HHMI grant – Inclusive Excellence

CUR grant

2 New Physics Faculty Members

SPS designated a "Notable" chapter for 2016-2017

"Poetry Under the Stars" Planetarium special event

Arctic Geophysics 2018

Physics Department Part of $1Million HHMI Grant

The Howard Hughes Medical Institute (HHMI) awarded Radford University $1 million grant as part of the institute's new Inclusive Excellence initiative. HHMI is the largest private, nonprofit supporter of science education in the United States.

This grant effort was spearheaded by Biology Professors Dr. Tara Phelps-Durr and Dr. Jeremy Wojdak. The 3-year grant involves the departments of Biology, Chemistry, and Physics. The purpose of the grant is to increase the capacity of colleges and universities to effectively engage all students in successful science practices. The initiative especially targets undergraduates who enter four-year institutions via non-traditional pathways.

Each of the departments will use the funds to hire postdoctoral positions in their disciplines, as well as to fund various workshops and activities that will promote inclusivity. These postdocs will free up time so that current faculty members may rework their department's curriculum to provide for a more inclusive environment. An example of this would be a workshop in January 2018 on Project-Based Learning (PBL). PBL involves students working with faculty in regular courses to use the course material – as well as material learned from previous courses – to identify and solve real-world problems. Unlike new research projects, these PBL projects are at the appropriate level for each course, and allow the students to apply what they are learning in that semester to those real-world problems or investigations.

We will have more information about this program in the near future. We will also have more information about the just-hired Physics postdoc below.

Council on Undergraduate Research Grant

Radford University's Physics and Biology Departments were recently selected to participate in the Council on Undergraduate Research (CUR) Transformations Project that will examine and enhance the university's undergraduate research-based opportunities over the next four years. Their estimated value is $80,000 a year. The bulk of this funding will pay for two consultants who will conduct site-visits to gather information and to help the departments create an action plan for transforming their curricula. Each department will also receive $2,000 each year to support implementation of their action plans.

Undergraduate research has been shown to increase both retention in the major as well as enhancing student opportunities post-graduation. In addition to the Project-Based Learning initiative through the HHMI grant, the Physics Department is committed to providing more research opportunities to our students.

Our current research areas include arctic geophysics, microcontroller-based environmental sensor design, solar physics, and scanning tunneling microscopy. You will hear more about our expanding research opportunities soon.

2 New Physics Faculty Members

Two new faculty members have joined the Physics Department, Dr. Todd Rutkowski and Dr. Sandra Liss.

Dr. Rutkowski was hired as part of the $1million HHMI (Howard Hughes Medical Institute) grant to to increase the capacity of colleges and universities to effectively engage all students in successful science practices.

Dr. Rutkowski will be doing two things. He will be teaching a regular load of classes so that other Physics fauclty members can have some time released from teaching to research and incorporate those practices into our curriculum. His other focus will be to regularly communicate with the other two postdocs – one in Biology and one in chemistry – to cross-communicate about these practices and potentially to set up cross-disciplinary initiatives. He will be teaching both algebra- and calculus-based introductory physics this fall.

Dr. Todd Rutkowski received his PhD in theoretical condensed matter physics from Binghamton University in May 2018, where his dissertation work focused on the magnetic properties of alkali gases cooled to microKelvin temperatures. During this time, he was also an integral member of an interdisciplinary team which merged science and the humanities to develop a new course called Materials Matter. This cross-disciplinary course exposed freshman honors students to several spectroscopic techniques used in materials analysis, and put these techniques into practice by analyzing the pigments present in historically significant paintings and artifacts. As a post-doctoral teaching fellow with REALISE, Dr. Rutkowski is eager to work with interdisciplinary teams to develop hands-on experiences for students, allowing them to understand both how and why scientific methods and techniques are needed in all aspects of our modern society.

Dr. Sandra Liss grew up in South Florida before pursuing a BA in Physics from Swarthmore College. Her undergraduate research involved pre-main-sequence (PMS) binary stars, among the youngest astrophysical objects in our Universe. As a minor in Educational Studies Dr. Liss was also involved in science education research with both the physics and educational studies departments. Outside of the classroom, she helped coordinate science outreach experiences for underrepresented K-12 students in and around Philadelphia.

Following her time at Swarthmore, Dr. Liss worked for a year as a research assistant in Penn State's Department of Astronomy and Astrophysics where she studied the orbits of hot subdwarf binary stars, the hot exposed cores of evolved stars. Dr. Liss volunteered with the department's AstroFest outreach program and with the Shaver's Creek Environmental Center.

Dr. Liss received her MS and PhD in Astronomy from the University of Virginia (UVa) as a National Science Foundation Research Fellow. Her dissertation, entitled 'Star Formation in Interacting Dwarf Galaxies,' focused on determining how and where stars form in interacting low-mass galaxies, with the ultimate goal of understanding how large galaxies like our Milky Way may have formed. As part of this research, Dr. Liss was awarded over 300 hours of telescope observing time on ground- and space-based telescopes including the Hubble Space Telescope, Spitzer Space Telescope,

Magellan Baade Telescope, and Gemini North Telescope. While at UVa Dr. Liss worked closely with undergraduates, traveling with students to Arizona, New Mexico, and Chile for observing runs.

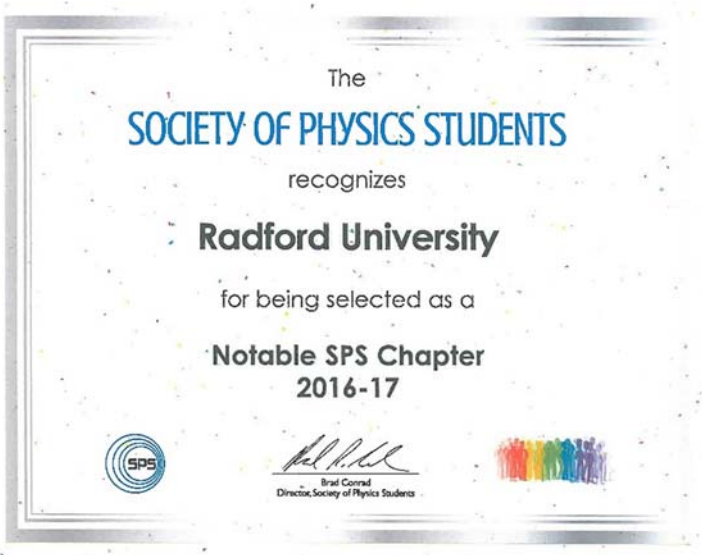
As a graduate student, Dr. Liss was a leading member of UVa's Dark Skies, Bright Kids (DSBK) outreach program focused on bringing hands-on inquiry-based astronomy activities to underserved students throughout Virginia. She founded and led the group's evaluation team, developing and assessing DSBK's out-of-classroom STEM curriculum.

When Dr. Liss isn't in the office or at a telescope, you can find her baking, hiking, or playing with a nearby dog.

SPS "Notable Chapter 2016-2017" designation

Perhaps it's best to simply quote the letter from National SPS Director Dr. Bard Conrad in recognizing our chapter:

"Congratulations to you and your chapter for your accomplishments during the 2016-17 academic year! We are consistently amazed each year at how much time, energy, and effort everyone devotes to their departments and local communities. This year the Radford University chapter has earned the designation of a Society of Physics Students Notable Chapter!"



We have a busier schedule planned for this coming year with 2 external speakers lined up for the fall, both of whom will be sponsored by the SPS. The SPS is also planning their first ever trip to attend an SPS Zone Meeting. Members will present the research that they have done – or are doing – both on- and off-campus.

You will hear more about all of this in the next newsletter.

"Poetry Under the Stars" in the Planetarium

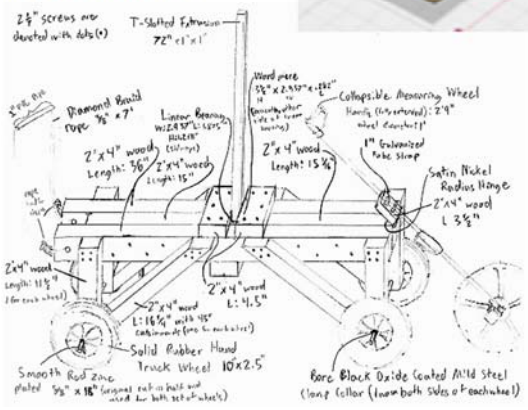
On Thursday, January 25 the Radford University Planetarium hosted a special evening of poetry under the stars by Hollins University Professor of English Dr. Cathryn Hankla, author of more than a dozen books. Dr. Hankla read her poetry at 6:45 and 8 p.m. in the Radford University Planetarium, giving the community an opportunity to hear the author's take on her own material. In addition to the poetry reading, the planetarium provided visuals including galaxies, constellations, meteor shows, and more.

Among Hankla's publications are *Fortune Teller Miracle Fish*, *Great Bear*, and *Galaxies*. She will be working with us to develop a more permanent show that may be released to the Digistar 5® cloud so that other planetariums can show this.

Arctic Geophysics 2018 – from cart to C.A.R.T.T.

The PHYS 325 class went to Utqiagvik (nee' Barrow), Alaska February 24-March 10 to study the polar sea ice. This trip was quite different in that the equipment taken was primarily student–designed and student–built. This year's course had a stronger fall-semester "pre-class assignment" with students required to design a cart or something to carry an array of sensors that would be used to study the ice.

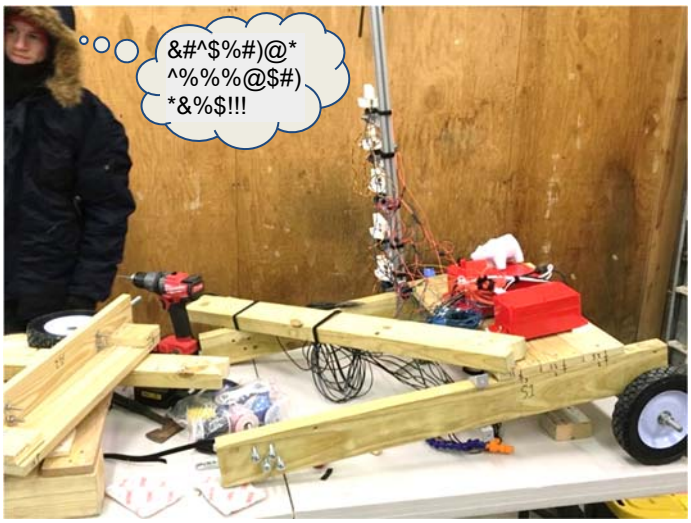
Many designs were submitted, with some being high-tech and others being lower-tech (but still effective). In the end, a cart was carefully constructed, one that could be easily disassembled and reassembled for packing and shipping to Alaska.



The students were deservedly proud of *their work.*

They had repeatedly tested it and everything worked including the IR sensors pointed at the ice surface, the sun-shielded Dallas Semiconductor temperature sensors arrayed vertically for 1.5 meters, the odometer wheel/sensor, and the incredibly-accurate GPS sensor.

And of course, on the first day of deployment…the cart ***totally broke*** on the surprisingly-rough terrain!

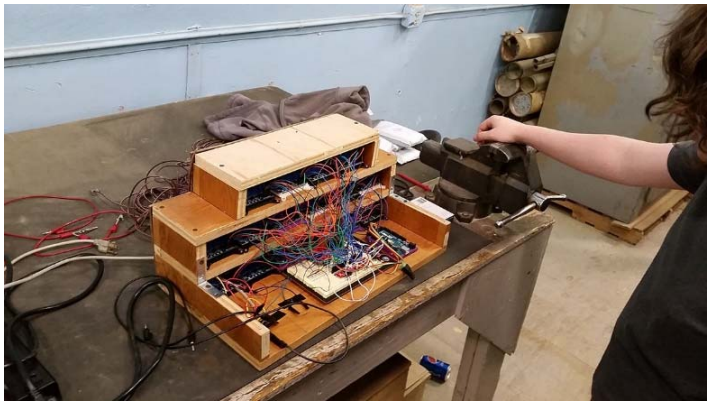


After fixing the cart repeatedly over the next few days, and having it repeatedly break, the group decided to totally rework it and make it into the C.A.R.T.T. – Compact Arctic Research Tech Transport, shown below. This happened over the weekend between the first and second week, and the students again did an outstanding job with limited tools, resources, and time.

In the end, the data were obtained, and one research direction for the 2020 trip was established. While the constant cloud cover this time alleviated the need for the "active sun shields" that they had developed, this line of work will be pursued in the coming year so that finely-detailed near-surface vertical temperature gradients may be studied anywhere.

Arctic Geophysics 2018 – Micro Resistivity Array

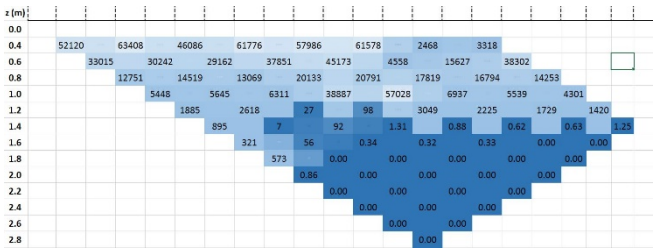
Another piece of equipment developed by students was the "micro resistivity array." This development had actually started in the spring of 2017 with two of Dr. Wirgau's Accelerated Research Opportunities (ARO) students (one physics major, one chemistry major). This was continued with a physics major through extensive work in the fall of 2017.



This was based on an Arduino microcontroller, a couple of multiplexers, sixteen 4-channel relays, sixteen copper electrodes and their connecting wires, and a conglomeration of shorter control wires that made everyone who saw it wince in pain! All of this directed the electrical current from a 120-volt ac generator through two relays at a time, with a voltage difference being measured via two other relay-activated electrodes.

The goal of this was to recreate a small-scale galvanic resistivity array that could obtain data close to the surface to yield an electrical resistivity profile of the ice. Once again, after several attempts, fixes, and frustrations, it finally worked and did give that almost-magical cross section of the frighteningly-thin sea ice. Due to the extreme time crunch in getting ready for the trip, the current and voltage measurements were obtained manually with multimeters.

While the data are not yet fully processed, even the raw-data crude image below shows the ice/water boundary lying approx. 1 meter below the surface. This is what we confirmed by drilling in the area. Note: Lower resistivity (water) is darker blue, higher resistivity (ice) is lighter blue.



The same student obtained funding from Radford University through the new Summer Undergraduate Research Fellowship program and continued this work in the summer of 2018. The last step is to automate the data collection and ensure that the data obtained accurately represent the electrical resistivity distributions of the subsurface. As of this writing this work is nearly complete.

In the end, 4 members of this group submitted two separate abstracts to the Fall Meeting of the American Geophysical Union (AGU) to be held in December in Washington, DC. Both were accepted. One is on the vertical electrical sounding technique that we have developed (on the 2016 trip and this one), while the other is on this micro resistivity array.

As usual, each trip is amazing, and builds on the work done on previous trips. This truly-spontaneous picture from February 28, 2018, really sums things up.

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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