RADFORD UNIVERSITY

Department of Physics



## Back Home Again!

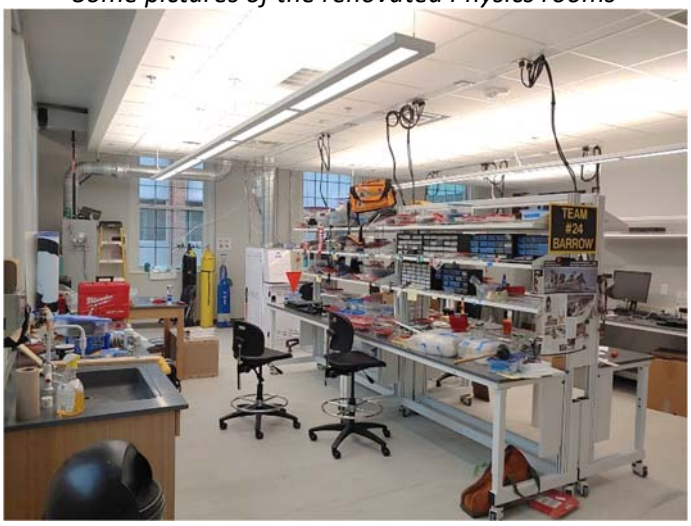
We first shuffled around in Reed & Curie Halls in January of 2016, clearing the way in Curie Hall for the upcoming renovations. Then, in August of 2017, we moved completely out of Reed & Curie to spaces in the Library (offices, some research/work space), Walker Hall (introductory & upper-level teaching labs), and Preston Annex (research labs). Plus, we had the Planetarium in the Center for the Sciences. One department, 4 locations across campus – a confusing 4.5 years.

We are now back in our newly-renovated, permanent location. Our offices – and department office! – are on the 3rd floor of Reed Hall, along with 2 upper level teaching labs. We have a large research lab on the 2nd floor of Reed, along with a dedicted Society of Physics Students (SPS) room! We have two large introductory teaching labs, with one hosting physics labs and one hosting astronomy labs and the Physical Science 350 hand-on science class for future teachers. We have a physics-only storeroom just across the hall from the introductory physics lab.

The ground floor of Curie Hall houses the wind tunnel research lab, and the Scanning Tunneling Microscope (STM) research lab.

*Introductory Physics teaching lab, adjacent to same-size introductory astronomy lab.*

*Some pictures of the renovated Physics rooms*



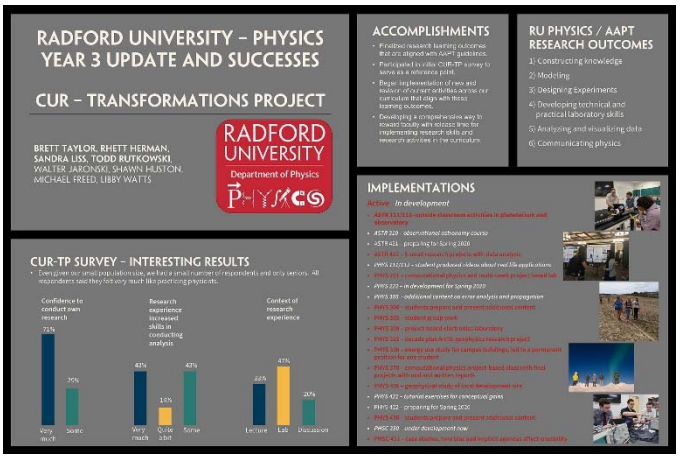

*Phyiscs faculty/student research lab; the SPS room is behind the wall on the right.*


*Curie-to-Reed Hallway to Physics Department showing how the whole building is much more open.*

*Wind tunnel research lab, adjacent to the STM lab.*

## Physics at Undergraduate Research Meeting

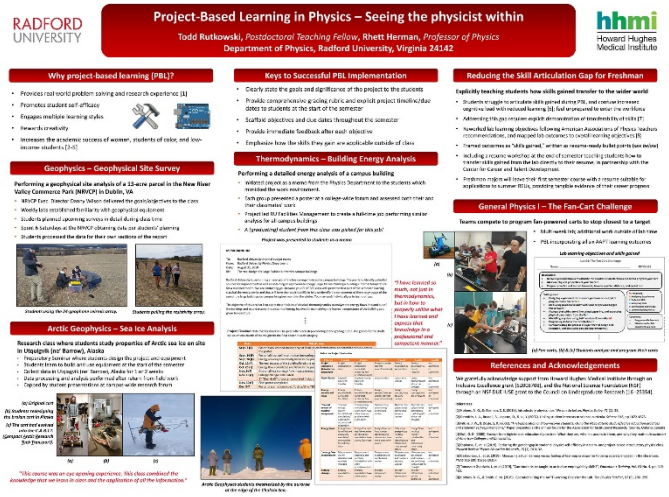
The Physics Department is part of 2 ongoing grants within the Artis College of Science and Technology. One of these is the Council on Undergraduate Research Transformations Project (CUR-TP). Faculty members attending the national meeting October 4-6 in Houston included Dr. Brett Taylor, Dr. Rhett Herman, Dr. Sandra Liss, Dr. Todd Rutkowski, and Dr. Michael Freed. They presented a poster they authored – along with Dr. Walter Jaronski and Mrs. Libby Watts – about our ongoing work to embed research practices throughout the entire curriculum.



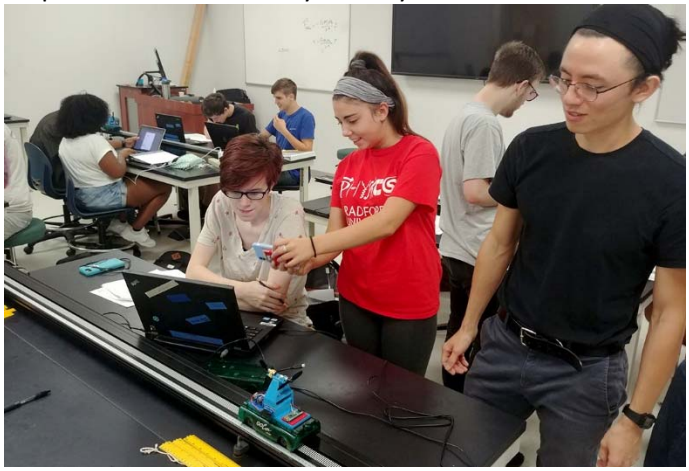

We have infused research skills into our introductory classes via multi-week investigative/open-ended labs, and by including VPython programming work as part of the curriculum. Thanks to the efforts of Dr. Rutkowski, we have mapped the skills presented in our labs to those listed in the "Research Outcomes" of the American Association of Physics Teachers. In our advanced classes these research skills take the form of semester-long Project Based Learning (PBL) activities, which are clearly-defined problems and tasks presented to the class that require the use of class content to address.

## Physics at AAC&U Diversity/Inclusion Meeting

Two Physics faculty members attended the American Association of Colleges & Universities (AAC&U) STEM Ed meeting on November 7-9 in Chicago. They were joined by faculty members from both the Biology and Chemistry Departments, as well as Dean Rogers and Vice Provost Dr. Jeanne Mekolichick. Drs. Rutkowski and Herman presented their work to incorporate Project Based Learning into both introductory and advanced courses. This is part of the ongoing work with the HHMI Inclusive Excellence grant shared by the three departments.

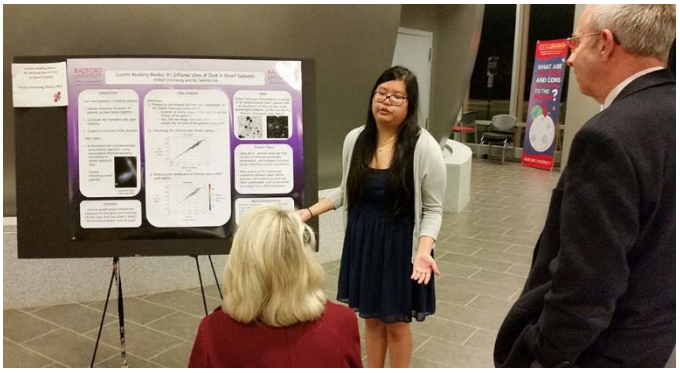



Many of you have participated in some of these initial PBL efforts. We are working to continually refine this work with the goal of giving students skills and final products that they can put on their resumes. To help with this, at the end of the fall, we had a "resume session" in one of the final PHYS 221 labs to guide students through exactly where they put their Physics skills into the resumes. Students were pleasantly surprised to find that they already had marketable skills!



## Physics Students Present at the Artis Showcase

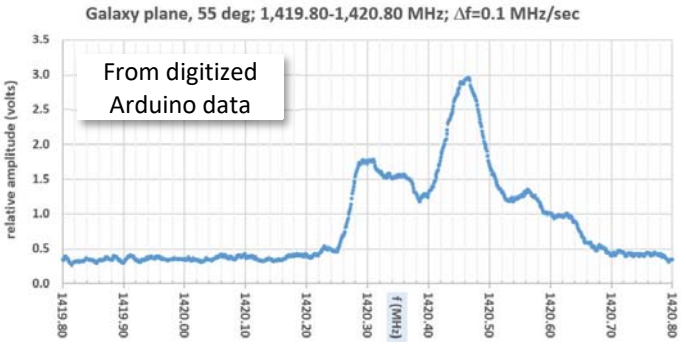
The Artis College of Science and Technology held its annual Student Showcase in the lobby of the Center for the Sciences on Thursday, December 5, 2019. This highlighted student work throughout the College in both their research projects as well as in their classes. Below, Physics Major (Astrophysics Concentration) Krislyn Sourivong presents her ongoing research with Dr. Liss on the evolution of the dwarf galaxies orbiting our own Milky Way galaxy. She is talking with Mrs. Nancy Artis, who donated (with her husband Pat) $5 million to fund 67 Artis Scholarships for students in the College.

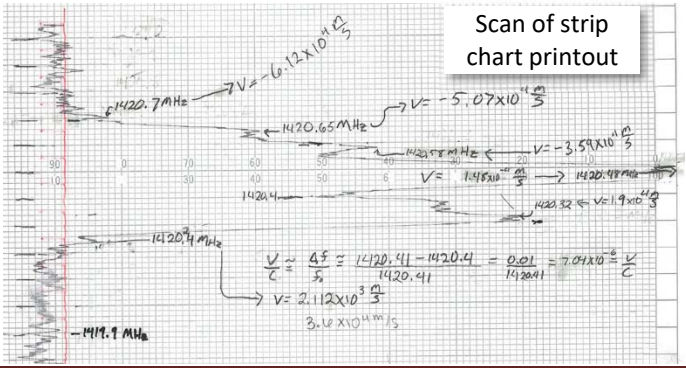


Above, May 2020 Physics graduate Roque Aguon presents his work with a microclimate sensor in the PHYS 301 – Meteorology (now Atmospheric Physics) class. He and his partner installed a lightning sensor along with various other humidity/temperature/pressure sensors on a sensor post designed to monitor possible ionizing effects of storms on the microclimate near a small stream.

## Green Bank NRAO 2020

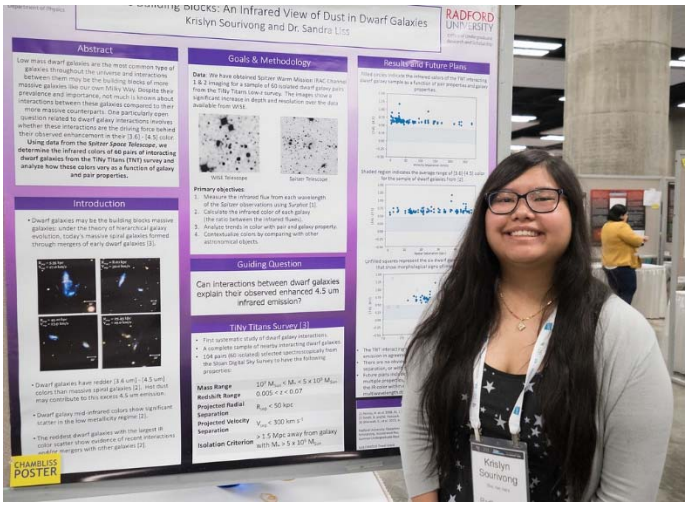
On the weekend of January 24-26 the Society of Physics Students traveled to the National Radio Astronomy Observatory at Green Bank, WVa, to learn about radio astronomy. While there, the group had access to the 40-foot-diameter teaching radio telescope and used that to gather data. This year was a bit different. Dr. Liss used a lot of the data in her upper level ASTR 310 – Observational Astronomy class. We also had a home-made Arduino-based analog-to-digital coverter that we used to try to digitize the scans. While not perfect, our modest success led us to realize that we can improve the design and take it back next year.



## Students Present at Astronomy Meeting

Dr. Sandra Liss and two of her students – Krislyn Sourivong and Michael Hess – traveled to Hawaii January 408, 2020, to present at the 235th meeting of the American Astronomical Society. Krislyn (below, with her poster) presented her work in analyzing data from the Spitzer Space Telescope as it studied 60 isolated pairs of interacting dwarf galaxies. She also studied how these pairs compared to other classes of galaxies.




Michael Hess (below, foreground/talking) presented his work on a 16-electrode homemade galvanic electrical resistivity array for geophysical surveys. He did this to show that such work gives students skills in instrumentation and troubleshooting that will be valuable in their future career path in astronomy, a field that is instrumentally intensive.

Dr. Liss also presented work that she did with another of our faculty members, Dr. Michael Freed. Her presentation focused on their work in "…restructuring our astronomy and physics classes through backward course design with a focus on creating an active and inclusive science community." Specifically, they are focusing on project-based learning, along with diversity, equity, and inclusion training for all our faculty members. This work was supported by grants from the Howard Hughes Medical Institute Inclusive Excellence program, and from the Council on Undergraduate Research (CUR).

## Student Research in the Arctic

The "next generation" of the Arctic Geophysics Research Experience had a new format. The fall of 2019 saw the first offering of the new class, PHYS 324 – Arctic Geophysics Preparatory Seminar. In this class, students studied the arctic, and then created their own research question that could be addressed through some homemade sensor project. The students submitted the initial research proposals – without identifying information! – which the entire class (and instructor) critiqued and improved. The students then re-submitted their modified proposals, parts were ordered, and they started building their own sensor projects. Members of the "arctic class of 2019-2020" are shown below in the research lab as they solve a problem that one of the students was having.

## Student Research in the Arctic

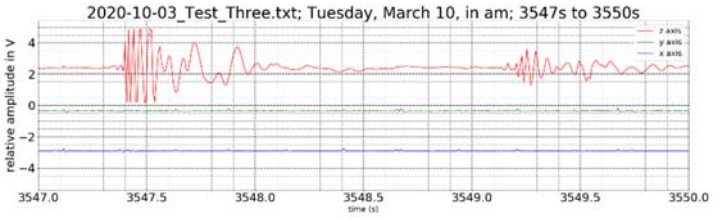
The research group traveled to Utqiagvik (ne' Barrow), Alaska from February 29-March 14. Unlike prior trips, equipment shipping issues (too long of a story for this newsletter!) delayed the start of the work until the end of this first week. However, with some "first-weekers" staying an extra day, their work was completed before they left. One of the new things that we had was an ice corer. This is shown below in its "manual" configuration, with a hand-crank handle. When the rest of our equipment arrived we used a battery-powered drill which made the work go much, much faster. This allowed cores to be obtained to be later analyzed for the presence of microbes as well as microplastics.

Other projects included the wind "friction layer" at various locations on the ice (below). Anemometers on a sensor pole collected plenty of (via the Arduino control box) at 5 heights to characterize the ice boundary layer.

Special note: We are grateful for the financial support received from our alumni for this trip! A crowdsourcing campaign raised approximately $4,500 to help alleviate the costs for the students on this year's trip. This will be a regular part of future campaigns, with 100% of the funds raised going to directly offset students' costs.

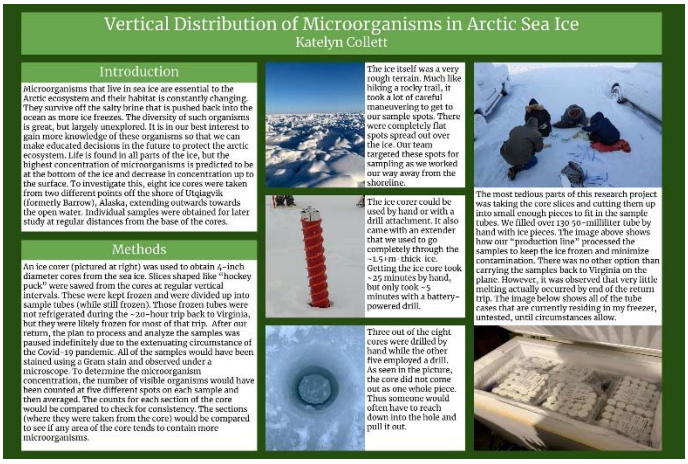
Another experiment involved putting a student-waterproofed pressure sensor into the seawater. The data was to be used to investigate potential correlations in tiny ocean pressure differences with the ubiquitous cracks forming in the ice. Below, Deanna Perales is getting ready to put her sensor into the seawater, with data to be obtained through her Arduino control box.

Yet another study involved a custom 3-d seismic sensor box. Designed and built from scratch by Hunter Witt, these boxes had 3 professional geophones whose signals were amplified by LT1677 op amps. These boxes returned copious amounts of seismic data since they recorded x-, y-, and z-values for vibrations over 140 times per second! They were left on the ice for up to 4 hours at a time, yielding up to 2 million 3d data points! One small portion of one of the scans is shown below, revealing the only-vertical displacement of the ice, and the dispersion in the wave.



## Arctic Research at the Student Engagement Forum

This year's Student Engagement Forum (SEF) was virtual, as with so many things in this covid-changed semester. But the students did great with their poster preparations, and the results were impressive. Note that the research expanded to include more study fields.




Other posters may be found here: https://portfolium.com/discover/tag/RUSEFArctic

## Dr. Rutkowski is Moving On!

We have been excited to have HHMI Teaching Postdoc Dr. Todd Rutkowski with us these past 2 years. During that time he has taught several classes with us, and has worked to overhaul both the calculus- and algebra-based introductory physics classes. His modifications include adding multi-week labs, incorporating metacognition into the curriculum, and including a number of student-centered aspects to the class (e.g. mandatory professor drop-ins to get to know students, etc.). Here at the end of his 2-year postdoc position he has accepted a physics teaching position "just up the road" at Washington & Lee University. We are grateful for Dr. Rutkowski's contributions to our curriculum, and wish him the best in his new position.

## An Updated Curriculum

We have reworked our curriculum to better reflect the changing job and educational needs of our students. We now have 4 concentrations:

- Experimental & Theoretical Physics – for those who are going to graduate programs in physics or related areas.
- Astrophysics – for those going into astronomy or fields that use the skills common in this area. Recall that, even at the height of the Great Recession, the unemployment rate for those with this degree had a 0% unemployment rate (see Georgetown Center for Education & the Workforce).
- Biophysics – for those who want to go into the exciting field of medical physics. This concentration includes 2 years each of Chemistry and Biology classes.
- Physics Teaching – for those who want to take their degrees into the K-12 classroom and enjoy a rewarding career.

## A Record Number of Dual Degrees

In the years that we have had the Dual Degree program with Virginia Tech's College of Engineering, we have had a small but steady stream of Dual Degree recipients. But this year saw a record number of these graduates earn both their RU Physics degree and their Virginia Tech Engineering degree. We had one person formally finish in December, and then 5 (yes, really!) graduate in May. Congratulations to all of these students for this amazing accomplishment.

## Yet Another Success Story

Just one more big ***THANK YOU*** to everyone who contributed to the Arctic Geophysics crowdsourcing fund this year. You helped raise approx. $4,500 for the students in this year-long research experience in its new format, and we are certainly grateful. You made all the difference in the world for these students, and you are greatly appreciated.

## Contact Us

*Let us know how you're doing, what you're doing, and where you're doing it!*

Update your information here!
https://www.radford.edu/content/csat/home/physics/alumni.html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