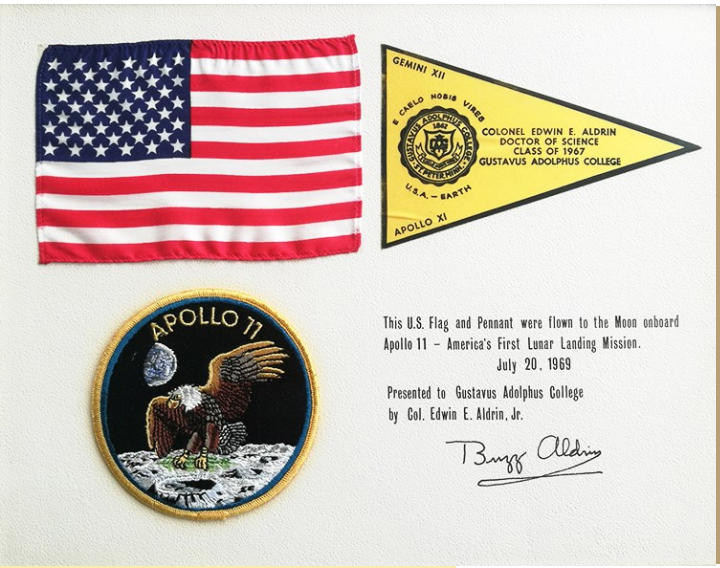

GUSTAVUS PHYSICS

Physics Department Newsletter

Apollo 11 50th-Anniversary Edition — 2019

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Important Fall Dates:

Classes Begin	Sept. 3
Last Day to Register for Fall Classes	Sept. 16
Nobel Conference	Sept. 24-25
January Term Registration Begins	Nov. 4
Spring Semester Registration Begins	Nov. 11
Final Exams Begin	Dec. 16

Plans for an Engineering-Physics Major Moving Forward at Gustavus

The Physics Department believes that a new track through our major may better serve those students who are contemplating careers in engineering, and is also likely to attract more students to the College. The Administration agrees, and has authorized the hiring of a new, tenure-track faculty member to move this forward.

In the past twenty years, over 100 Gustavus physics graduates have gone on to earn graduate degrees in some subfield of engineering. Almost all of them have gone on to careers in engineering. Obviously, then, a Gustavus physics degree provides excellent preparation for such a career.

Along with their successes, our alumni who have become engineers have learned, to varying degrees, that there is a mismatch between the way similar topics in physics and engineering are presented at the undergraduate level. For example, while we know that a physics course in Classical Mechanics has a strong topical overlap with an engineering course in Statics and Dynamics, the approaches to the topics, the nomenclature, and the mathematical techniques used in the courses may seem quite different.

Three years ago, the Office of the Provost put out a call for any Gustavus department to propose new academic initiatives that would help to move the College forward. The Physics Department presented a plan to develop and implement an Engineering-Physics program.

The goal of the proposed program would be to help our graduates who choose to pursue engineering careers by introducing them to the topics, techniques, and nomenclature that are common in undergraduate engineering programs. By doing so, we hope to help ease the transition into engineering graduate programs.

Here is what the proposal said:

"The Gustavus Engineering-Physics program would be an innovative new program that would enhance opportunities for faculty/student research in physics/

(Continued on page 3)

Departmental Awards

Each year the Physics Department makes a number of awards to honor our students who have excelled in the major. Here is a list of the awardees for the upcoming year:

The 2019-2020 John Mark Chindvall Memorial Scholarship in physics was awarded to **Logan Bican '20**. This endowed scholarship was established in memory of 1970 Gustavus graduate John Chindvall by his parents and friends. It is awarded annually to a student majoring in physics who has shown both character and scholastic ability.

Sam Maruska '20 is the winner of the 2019-2020 Gerald and Julia Swanson Scholarship, awarded to a physics student with high promise. This scholarship was established to honor the work of the physics department faculty who provided Gerald Swanson with a background that prepared him for graduate study in physics and for a career with the Bendix Corporation.

Shelby Klomp '20 has been presented with the Milward T. Rodine Memorial Physics Award for 2019-2020. Named for the longtime Gustavus professor of physics (he taught here from 1933-1969), this prize is awarded annually to a junior physics major on the basis of interests and scholarly achievements.

Ezekiel Haugen '20 has received the 2019-2020 John Borneman Prize Par Excellence in Mathematics. This prize is decided by the Department of Mathematics, Computer Science and Statistics in consultation with the Physics faculty. It was designated in memory of John Borneman '55 by his family, and is presented annually to an outstanding student in the fields of mathematics and physics.

The winner of the 2019-2020 Julian A. Crawford Memorial Prize in Physics is **Vatsala Adile '20**. The prize is named in memory of the former chair of the Gustavus physics department (1967-69) and awarded to the student with "the greatest potential for contributing to physics and society."

A particularly strong first-year class led to the unprecedented awarding of four Harold Q. Fuller and Richard M. Fuller Prizes in Physics this year. This award is given to the first-year student majoring in physics who has compiled the highest overall grade record. This year's awardees are **Conrad Cronin '22, Alex Florea '22**, **Maya Lengvenis '22**, and **Tommy Myers '22**. The award was established in 1997 by Professor Emeritus Richard M. Fuller (who taught at Gustavus from 1968-1999) and his wife, Judith. The award honors his late father, a physics professor and dean at the University of Missouri, Rolla, for his lifetime commitment to the teaching of young people. It also marks Dick Fuller's own 30-year career teaching physics at Gustavus.

The Physics Department Academic Assistants for Fall 2019 are **Kristen Cash '20** and **Josh Theis '20**. This position is paid, and has a nominal expectation of four hours per week in research, course development, or other activities that will assist in the work of the department. The recipients are chosen by the physics faculty based upon their work in and dedication to the department.

Baccalaureate Origins of Physics Ph.D.'s

The latest data available from the National Science Foundation give the top dozen liberal-arts colleges that have produced the most baccalaureate graduates who eventually went on to receive a Ph.D. degree in physics. The schools (along with the number in parenthesis of physics Ph.D.'s in the 20-year period from 1998-2017) are:

1. Harvey Mudd College (138)
2. Reed College (83)
3. Carleton College (66)
4. Swarthmore College (64)
5. Williams College (59)
6. **Gustavus Adolphus College (47)**
7. Lawrence University (41)
8. Grinnell College (38)
9. Amherst College (37)
10. Haverford College (36)
11. Oberlin College (35)
12. St. Olaf College (31)

No other liberal-arts school generated as many as 30 eventual Ph.D.'s during those two decades.

Engineering–Physics Major

(Continued from page 1)
engineering. The students enrolling in the program would see a rigorous introduction to engineering in the new coursework. However, unlike traditional engineering programs at large universities, this would take place within the context of a liberal arts institution. There would not be the differentiated engineering approach, with separate majors for Mechanical Engineering, Civil Engineering, Electrical Engineering, but would be a more interdisciplinary approach. This would prepare graduates of the program to engage in collaborative approaches to academic, technical or societal challenges that require integration of different disciplinary approaches."

After receiving preliminary approval this past spring to move forward, the department was authorized to hire a new, tenure-track faculty member. We seek an experienced teacher with some background in both physics and engineering, who understands the nature of the educational gap we seek to fill for our students.

As the proposal for the new major moves forward, we will work together to develop the needed courses and curriculum and submit those to the Curriculum Committee.

The search for the new faculty member is now underway and scheduled to be completed this fall semester. (Full details of the position description can be found on our website.)

Shelby Klomp '20 Wins Rossing Physics Prize

Shelby Klomp '20 has been named a Rossing Scholar for 2019-2020 for her outstanding work in physics.

The Maplewood, Minn. native is one of six students in the nation receiving a $10,000 scholarship from the Rossing Fund for Physics Education Endowment through the Evangelical Lutheran Church in America (ELCA).

A physicist who did his undergraduate studies at Luther College before going on to an award-winning career in musical acoustics, Dr. Thomas Rossing funded this program, which awards annual scholarships to physics students at one of the 27 ELCA-affiliated colleges and universities. For the past nine years, at least one Gustavus physics student has been awarded one of the Rossing Scholarships each year.

In 2018, Shelby performed summer research on magnetite nanoparticles at Brigham Young University in Utah. She was selected as a second-year student for a National Science Foundation Research Experience for Undergraduates (REU). It is relatively rare that second-year students are selected for such programs.

She has also been involved in on-campus research at Gustavus focused on developing a cosmic-ray muon detector that can be carried by a high-altitude balloon. This summer, she worked at the University of California, Davis in the experimental particle-physics lab.

She says, "The physics department at Gustavus is phenomenal. The professors are so supportive and really put in the time to make sure every student is challenged and has the opportunity to reach their potential.

"All of these opportunities have been a direct result of the skills I have learned in the Gustavus physics department and will allow me to be successful in my professional career."

When Shelby is not doing research, she is involved as a teaching assistant, tutor, and this coming year will be the co-President of the Society of

Physics Students. Outside of physics, she is a philosophy minor, enjoys singing in the Chapel Choir, and is a part of the Feminist Bible Study.

After her time at Gustavus, she plans to pursue a Ph.D. with a focus on researching particle and high-energy physics.

Congratulations, Shelby!

Physics Graduating Class of 2019

L to R (Back Row): Gilbert Mwangi, Ben Rorem, Nick Brazel, Katy Hagen, Tyler Brau, Hannah Nolte, Matthew Blomquist, Erin Moes, Karl Satterlund, Eric Brabson. (Front Row): Jessie Petricka, Tom Huber, Darsa Donelan, Dalton Myers, Andrew LaGrange, Peter Varanasi, Tasnim Lamisa, Daniel Nold, Ethan Henneman, Robert Nelson, Madison McMurray, Xiaoqi Yu, Paul Saulnier, Seamus McDonald, Steve Mellema, Chuck Niederriter

This photo, taken after the Commencement ceremony on Saturday, June 1, shows the entire class of physics majors and minors for 2019.

Some of them have written to talk about their experiences at Gustavus and their current and future plans.

Matthew Blomquist says, "I truly enjoyed my time at GAC and my time in the physics department. I loved the student-professor relationships that developed over my four years, and different SPS events really helped in aiding those relationships. This fall, I am attending the University of Wisconsin-Madison to pursue a PhD in Biomedical Engineering. My advice to any future physics majors, as obvious as it sounds, is to make the most of your time at GAC. Work hard and take advantage of all the opportunities that GAC offers. Have fun and enjoy your time!"

Eric Brabson writes, "Overall I really enjoyed my time at GAC, although, there were a lot of long nights of studying and doing homework. I found that the physics department does a great job of offering you the opportunity to find a close knit group of friends and the professors do their best to be very available and helpful. I am currently employed as a Product Marketing Manager at Linx Technologies in Pennsylvania. In the future I'd like to move up and become the Director of Marketing of a technology firm. Right now, I plan on working for two years before pursuing an MBA. My best advice is to talk to your professors! They are fantastic resources. Also, go to SPS events - they are really fun and I wish I had started going to them earlier when I was a student."

Nick **Brazel** says, "I am seeking a job in an engineering field while applying to grad schools for astrophysics."

Katy Hagen tells us, "This upcoming year, I will be a biophysics PhD student at Indiana University, Bloomington. I will TA laboratory courses for physics undergrads and play my clarinet in one of the bands on campus. This all echoes my time at Gustavus, where I majored in physics, minored in neuroscience, worked for the physics department primarily as a lab TA, and played in the band.

"To me, Gustavus is the perfect place to explore any and every passion you have while making decisions about the future. That said, nothing you try has to become a lifelong dedication. Never force yourself down a path that you find unful-

(Continued from page 4)
filling, and change course if you feel like that is the best option for yourself. At Gustavus and beyond, keep looking for the things that make you happy and build your life around those, whatever they may be."

Ethan Henneman writes, "The physics department was the cornerstone of my experience at GAC. It is a great community to get involved in, and it is where I met most of my friends. Get to know your professors, as they are an invaluable lifelong resource. I am currently working as a Technical Services Engineer at Cardinal IG Company in St. Louis Park, MN, doing a mix of lab and computer simulation work on insulating glass performance. I plan on staying in industry for awhile and later returning to school to get a master's degree in an applied field."

Andrew LaGrange is working as a CNC machinist at CNH Machines.

Madison McMurray says, "I will be taking a gap year and applying to law schools."

Erin Moes writes, "My first semester on The Hill I was a chemistry major, but I quickly found my home in the physics department the next fall. My first impression was that everyone in the department was incredibly welcoming and helpful, and nothing has changed! Currently, I am an engineering technician at Northern Technologies, LLC. Specifically, I am testing concrete and soils at construction sites around the Twin Cities. This fall I will be applying to go back to school for civil engineering with an emphasis in either structural or environmental engineering. Gustavus, especially the physics department, has so many resources readily available to students. I hope everyone will take advantage of them; they truly help you succeed!"

Dalton Myers tells us, "For the summer, I'm spending some time relaxing and having fun while working a little here and there to have some income before the fall semester starts. After the summer, I begin an MS program at UMD in Duluth where I will be spending my next two years researching particle physics and attending graduate classes.

"My words of wisdom to future students would be to use the resources that are around you. Don't be afraid to seek and ask for help for fear it will make people think less of you. Success is measured by what you achieve in the end, not by what you achieved without any outside help."

Bobby Nelson says, "As a graduate of the physics program at Gustavus I can tell you with certainty that, while the physics major can sometimes be gruelingly difficult, it promotes a strong sense of camaraderie and teamwork. Through the major I met some of my closest friends, who would provide constant entertainment both inside and outside the classroom. Ya ever hear of the Christ Chapel Nuclear Station or about the Applebee's in the Arb? If not, go ask a professor. After having the opportunity to work in Tom Huber's acoustics lab during the summer of 2018, I decided to pursue graduate school in the field of acoustics. This fall I am beginning a Masters of Science in Acoustics at Pennsylvania State University. As far as words of wisdom, I suggest developing strong friendships with your classmates as soon as you can. You will need these relationships to survive in your later years. Also you can get away with a lot on 2nd floor Olin, so test your bounds (after you have already finished your major)."

Daniel Nold writes, "I had a great time at Gustavus and made many great friends. The physics department was so close knit and I really enjoyed that sense of community. I am currently working as a Technical Solutions Engineer at Epic Systems in Madison, WI, and appreciate the coding that I learned at Gustavus. Pay attention, learn, and have fun."

Hannah Nolte says, "Gustavus gave me guidance, space, and support to explore all of my interests. It allowed me to figure out what I really enjoyed doing and it gave me the freedom to explore. I also made wonderful friends along the way.

"I am currently at The Pennsylvania State University. I am a graduate student in the industrial engineering department with a focus in human factors engineering. I am a researcher in the Technology and Human Research in Engineering Design (THRED) Lab. I hope to have my doctorate by 2023.

"My advice would be to ask more questions than you think you need to and take some time to explore all your interests while at GAC."

Ben Rorem writes, "This fall, I am attending the University of Michigan for a PhD program in Applied Physics. While at Gustavus, I was heavily involved in the physics department, choir, and Gustie Greeters. Each of these programs provided me with a group of friends who pushed me to be my best. My words of advice for students would be to seek friends who support and challenge you, regularly practice kindness, and don't

(Continued on page 11)

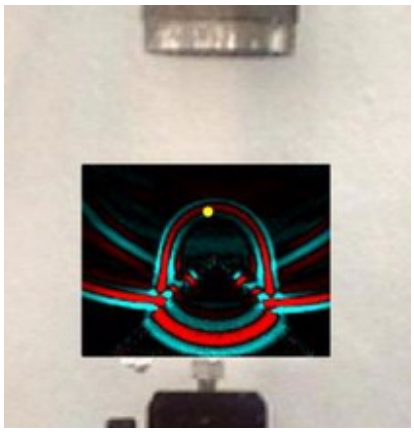
Student Summer Experiences from A to Z

Every summer, Gustavus physics majors take advantage of opportunities around the country to become involved in an internship experience related to physics, engineering, or a related field. The motivations to do so range from exploring a new interest to trying out a potential career to building a post-graduation résumé. Here are some summer 2019 internship expertness shared by Gusties:

Vatsala Adile '20 and **Espen Fredrick '21** are working at Gustavus with Dr. Darsa Donelan. They write, "This summer, we are working as research assistants through the Fuller Research Endowment. Our project focuses on the detection of gravity waves in the atmospheres of Titan, Venus, and Mars using Morlet wavelet analysis. Furthermore, we plan on analyzing the atmospheric data gathered by the new Mars InSight lander as one of the first teams to observe gravity-wave candidates in this region. The work is a continuation of last year's research, and we plan on submitting it for publication by the end of the summer."

Vatsala and Espen studying gravity waves with Dr. Donelan

Haley Anderson '20 has been doing physics research at Gustavus this summer. She writes, "I am working for Dr. Tom Huber in his acoustics lab, specifically focusing on ultrasound behavior in acrylic. Using a water tank, 500kHz and 1MHz ultrasound transducers, and acrylic blocks of various shapes and sizes, I am characterizing ultrasound waves as they reflect off and transmit into the acoustically faster medium of acrylic. Initially, we were searching for evanescent waves to determine their attenuation, however, we were faced with unfamiliar and curious wave behavior upon entering the acrylic, regardless of incident angle. Notice the beautiful picture of ultrasound reflections and transmissions off of an acrylic prism. It took only 3 hours to get this data, compared to the usual 6 to 12 hours!"



Haley's visualization of ultrasound waves on acrylic

Kristen Cash '20 tells us, "I have an internship at American Engineering Testing Inc. in St. Paul this summer. I've been doing various tests on asphalt samples as well as soil samples that are being used to build roads all over the state and country. I've also helped with making asphalt mix designs using preexisting road core samples which will be used for future road construction and maintenance."

"In the photo I was doing a burn-off test on an asphalt sample in an ignition oven to determine the asphalt content of the sample. I then did a gradation test on the sample when it came out of the oven to determine the particle size distribution of the sample which is an important quality in any asphalt mixture."

Kristen analyzing an asphalt sample

Mitch Donoughue '21 writes, "I am working at The Boeing Company in Houston. I am involved in supporting the International Space Station (ISS) and the NextSTEP 2 program as an intern on the Systems Engineering and Integration team. I have been reviewing anomalies to determine trends in failures of external payloads (like the Alpha Magnetic Spectrometer) on the ISS.

Mitch and the future space capsule

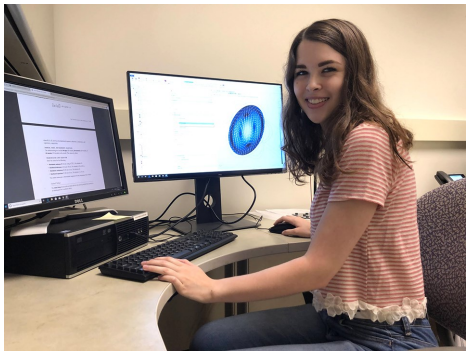
(Continued from page 6)
"NextSTEP 2 is a planned station in cis-lunar orbit. I have been helping to describe theoretical integration of the station and helping build models.

"I've attached a picture of me in front of the Boeing CST."

Alex Florea '22 says, "This summer I'm working in Dwight Stoll's lab on campus. We are currently working on using analytical methods to predict the change in the pH of solutions (or mobile phases) as they pass through High Performance Liquid Chromatography (HPLC) columns. We are taking note of the change experimentally through a certain number of columns, and then developing a mathematical model to predict this change. Our ultimate goal is to be able to apply this model to other columns of different lengths and compositions in order to predict the pH change without having to do so experimentally."

Zeke Haugen '20 writes, "I am working for Concord Technology this summer in their T-Labs program. In an individual R&D project, I am developing an iOS and watchOS application that will determine a person's blood alcohol concentration (BAC) based on their gait using machine learning. The app is named Tipsy and can be thought of as a virtual breathalyzer. This research has great implications if proven accurate as it could help people to determine if they are okay to drive with just a smart phone and smart watch."

Zeke at work developing "Tipsy"



Shelby Klomp '20 says, "I am spending this summer doing an REU at the University of California Davis. The project I am involved with is attempting to detect a dark matter candidate called the dark photon. Its existence has only been theorized, but if it exists, we would be able to detect it through its coupling with electromagnetic fields. The experiment utilizes a low-noise radio antenna in an electromagnetically shielded room to scan for a small signal of predicted amplitude and unknown frequency. I am involved in many aspects of the project, including constructing simulations in COMSOL to predict the behavior of EM waves in the room and their interactions with the antenna. I also help to run the experiment, and I am collaborating on writing optimized data-analysis code to locate the desired signal by filtering away noise."

Jesper Salverda '22 is teaching robotics to middle schoolers in a summer STEM program for Minneapolis Public Schools.

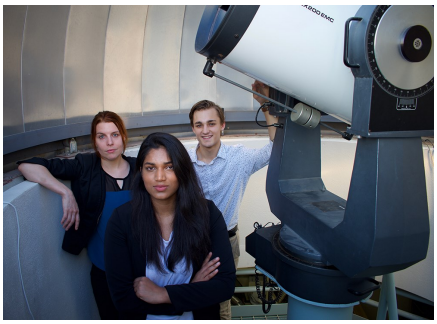
Jack Stonecipher '23 writes, "I am interning at Eden Medical, a small medical technology company, in Howard Lake, MN. The project we are working on currently is a device that creates a heat map of a diabetic patient's foot wound. This heat map is cross referenced with other visits to measure the body's healing progress. When cells are working to repair a wound, they tend to heat up as a byproduct of spending energy. It has been a good learning experience for me, both in how the engineering process works and in electronic design."

Santiago Zapata '23 has an internship with Medtronic, working with their Healthcare Innovation Team in the Applied Innovation Lab. He says, "The team is composed of designers, consultants, and engineers. Some of my most recent projects consisted of documentation, email marketing, and extended reality. I make sure things get documented for new applications or anything happening in the lab. This also includes digitizing data from different lab events. Now, probably the coolest part of working in the lab is working on Virtual Reality and Augmented Reality (VR/AR). For the most part, it's me helping test things and learning how to use it."

Santiago exploring virtual reality in the Innovation Lab at Medtronic.

Faculty Summer Happenings

Darsa Donelan writes, "This summer I worked with Vatsala and Espen to continue our project from last year. We made improvements on our code that analyzes small-scale variability in planetary atmospheres in preparation to analyze the entry and descent data from the Mars InSight Lander. We also drafted a technical paper on the success of our algorithm and we are planning to submit it for publication this fall.



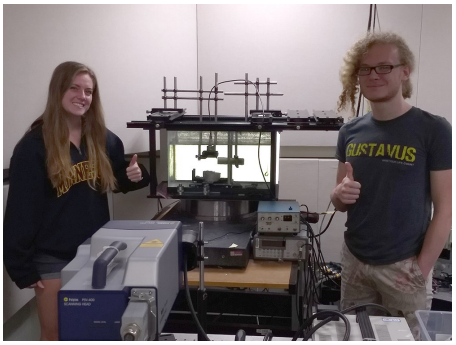
This summer Darsa Donelan worked with Vatsala Adile '20 and Espen Fredrick '21

"I attended the American Association of Physics Teachers (AAPT) New Faculty Workshop where I was a speaker for a session on a Faculty Online Learning Community (FOLC) for early career physics and astronomy faculty members across the United States. I will once again be facilitating a FOLC cohort this academic year.

"I became a member of the NASA Space Science Education Consortium where I will develop research-based instructional materials for astrophysics taught in the context of introductory and upper division physics and astronomy courses. I also attended the AAPT Summer Meeting as a co-presenter in a workshop on teaching introductory physics in an earth and space science context. While at the Summer Meeting, I was nominated and am now a member of the AAPT's Space Science and Astronomy Subcommittee.

"I also spent quality time with my cats."

Tom Huber had NSF funding to allow him to collaborate this summer with **Haley Anderson '20** and **Zane Michael '22** on ultrasound research. Haley was funded by a grant from the National Science Foundation, and Zane was funded through Gustavus' First Year Research Experience (FYRE) grant. The goal of this project is to use a laser interferometer to visually measure ultrasound waves in water and air. In the experiments, a laser vibrometer directed at a retroreflector measured ultrasonic pulses from a transducer that were traveling through a water tank. By measuring tens of thousands of points, they were able to construct videos showing how the waves interacted with different targets.



Haley Anderson '20 and Zane Michael '22 worked in Tom Huber's acoustics lab this summer.

One of the projects this summer was to utilize "bat hearing" for reducing noise in ultrasound signals. Instead of sending out single ultrasound pulses, we used a swept-frequency chirp waveform similar to what bats emit. Unlike bats, humans don't have a neural processing circuit for performing the complicated mathematical algorithm called a cross correlation to decipher the complicated wave forms. Therefore, we had to use MATLAB to perform the analysis. Tom will be continuing as department chair this year. This fall will be his second time teaching the Cosmic Universe class.

Steve Mellema spent the first two-thirds of the summer completing a draft of his textbook, "The Cosmic Universe." The final third was a trip to Malaysia and Singapore to visit family and friends. He even made a return visit to the school where he first taught physics as a Peace Corps volunteer from 1973-76.

Steve visiting his former Peace Corps physics teaching lab at Kamil Secondary School in Malaysia.

This fall Steve will teach a First Term Seminar, Quantum Mechanics, and two General Physics labs. He will also serve on the Faculty Senate, the Faculty Compensation Committee, and the College's Internal Budget Committee.

It was a busy summer for **Chuck Niederriter**. He and **Sam Maruska '20** had a Presidential Faculty/ Student collaboration grant to design and construct an inexpensive multi-spectral camera using Raspberry Pi mini-computers and cameras. They plan to make the designs available for those needing an alternative to

(Continued on page 10)

ΣΠΣ - The National Physics Honor Society

Since 2004, Gustavus has hosted a chapter of Sigma Pi Sigma, the national physics honor society.

Nomination and election are by the faculty, based on a combination of student achievement in course work and research, and participation in department and SPS activities. ΣΠΣ is a member society of the American Institute of Physics. It "exists to honor outstanding scholarship in physics; to encourage interest in physics among students at all levels; to promote an attitude of service of its members towards their fellow students, colleagues, and the public; to provide a fellowship of persons who have excelled in physics."

2019 Sigma Pi Sigma Inductees, L to R: Hannah Nolte, Ben Rorem, Karl Satterlund, Katy Hagen, Xiaoqi Yu, Nick Brazel, Daniel Nold, Ethan Henneman, Matthew Blomquist, Tyler Brau, Dalton Myers and Bobby Nelson

Twelve of our 2019 graduating seniors were inducted into ΣΠΣ at a banquet held on May 4. The banquet speaker for that evening was **Mara Johnson-Groh '14**, who went on to earn a Master's degree in Astronomy from the University of Victoria (in British Columbia). Mara curently works as a science journalist, publishing a broad range of work independently while also working for the Heliophysics Division at NASA.

High-Power Rocketry

Last fall the physics department started a high-power rocketry club where we learned to do a basic high-power rocket build. We had weekly lessons by Dr. James Flaten (from the University of Minnesota Department of Aerospace Engineering and Mechanics) funded through NASA's Minnesota Space Grant Consortium. Our students worked together to build a rocket and launched it in North Branch in late fall through the Tripoli Minnesota High-Power Rocketry Club.

We then entered a Space Grant Midwest High-Power Rocket Competition (the "Check-Off Challenge") in the spring. As part of this challenge, we had to design and build a single-stage, dual-deploy high-powered rocket that we could fly twice in 3 hours (first to 3000 feet, then to 4000 feet) with specific characteristics that we could "check-off" a list. Students learned to program and use our laser cutter to make fins for the rocket, made custom components with our 3D printer, used tools in our machine shop, designed rocket parameters with rocketry modeling software, programed Arduinos, and built their own circuits.

It was a cold day in November when the Rockery Club got to launch their first rocket.

These are many of the same skills that our students practice when they get involved in our regular program of high-altitude balloon flights (see previous issues of this newsletter), which also spun-off from the NASA Space Grant

The rocketry club is open to all Gustavus students, but was started especially those with interests in physics and pre-engineering.

Faculty Summer News

(Continued from page 8)
expensive cameras for drone and balloon applications. With the help of Rory McFarland (Geology), Sam and Chuck also dismantled and transported to Gustavus a newer scanning electron microscope. Putting it in service here was stalled by the need for electricians to install new power outlets in the imaging lab, but we should be able to get it working in the fall.

Chuck also spent time moving renewable energy initiatives forward for the campus and our neighbors on the hill. With President Bergman on board with several proposed sites, we expect to see a serious proposal for approximately 1 MW of solar panels in the very near future, hopefully soon enough to announce at the Nobel Conference. And, in collaboration with climate scientist **Jason Smerdon '98**, Chuck is developing a workshop on climate change mitigation for the conference—work that was completed this summer.

Chuck and Tom Young (VP for Advancement) hosted a rocket party to celebrate the 50th anniversary of the Apollo 11 flight to the Moon. The maiden voyage of Tom's Saturn V replica was somewhat less than successful, but everyone enjoyed good launches with other rockets.

Chuck and his wife, Debbie, visited their daughter Gretchen in the Netherlands and spent two weeks traveling around Europe. They visited Amsterdam, Enschede, Rotterdam, Delft, Dussedorf, Heidelberg, Frankfurt, Munich, Salzberg, Freiburg, and Zurich, as well as many rural venues. They saw many castles along the Rhine river as well as in the mountains of Germany and Switzerland, visited the hills above Salzburg from the Sound of Music, and hiked in the Swiss Alps. Probably the best part of the trip was visiting friends from graduate school whom they hadn't seen for almost 40 years.

The Niederriters in the Netherlands

Chuck will be teaching Experimental Modern Physics lab this fall, as well as one General Physics lab. He will be serving on the Curriculum Committee during a crucial year in the development of the College's new general-education curriculum.

There should be plenty of time for continued work on renewable energy and projects like the SEM, the multispectral camera, high altitude muon measurements, and more.

Jessie Petricka spent this summer researching wireless power transfer with **Maya Lengvenis '22** and took a month-long road trip camping with his family in the Pacific Northwest. He will be teaching four courses (FTS, Math Methods, Senior Seminar, Thermal and Statistical Physics) and a lab (EMU) this fall.

Jessie hiking in Olympic National Park in Washington

In addition to teaching classes this coming academic year, **Paul Saulnier** will be working on two separate research projects involving students. The first of these projects has a dedicated pair of students actively involved in working on it, while the second project is in need of a new pair of undergraduate researchers (students please contact Paul if you are interested). Besides teaching and working on student-faculty research projects, Paul will be serving as the department's seminar coordinator, pre-engineering advisor, and program assessment liaison (PAL). Outside of the physics department, Paul will be serving on the Faculty Personnel Committee.

Nobel Conference 55

This fall's Nobel Conference, entitled *Climate Changed: Facing Our Future*, will be held on September 24 and 25.

The changes being wrought on the earth's climate system are vast, without precedent, and of such magnitude and scale as to potentially alter life itself. Nobel Conference 55 asks "What tools are available, what research efforts do we require, and what kind of people do we need to be, to conceptualize and address global climate challenges?" The conference will bring together seven leading thinkers, and will address climate change from perspectives including paleoclimate studies, climate justice, climate modeling, and climate adaptation.

We invite you to join us to grapple with the causes and consequences of climate change and with our responses to the challenges it presents us, as individuals and as a society.

2019 Physics Graduates

(Continued from page 5)

forget your Schaum's!"

Karl Satterlund says, "I'll be attending graduate school in electrical engineering at Arizona State in August, and it's the top-notch physics program at Gustavus that I owe for it. I recommend to all underclassmen and incoming students two insights regarding your experience in the GAC physics department. First, always start a homework set the day it is assigned. Even if it's only a problem or two, get in the habit of doing 'future-you' a favor. They'll thank you for it when you want to take a night off. Secondly, please don't waste your summers. You have a plethora of opportunities as a STEM undergraduate. Send a bunch of quality emails over J-term and see what happens. You'd be surprised. If possible, spend at least one summer in industry and another in research. It looks good on graduate-school and job applications."

Saad Tariq tells us, "Going to Gustavus Adolphus College has been the most impactful decision in my life. The people at this College welcome and embrace you, and over the course of four years you basically become a family. The physics department and the amazing faculty that keeps things running smoothly made college especially worthwhile for me; they were ready to help me every step of the way and made sure I succeeded in achieving the goals I had set for myself. I found my true passions spending long hours doing interdisciplinary work in Advanced Lab, convincing me to pursue a Master of Science in Industrial Engineering from NYU Tandon School of Engineering. I plan to use this degree to help alleviate the problems faced by industries in my home country, Pakistan. My piece of advice for my fellow students is that perseverance will take you a long way; you really don't have to be a genius or super smart to make it through to the end. Don't let your first 'C' or 'D' grade bother you or make you quit. Use it as motivation to do better the next time!"

Peter Varanasi writes, "Physics was challenging but I felt that it was the most interesting field I could have studied at school. I don't know what else I would have rather majored in.

"I enjoyed going to different events on campus and participating in different student organizations. I would recommend to everyone to join a club or activity that you may even be slightly interested in as soon as possible.

"I am currently working as an engineering intern at Elucent Medical in Eden Prairie. I am thinking of potentially going back to school for engineering in the near future, but I am not sure yet.

"Words of Wisdom: Start applying to research opportunities and internships as soon as possible, and apply to many. Carve out a half hour to an hour in your schedule to talk to your professors. And enjoy the time you have at GAC. I know everyone tells you this but the time really does fly by faster than you expect."

SPS Activities

The Society of Physics Students at Gustavus has a very active chapter, which garners national recognition almost every year. SPS helps students connect with one another and with faculty. The chapter plans and hosts activities approximately twice per week during the school year in four broad areas: research talks, social activities, service to the community and career development.

SPS activities, clockwise from upper left: mentoring elementary-school students at Science on Saturday; taking the ultimate frisbee trophy from the Math Department; highway cleanup on U.S. 169, and the annual fall picnic.

Research talks include outside speakers (about once a month) as well as our own students who have been involved in research on- or off-campus. They discuss their experiences and present their results.

Social activities, which often take place on Fridays, include sports and games, plus our annual department picnics and Sigma Pi Sigma banquet.

Community service activities include a number of mentoring activities that involve working with students from local schools, as well as the twice-a-year Adopt-a-Highway cleanup un U.S. 169.

Career development activities include sessions about how to apply for summer internship programs and occasional physics alumni panels who discuss their various career choices after Gustavus.

It all begins each fall with an opening SPS meeting during the second week of classes. Watch for the announcement, and then come meet the professors to learn about opportunities for research, and, finally, join your fellow students in making and enjoying liquid nitrogen ice cream.

Here's a list of the SPS officers for 2019-2020:

Co-Presidents - **Vatsala Adile '20** and **Shelby Klomp '20**

Treasurer - **Kyle Krippner '21**

Communications Manager - **Kate McGregor '21**

Sophomore Representatives - **Alex Florea** and **Maya Lengvenis '22**

Junior Representative - **Maheemah Bokhoree '21**

Senior Representative - **Sam Maruska '20**

Cover Photo—A Gustie on the Moon?

Here's a trivia question: Twelve human beings have walked on the Moon. How many of them were Gusties? The official answer is: one.

In 1966, Col. Edwin A. ("Buzz") Aldrin was the pilot of NASA's Gemini 12 mission. In 1967, he was invited to the Gustavus Commencement ceremony, and the College awarded him an honorary Doctor of Science degree. So, in 1969, minutes after Neil Armstrong became the first person to set foot on the Moon, he became the first Gustie to do so.

This Newsletter is issued at the beginning of the fall semester for the benefit of students, alumni, faculty and others interested in the physics program.

Editor: Steve Mellema

Cover Photo: Edwin Aldrin D.Sc. (h.c.) '67 flew this Gustavus flag onboard Apollo 11

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