow radio emissions. I build analytical models to hypothesize the physical mechanisms causing these emissions and simulate them in a three-dimensional high-resolution grid to reproduce astrophysical observations using the astrophysical code called PLUTO written in the C programming language.

As a Graduate Teaching Assistant at Purdue University, Dr. Mehta contributed in outreach programs such as

Saturday Morning Astrophysics and Purdue NanoDays involving high school and middle school students, and girl scouts. Her teaching interests are introductory mechanics, electromagnetism, solar system and stellar astronomy.

### SPS Members get Published

In a first for RU Physics, SPS officers Sam Williams (President) and Kaleb Martin (Vice President) had their article "Presenting on Our Outreach Program" published in the 2022 Winter edition of the *SPS Observer*, the national magazine of the Society of Physics Students.

Sam and Kaleb wrote about their experience with their National SPS-funded physics outreach program teaching high school students how to build unpowered radios. They talked about presenting their work at the 2021 Spring Meeting of the Chesapeake Section of the American Association of Physics Teachers hosted virtually by Radford University Physics.

They wrote, "Even though the meeting was virtual, giving a talk was daunting. Several dozen physics teachers from across Delaware, Maryland, Virginia, and the DC area – plus a few from outside the region – were also presenting. ... Here we were, a group of college students, with all of these professional educators listening intently to what we had to say about outreach."

Kaleb wrote, "When I started speaking I was pretty nervous, but as I kept talking I noticed the butterflies in my stomach left. It was nice to see that other people were actually interested in what we did as a group, and I can't wait to do it again. Overall, I think it was a really cool experience to hear all of the professors [giving talks] and listen to what they did or wanted to improve on."

### SPS CHAPTERS ON PROFESSIONAL DEVELOPMENT

## Presenting on Our Outreach Program

by Sam Williams and Kaleb Martin, SPS Members, Radford University

Last April we gave a professional presentation about our SPS chapter's outreach events for local high school students. The goals of our outreach program were to increase interest in and motivate high school students to pursue STEM by teaching them to build AM radios. We hosted two events via Zoom, one in the fall of 2020 and one in the spring of 2021. Each student received an AM radio kit purchased with funding from an SPS Marsh W. White Award. We learned a lot from these outreach experiences and even more from giving a talk on them to physics educators.





### Arctic Geophysics – Student Driven Research

The latest “Arctic Geophysics cycle” was in the just-completed 2021-2022 academic year. The current format starts in the fall with the one-hour PHYS 324 – Arctic Geophysics Preparatory Seminar – in which students planned their own research, submitted proposals for conducting that research, and got started building their equipment. Then they finished their sensor builds (using your friend and mine, the Arduino!) in the 4-hour PHYS 325 – Arctic Geophysics Field Research in the 2022 spring semester. They traveled to Utqiagvik, Alaska for one week during February 26-March 12, 2022, to gather their data.

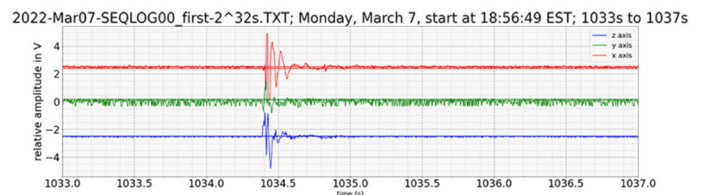
The projects this time included the laser diode-based air particulates detector built by Sami Reitz. As she described it, her detector was the “\$100 version of the million-dollar version that we saw with the CHACHA equipment.” The “CHACHA” reference was to a group of 10 scientists from across the country who were in Alaska, and flying those truly million-dollar versions on planes through contaminant plumes emanating from oil fields on the North Slope. It was exciting for Sami and the others to know that they truly understood the instruments at their most fundamental level as they talked with members of the CHACHA group ([https://www.eol.ucar.edu/field\\_projects/chacha](https://www.eol.ucar.edu/field_projects/chacha)).



Other projects included an ice seismic study that was coupled to a shore-based planetary-scale seismic study. The two researchers posited that planetary seismic activity might be correlated with activity on the ice pack. Their data analysis is ongoing and will be presented at the 2022 Fall Meeting of the American Geophysical Union in Chicago in December.

More projects included homemade laser diode-based turbidity sensors for the seawater that required drilling through the ice to get the sensors into the ocean below (Grace Psenicska, right).

Other projects involved studies of the winds across the ice to investigate the “boundary layer” of the fluid (air) flow; apparatus to study of the flexural strength of the ice; a study of the thermal gradient within the ice (more drilling!); water pressure and its correlation with atmospheric pressure; a Raspberry Pi-based microplastics detectors system; and a study of the distribution of environmental DNA (“eDNA”) in the ice. All were conceived of, and built by the students in this year-long research experience.



For more information: <https://www.radford.edu/alaska>

### Planetarium Update

The Radford University Planetarium received state funding to upgrade our projection capabilities. Our 10-meter-diameter dome was installed in late 2015 with 2k resolution (i.e. 2,000 pixels across the  $\pi(5m)$  “equator” of the dome). This is being upgraded as of this writing to 4k resolution! This is just in time for an upcoming big event to which you are all invited.

On Friday and Saturday, June 10 & 11, the Radford University Planetarium will be the center of a James Webb Space Telescope (JWST) Community Event. We are an official partner with NASA and the JWST outreach team. We will offer a range of public programs to bring the excitement of STEAM (science, technology, engineering, arts, and math) for all ages, and to everyone in the New River Valley and beyond.



In this 2-day event, there will be multiple planetarium shows, the geology museum will be constantly open, and there will be science activities and demonstrations and displays. We will have telescopes with solar filters pointed at the sun (weather permitting), and we've got a number of on-campus and community partners participating. People are welcome to come for any or all of this. It's all about science, and there will be activities for all ages. Everyone is invited.

Webb is the largest and most complex space science telescope ever built – the premier observatory of the next decade. This international mission, led by NASA in partnership with the European Space Agency and the Canadian Space Agency, launched Dec. 25, 2021. After unfolding in space into its final form, Webb successfully arrived at its destination nearly 1 million miles from Earth and began preparing for science operations.

The JWST observatory, which is designed to see the universe in the infrared, will push the field of astronomy into a new era. Webb will be able to study light from distant parts of the universe for the very first time – the first galaxies that formed over 13.5 billion years ago – and give us insight into how our universe formed.

### Project-Based Learning Grows

The Physics Department is continuing its curriculum evolution by incorporating more project-based learning (PBL). PBL has been shown to be a more equitable way of learning and assessing students' abilities. PBL is a change from purely lecture-based learning. This involves projects that deliver some learning outcome of a class without the instructor needing to spend much – if any – time on the material in the class.

Recent projects include building sensors to measure an atmospheric property (PHYS 301 – Atmospheric Physics), a project that led Sami to her Alaska work with her particulates detector (in action in the image to the right).

Our PHYS 370 – Numerical Methods in Physics class is almost all project-based. Students in this class learn scientific

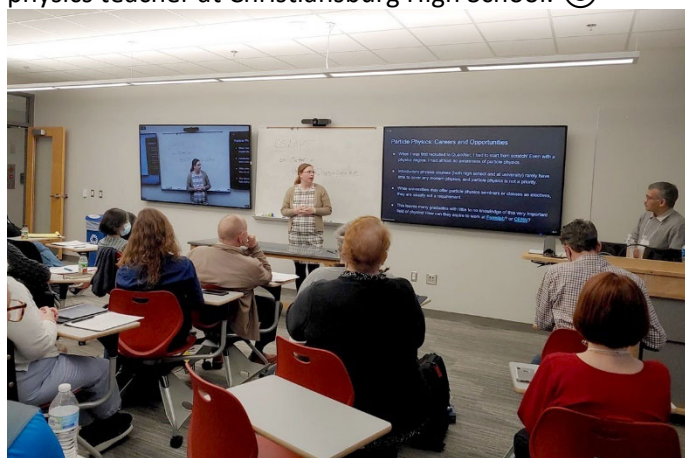
programming, and end the class with a project of their own choosing that involves intense Visual Python coding. The students not only enjoy this work (well, once their codes actually work!), but they get an almost-required line on their resumes for jobs and graduate studies. As many of you have advised us to do, we are making sure that our majors have a strong exposure to coding.





### RU Physics Hosts Regional Meeting

On April 2 the Radford University Physics Department hosted the in-person plus virtual Spring Meeting of the Chesapeake Section of the American Association of Physics Teachers. This regional group encompasses Virginia, Maryland, DC, and Delaware. The meeting had over 40 in-person attendees as well as another 40 who joined in via Zoom videoconferencing. This day-long meeting featured in-person and virtual talks by faculty and students from around the region. Note that one of the speakers – pictured below – was Rebecca **Jaronski**, physics teacher at Christiansburg High School. ☺



The meeting was a great success, and was really the covid-delayed version of the all-virtual 2021 April Spring Meeting that we hosted.

### Alumni at the Student Engagement Forum

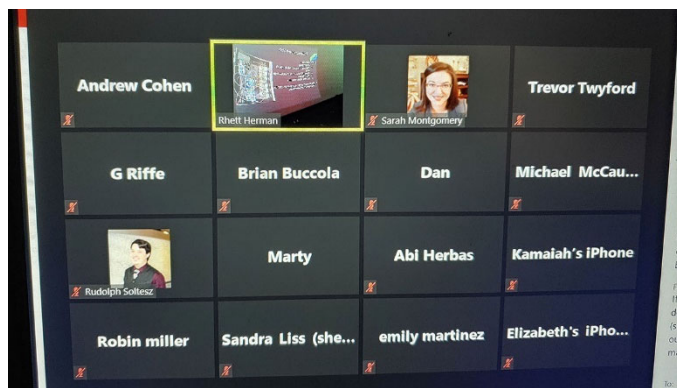
On Wednesday, April 20, the 12 students in the Arctic Geophysics Research Experience presented their talks about their just-completed research in Alaska.



As usual, there were so many presentations from this one research effort that the Office of Undergraduate Research and Scholarship (OURS) designated a special “Arctic Geophysics Oral Session” within the Forum.

The students had performed their preliminary data processing, and were able to talk about both their research equipment and methods as well their results.

An exciting feature this year was the inclusion of so many of you in these talks via the now-ubiquitous Zoom. It was really great “seeing” so many of you, either by name, or by seeing your faces. The current students really enjoyed the questions and comments that they received from alumni and past researchers. It was a great way to connect the current generation to the broader RU Physics community.



The next step in this process is the upcoming one-hour 2022 fall PHYS 326 – Arctic Geophysics Capstone Experience class. In this class, the Alaska students (who have not graduated) will work on further processing of their data so that they may present at the Fall Meeting of the American Geophysical Union (in Chicago, December 12-16). As many of you have experienced yourself, one of the best ways of truly knowing something is to present it in front of a broader audience. The AGU meeting is the world’s largest gathering of earth & space scientists, typically seeing around 24,000 attendees at these amazing meetings.

But it won’t just be current students presenting. Some of the just-graduated seniors will be working remotely on their own AGU presentations. They have important results to share, and this will be another resume-enhancing experience for them.

### June 10-11 Planetarium JWST Event

On Friday and Saturday, June 10 and 11, **YOU ARE ALL INVITED** to the Radford University Planetarium's James Webb Space Telescope Community Event. As described previously, this event will feature multiple planetarium shows, the continual opening of the Museum of the Earth Sciences, numerous science-themed activities and demonstrations, and a special guest speaker.

Our local partners in this event include multiple faculty and students from the Artis College of Science and Technology, McConnel Library, Radford High School, Christiansburg High School, the Wonder Universe Children's Museum, Wine & Design Christiansburg, the Virginia Tech Physics Outreach Team, the Roanoke Valley Astronomical Society, and more. We are working on a plan to simulcast some parts of this online, with the plans to be announced on the Planetarium web page and Facebook page.

Our special guest speaker will be Dr. Francisco Muller Sanchez, Assistant Professor of Astronomy in the Department of Physics and Materials Science at the University of Memphis. Dr. Muller-Sanchez is the only scientist who has already been awarded two research projects with the JWST.

Prof. Muller-Sanchez is an observational astronomer with a broad interest in extragalactic astronomy. His research focuses on galaxy formation and evolution, with interests ranging from the physical properties of active galactic nuclei and nuclear star clusters, to the role of supermassive black holes in galaxy evolution, galaxy mergers and the cosmic evolution of the relations between the central black hole and its host galaxy. He uses multiwavelength analyses for these studies, with a focus on the optical/near-IR and radio regimes.



### Support RU Physics and Our Students!

Here are the links for supporting us with your comments, news, and information (and perhaps a donation 😊).

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<https://planetarium.radford.edu/>  
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To donate **directly** to the Physics Department, or one of the funds supporting the department, click the following link:

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After filling in your donation amount, go to the pull-down list and select "Other (please specify)." Then type any of the following into the box:

RU Physics Department  
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Physics Faculty/Alumni Scholarship  
RU Planetarium

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