

### RU Physics @ Virginia Science Festival

White House Astronomy Night

"The Science of the Martian"

Arctic Geophysics Research in Barrow, Alaska

Special Thanks to our Alumni!

Green Bank NRAO

New Graduates, winter and spring (double digits—woot!)

### RU Physics at the Virginia Science Festival

On September 25, 2015 Dr. Rhett Herman and biologist Dr. Sara O'Brien joined 7 other groups from Radford University at the Virginia Science Festival at Virginia Tech. This was a region-wide celebration of research held at Virginia Tech with satellite locations in downtown Blacksburg and Roanoke, VA. Drs. Herman and O'Brien presented their work from June, 2015 in Barrow Alaska titled "Arctic Blast! Microclimate and Arctic Bird Behavior."

### White House Astronomy Night

On October 19, 2015 the Radford University Planetarium partnered with the White House for a night celebrating astronomy across the country. #astronomynight

Physics majors and members of the Society of Physics Students assisted in setting up a number of telescopes on the lawn in front of Reed Hall. The campus and the public was invited to come look through the scopes, and to even take pictures using their phones.



Nearly 200 people dropped by, including Physics alum Marc Eaton, who—along with Matt Trayer—used to regularly set up scopes on campus and invite passersby to have a look. The special planetarium shows that night also included a very special visitor—our 40,000<sup>th</sup> planetarium guest!

### Location! Location! Location!

#### Exploring the Influence of Microclimate on Arctic Bird Behavior

Presenters: Drs. Sara O'Brien (Dept. of Biology) & Rhett Herman (Dept. of Physics)  
Student Co-authors: Jordan Eagle (Physics '15) and Madison King (Biology '18)  
Radford University College of Science and Technology, Radford, VA

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#### Background

**Why the Arctic?**

- Birds migrate many hundreds, if not thousands, of miles to the Arctic to breed.
- Migration uses an enormous amount of energy, but birds have to trade off stored energy (extra weight) for aerodynamics.
- Birds are not certain what their breeding grounds will look like when they get there.
- Birds must adjust accordingly to ensure they maximize the short breeding window.
- Bird are pressured to find a nesting site quickly to maximize the short Arctic breeding season.
- However, weather is unpredictable so they must also choose a spot that ensures eggs and nestlings survive.
- Must consider predators and weather when finding a nesting site.

**What looks and feels the same to us, may not appear that way to the birds...**

- How do they choose a nesting site?

#### What is the "Microclimate"?

Microclimate is defined as the local changes in a small area in characteristics such as temperature, wind speed, light, and humidity in a small area of habitat.

*In order to see and feel what the birds do... we have got get down to their level and record what they might feel.*

#### Big Questions

Exploring spatial influences on microclimate:

- How does microclimate vary across a polygon on the tundra?

Exploring temporal influences on microclimate:

- How does microclimate vary over time in a particular spot on a polygon?

Exploring microclimate influences on breeding behavior:

- How does microclimate vary among areas on a polygon that have a nest and areas that do not have a nest?

#### How did we do it?

Constructed "MotherShip" array

- Studies abrupt changes in microclimate including temperature, relative humidity, and red, green, and blue wavelength intensities of light.

- 4 other arrays to study temperature with same spacing as the temperature sensors on the MotherShip to cover more area across one polygon.
- Arduino microcontroller reads sensors and recorded on computer.

#### What did we find?

- Temperature, humidity and wind speed profiles show significant changes across a polygon.
- Where a bird nests on a polygon could be driven in part by microclimate profiles.

#### What's next?

- RU microclimate sensor 2.0
- Scale up!
- Keep exploring how technology can be used to answer pressing questions on the effects of climate change.

#### Acknowledgements & Contacts

Special thanks to RU staff for helping our Arctic Blast! grant proceed. Thanks also to Virginia Tech for providing the array. The authors would like to thank the following individuals for their help: Jordan Eagle, Madison King, Rhett Herman, Sara O'Brien, and Matt Trayer.

That special guest was the girl at the front of the picture below. She and her family were very excited. Planetarium operators Jordan Eagle (left) and Jessi Basham were there to run the show.

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### “The Science of the Martian”

On October 24, 2015, Dr. Herman joined faculty from the departments of Biology and Psychology at the Radford theater downtown for a special panel discussion after a showing of “The Martian.”



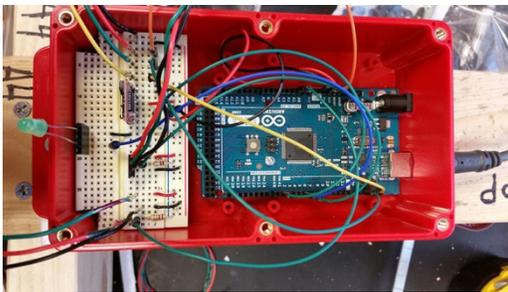
The discussion topics included the orbital mechanics that required such long flight times between Earth and Mars, the psychology of the team would be chosen for such a mission, and the biological accuracy of the movie.

### Barrow 2016 – The Research Continues

From February 27-March 12, 2016 another group of research students traveled to Barrow, Alaska for the Physics 450 – Arctic Geophysics research class. As with all previous trips, this one built off of what was learned before. This trip featured a microcontroller-based microclimate sled based on the original work of RU Physics alum Dan Blake ('05).

In addition to the original IR sensor for measuring the surface temperature of the ice, this sled had 6 other temperature sensors arrayed vertically (between pairs of orange cones on the post at the right). The sled design was chosen to add strength and stability on the ice. Data analysis will occur throughout the summer.

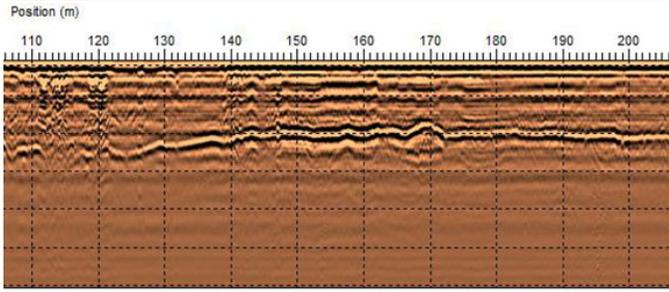
In addition to the microclimate sled the team deployed ground penetrating radar and electrical resistivity, and an ice drill for the ground truth. The GPR worked surprisingly well, revealing the location of the ice/water boundary, which was seen to be despairingly shallow (see image on next page).



Pictured after the discussion are (above, left to right) Dr. Jay Caughron (Psychology), Dr. Jason Davis (biology), Paul Pallante (owner/manager, Radford Theater), Dr. Rhett Herman (Physics).

The OhmMapper electrical resistivity array was unable to obtain enough data to model the ice thickness due to the extremely thin ice. However, a unique experiment was performed (and repeated!) using one transmitter and one receiver in an “expanding dipole-dipole” configuration. This worked surprisingly well and has thus determined one of the main goals of the 2018 trip.





1z Proc: Dewow + SEC2 Gain (Attenuation: 24.89 Start Gain: 1.04 Maximum Gain: 30)

The 500MHz GPR image showing the bottom of the ice, and confirmed by the ice drill. We believe this only occurred this trip because (a) the extreme winds scoured the ice surface nearly clean of snow, and (b) the bottom of the ice was also “scoured” due to warmer water currents beneath the ice (and thus the ice/water boundary had far less slush than usual).

**A Special THANK YOU to our Alumni!!**

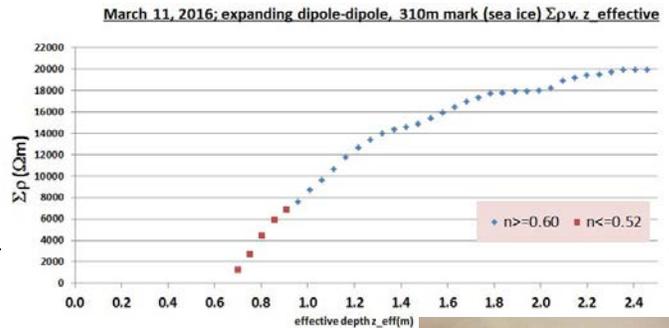
**In late November a call was put out to all of you to help fund this latest Alaska research trip. You exceeded all expectations and quickly hit the \$1,500 mark! Thank you so much for your generosity!**

### National Radio Astronomy Observatory Trip



The Society of Physics Students (SPS) and two alumni headed to Green Bank, WV, the weekend of March 25-27. While there they toured the Green Bank Telescope control room, sampled the cuisine at the Starlight café (picture at right), used the 40-foot-diameter teaching radio telescope, and wandered around the campus in pitch blackness with amazingly clear skies.

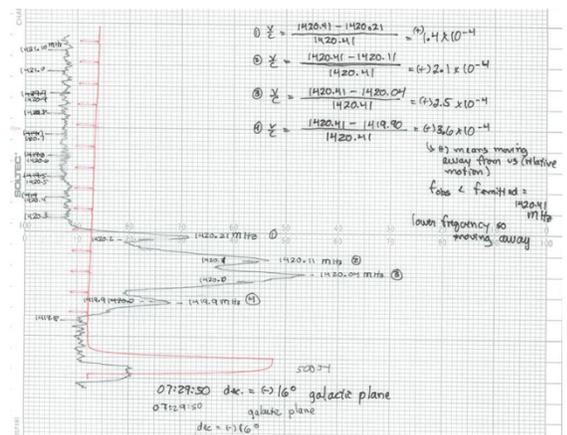
Results of the expanding dipole-dipole array showing a break in the slope around 93cm, which is the depth confirmed by the ice drill. This has determined the focus of the next trip will be building our own small dipole-dipole resistivity array based on the Arduino.



And a totally not-fake picture of Rudy taken in Barrow! →



As with previous trips, perhaps someone might be led to a career involving radio astronomy. And as always, a good time was had by all.



### New Graduates – Winter and Spring



2014-2015 Physics Dean's Scholar Jordan Snelgrove graduated in December. Fittingly he wore a mortarboard with LEDs driven by a microcontroller. It

stole the show at the commencement ceremony in Preston Auditorium. And, it has apparently started a larger trend—check it out with our spring grads!



Jordan Eagle's mortarboard indicates her future in graduate school in physics & astronomy at Clemson.

Jessi Basham made use of the original Radford University Tartan from the old planetarium. She will take this with her to graduate school at UNC in Educational Innovation, Technology and Entrepreneurship.



Abigail Ballowe said that her distinctive windmill design “came to [her] in a dream.” (“I am the walrus” anyone??) And finally we had 8 of our ten 2016 May graduates at the commencement ceremony: (left-to-right) Abigail Ballowe, Tyler “Jamal” Bowman, Jessi Basham, Kyle Poland, Rick Naramore, Rudy Soltesz, Kyle Winfield, Jordan Eagle. Congratulations graduates!



### Contact Us

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

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