

PHYSICS FOCUS

An Alumni Newsletter from the Department of Physics and Engineering

Volume 10 | Winter 2017

Lindquist Receives CAREER Award Grant From NSF

Lauren Pareigat '08, communications specialist

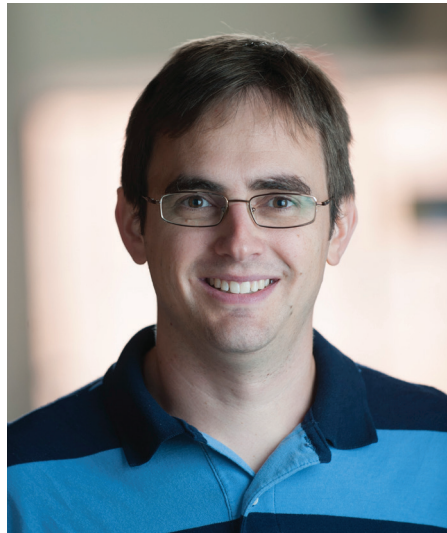
Assistant Professor of Physics Nathan Lindquist '02 was selected to receive a 2016 Faculty Early Career Development (CAREER) Award from the National Science Foundation (NSF). Providing \$500,000 in funding to researchers who exemplify the role of teacher-scholars, the CAREER Award is the NSF's most prestigious award for junior faculty.

Lindquist's project is titled, "Digital plasmonics-based nano-tweezing and nano-imaging for nano-particles." The project has two parallel activities. First, computer-controlled laser light will be used with extremely high resolution digital imaging techniques to capture detailed images of nano-sized objects. Second, similar computer-controlled techniques will be used to manipulate these nano-sized objects in order to study their behavior and gain understanding about their makeup. Some of the nano-objects are to include quantum dots, single molecules, and viruses.

The grant began at the beginning of February 2016 with the assistance of Bethel undergraduate students in the physics department's NanoLab, which Lindquist oversees.

"Nathan's NSF Career award recognizes his extraordinary research and dedication to students," says University Professor of Physics Emeritus Richard Peterson. "His interdisciplinary work with students developing nano-scale manipulation and imaging tools builds on the full breadth of STEM excellence at Bethel."

Lindquist received his B.S. from Bethel in 2002, and went on to the University of Minnesota to earn his M.S. in Physics and Ph.D. in Electrical Engineering. He has been teaching at Bethel since 2011. Last fall, Lindquist was recognized by his faculty peers, receiving the Faculty Excellence Award for Scholarship. In 2013, he was awarded a \$252,393 grant from the NSF to research, "Super-resolution plasmon-enhanced imaging and spectroscopy with patterned metallic surfaces and dynamic illumination," which is still in process. •



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Celebrating Over 30 Years of Dual-Degree Engineering

By Brian Beeken

HISTORY

In the early 1980s, at what was then Bethel College, with only two full-time faculty in the Physics Department (plus R.A. Carlsen, a split appointment with Computer Science), Dr. Richard W. Peterson started Bethel's Dual-Degree Engineering program. Students would come to Bethel and study physics, math, and chemistry—taking courses that were common to all fields of engineering—in addition to completing all other requirements for a Bethel degree. Then they would transfer to an ABET accredited engineering school of their choice and major in the engineering field of their choice. After completing their engineering major, the engineering school would grant a bachelor's degree and Bethel College would grant a B.A. degree, often with a second major in physics. In those days, a typical student spent 3 years at Bethel and 2 years at the engineering school. Hence, the program earned the affectionate nickname, "3-2 Program."

GROWTH

Dual-degree Engineering was a stunning success and has grown steadily ever since. Having a full Christian liberal arts education and a technical degree from an outstanding accredited engineering school combined the best of both worlds. In addition, taking introductory classes with a small number of students and passionate professors was very appealing. Official relationships were established with the University of Washington and Case Western Reserve. Many students were from Minnesota, however, and desired to go to the University of Minnesota. As a result, students started transferring there, and after receiving their engineering degree, Bethel granted the B.A. Eventually, the University of Minnesota realized what was happening, so in the late '90s they offered to establish a formal Dual-degree Engineering program with Bethel. We have now had approximately 150 of our students complete

engineering degrees at the University of Minnesota, in addition to more than 50 students who have completed their engineering degrees at various other schools.

The Dual-degree Engineering program opened Bethel's doors to many prospective Christian students. Since those early days in the '80s, students at Bethel have discovered many ways to pursue careers in engineering. In recent years, Bethel has had about 100 students at a time studying engineering. The career paths currently divide almost equally into three parts:

- **Dual-degree Engineering:** a degree from Bethel and also from an accredited engineering school.
- **B.S. in Physics or Applied Physics:** go straight into industry and get a job. In the last 3 years, 19 students chose this option and most of them have "engineer" in their official job title.
- **Master's in Engineering:** Bethel students with more A than B grades, now usually choose to go to graduate school. Such students almost always get >\$20k per year in financial assistance (not loans) and often have tuition completely or partially waived. Their starting job salaries average at least \$10k more per year than a bachelors in engineering.

The graduate engineering approach has grown dramatically. In the last 30 years, 67 Bethel physics majors have entered graduate school in engineering and another 16 have gone on in optics, optical science, or optical engineering. During these years, the Physics department has grown to six full-time faculty and two adjunct professors. Two of the current faculty, Dr. Keith Stein in aerospace and Dr. Nate Lindquist in electrical, have their Ph.D.s in engineering, and a third, Dr. Chad Hoyt, has his doctorate in optical science. The Bethel University Department of Physics has successfully blended physics, applied

physics, and engineering and continues to thrive.

TODAY

This year, nine students have been accepted into engineering programs at four different engineering schools (University of Minnesota, North Dakota State University, Kansas State University, and University of Wisconsin – Platteville) for Fall 2016 as part of our Dual-degree Program in civil, mechanical, materials, electrical, and chemical engineering.

University of Minnesota:

- Morgan Barth, Civil Engineering
- Dustin Barth, Mechanical Engineering
- Sam Harris, Materials Engineering
- Joshua Prescher, Civil Engineering
- Abby Rankila, Mechanical Engineering
- Morgan Wittner, Mechanical Engineering

North Dakota State University:

- Ben Brinkman, Mechanical Engineering

University of Wisconsin - Platteville:

- Dan Jacobson, Electrical Engineering

Kansas State University:

- Megan Niblock, Chemical Engineering

These students deserve congratulations! Acceptance into the second school in the Dual-degree Program has never been guaranteed. It must be earned by achieving a strong academic record, especially in today's economy because the field of engineering is drawing an ever increasing number of applicants.

CHANGES

The dramatic growth in students who desire to pursue engineering has resulted in some important changes.

Dual-Degree continued on p. 4.

Bethel's Advanced Physics Labs Provide National Leadership

By Dick Peterson

Bethel's nationally recognized advanced labs in physics were especially visible in July 2015. During July 8-10, NSF assisted ALPhA "Immersion" were held at Bethel and were led by physics professors Nathan Lindquist and Chad Hoyt, along with Kurt Wick (visiting Senior Scientist in physics at the U. of MN). Participating physics faculty members from throughout the U.S. were able to immerse themselves for over two days in chosen experiments housed within Bethel's Nanolab, AMO (Atomic, Molecular, Optics) lab, and Electronics lab.

A July 22-24 conference on advanced laboratory initiatives was attended by 150 U.S. physics faculty members and held at the U. of Maryland - College Park. Leading the nation's universities, Bethel was represented by three faculty members and one student who were invited to present several



Professor Chad Hoyt talks about teaching using his mode-locked fiber laser in College Park, Maryland.

workshops, posters, and invited papers as developed within project-based advanced labs that accompany many advanced Bethel physics courses. Professor Keith Stein and his student Peter Heppner led 6 workshop sessions on their NSF supported work on interactive web-assisted advanced labs (in addition to a paper on Bethel's optical measurements of pulsed supersonic

flow), and Professor Chad Hoyt led 6 hands-on workshops utilizing a low-cost mode-locked erbium pumped fiber laser system that he and physics students have recently developed with NSF support. Professor Dick Peterson presented an invited plenary paper addressing federal funding patterns for the nation's advanced teaching laboratories in STEM areas. •

Bethel University and Mayo Clinic Connections

By Tom Greenlee, Aeli Olson '17, Shane Dirks '17 (and Alyssa Hamre)

Bethel University has access to many local resources to help students connect with current research both inside and outside of Bethel. One exciting connection growing stronger in recent years is the connection between the Bethel Physics department and the Mayo Clinic in Rochester, Minnesota.

On April 11, 2014 six Bethel students—Anna Slattery, Aeli Olson, Josh Clarke, Dan Mohr, Sarah Venditto, and Andrew Schaffer—and Dr. Greenlee attended a meeting of the North Central Chapter of the American Association of

Physicists in Medicine at Mayo Clinic. After breakfast at the conference, they heard talks about the Mayo proton beam facility and some historical short stories about Emil Grubbe (believed by many to be the first American to use x-rays to treat cancer), the discovery of antimatter, and the origin of the radiation warning sign. Then, by the arrangement of Dr. Cynthia McCollough, they toured a CAT scan facility and the (under construction) proton beam facility. Both facilities are impressive examples of the application of physics in medicine. The group thanks Dr. McCollough for the memorable trip!



Mayo Proton Beam

Bethel's connection with Mayo doesn't stop there. Aeli Olson '17 continued to connect with Mayo through participation in the Mayo Innovation Scholar Program (MISP) during the '15-'16 academic year and worked at Mayo through their Summer Undergraduate

Mayo Connections continued on p. 5.

Dual-Degree continued from p. 2.

In addition to Bethel, the University of Minnesota eventually established formal Dual-degree Engineering programs with about 30 different schools. In December 2015, however, U of MN notified these schools of their intent to discontinue their Dual-degree Engineering Program. Fall of 2017 will be the last time students can be admitted to the U of MN on their Dual-degree Program. What does this mean for Bethel engineering students? Actually, very little will change for them.

Bethel sent students to the U of MN on Dual-degree for many years before they recognized our Dual-degree Program. We will continue to send students long after their program ends. Only three things change:

1. There will be no official program that the U of MN recognizes, but the U of MN is encouraging our students to continue to

transfer into their College of Science and Engineering.

2. Bethel students will not be automatically waived from U of MN's "liberal ed" requirements, but will instead be able to transfer Bethel courses to meet these requirements.
3. Bethel students may not be allowed to participate in Bethel athletics while enrolled at the U of MN. We are awaiting a ruling from the NCAA.

In the future, Bethel students will simply transfer to the U of MN, which is what they have always done. Bethel has over 100 courses in the sciences, math, and the humanities that the U has already approved for transfer and that will continue to transfer. At Bethel, students take 51 credits of general education, so the liberal education requirements (about 18 credits) at the U should normally be met before the transfer.

That is exactly what we have been doing with all other schools to which our students go on our Dual-degree Engineering Program. In recent years, students have gone to schools such as University of North Dakota, Colorado School of Mines, Iowa State, and University of Wisconsin (Madison and Milwaukee). After completing Bethel's requirements, students transfer to the school of their choice, complete their engineering degree, and then Bethel University grants the B.A. degree.

Engineering at Bethel continues to thrive. We now offer 7 explicitly engineering courses, plus dozens of others that count towards engineering majors, and we continue to add more. The Applied Physics major has four different emphases available in biomedical, computational, mechanics, and optics. We have Ph.D. engineering faculty and a record number of students pursuing engineering. Student research involves about 20 students every year. •

Students Invited to Optical Sciences Winter School in Tucson

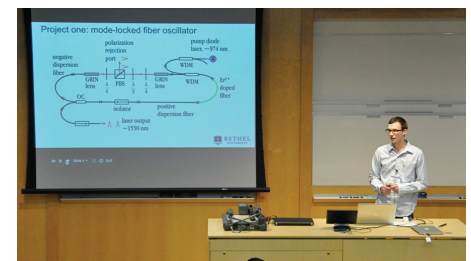
By Chad Hoyt

Bethel physics majors Ella Johnson '17 and Austin Riedeman '17 attended, by invitation, the first Optics and Photonics Winter School and Workshop at the University of Arizona's College of Optical Sciences in Tucson in January 2016 (wp.optics.arizona.edu/winter-school-workshop). Students and faculty represented Bethel, Carleton, Vassar, Harvey Mudd, Williams, Reed, UW River Falls, Greenville, Rose-Hulman, Cal Poly Pomona and San Luis Obispo, San Jose State, and the National Autonomous University of Mexico. As a part of the invitation, transportation costs, hotel, and meals were provided for attendees.

The Winter School included optics and photonics lectures for students by University of Arizona faculty such as Brian Anderson, Poul Jessen, Jim Wyant, Jennifer Barton, Amber Dagel, and Jason Jones '94. Lectures were

preceded by a lively poster session of undergraduate students and Optical Sciences graduate students. Johnson presented her poster "A connector-based, mode-locked erbium fiber laser for the advanced lab." There were also tours of labs and the world-renowned Richard F. Caris Mirror Lab underneath the football stadium that fabricates 8.4m mirrors for optical and infrared telescopes. Roger Angel of the University of Arizona gave a lecture at the workshop banquet entitled, "Optics, Photonics, and Solar Energy."

The Workshop followed the Winter School and was intended for students' advisors. It included a pedagogical methods talk by Eric Mazur of Harvard and advanced laboratory talks by faculty such as Chad Hoyt, who presented methods and several labs from Bethel Optics and Lasers courses. Riedeman was one of two students to give a talk during these faculty sessions, entitled



Student Austin Riedeman '17 speaks during faculty sessions.

"Inexpensive ultrafast optics laboratory projects with mode-locked erbium fiber lasers."

Bethel physics alumnus Jason Jones '94, Associate Professor in the College of Optical Sciences, organized the events. With Hoyt, Jones also led a hands-on ALPhA Immersion workshop where faculty constructed and characterized a mode-locked, connector-based erbium fiber laser. National Science Foundation (NSF), SPIE, TRIF Imaging, and the College of Optical Sciences funded the student and faculty portions. ALPhA Immersions were funded, in part, by the NSF and the American Association of Physics Teachers. •

Mayo Connections continued from p. 3.

Research Fellowship (SURF) during the summer of 2016.

The MISP partners with private colleges and universities from around Minnesota to provide experience within the interdisciplinary field of biomedical devices. Each school creates a team of four students (typically two business students and two students studying a branch of science) that is placed under the supervision of a St. Thomas MBA student. Together, these teams are assigned a topic, most being a new medical device invention, and are expected to create a market analysis and business plan. The experience lasts four months and culminates with a 40-minute presentation to the MISP participants and administrators. For Olson, “The experience provided great insight into the depth and significant interdisciplinary nature of the medical device industry.” See the full story at bethel.edu/news/articles/2016/april/mayo-scholars.

Mayo’s SURF program allows students to experience research firsthand within a clinically-innovative environment. Olson worked in the x-ray CT clinical innovation center in which research into CT scanner protocols and imaging reconstruction techniques help to improve patient healthcare. She specifically worked to develop a probabilistic method for in



Brigitte A. Barr
Lecture Hall F
Rosemary Berkel

Bethel’s MISP group at their presentation: Bethel’s MISP representative and Biokinetics Program Director Seth Paradis, Aeli Olson ’17, Madison Dorn ’16, Matthew Engeliem ’16, Mara Raymond ’16, St. Thomas MBA student project manager alumna Ally Freed ’12, and St. Thomas Professor Steve Vuolo.

vivo classification of mineral composition in kidney stones. She says, “the lab was filled with many wonderful and supportive scientists who were excited to help teach us students. I spent my time coding and processing data using MatLab, a computer program taught and emphasized within the Bethel’s physics department. Learning MatLab before my summer experience played a significant role in my success during my ten weeks at Mayo.”

Another connection is through Shane Dirks ’16 (Physics), who now works at Mayo on a project involving Channelized Hotelling Model Observer (CHO), which is used to automate the evaluation of the diagnostic quality

of new acquisition protocols or reconstruction methods. Testing for improvements in the diagnostic quality of new image acquisition or processing techniques currently requires human observer studies, which involves taking radiologists away from their clinical duties. The model observer software tool seeks to mimic everything from eye response and search patterns to the decision making process of a human observer. The development of a model observer would minimize costs (a radiologist’s time is quite valuable) and allow for much faster iterations in the process of optimizing CT acquisition protocols and reconstruction techniques.

Alumnus Brian McCollough ’16 (Applied Physics) is yet another example of the Bethel-Mayo connection. He participated in research at Mayo during the summer of 2015 on developing software tools to aid in MRI imaging accuracy, and is now pursuing his Ph.D. at Mayo in the field of Biomedical Engineering. It is clear that through student involvement in summer research, scholarship programs, graduate school, and post-graduation jobs, this exciting connection between the Bethel physics department and Mayo Clinic is growing stronger. We look forward to ongoing opportunities for students to explore the connections between medicine and physics & engineering. •



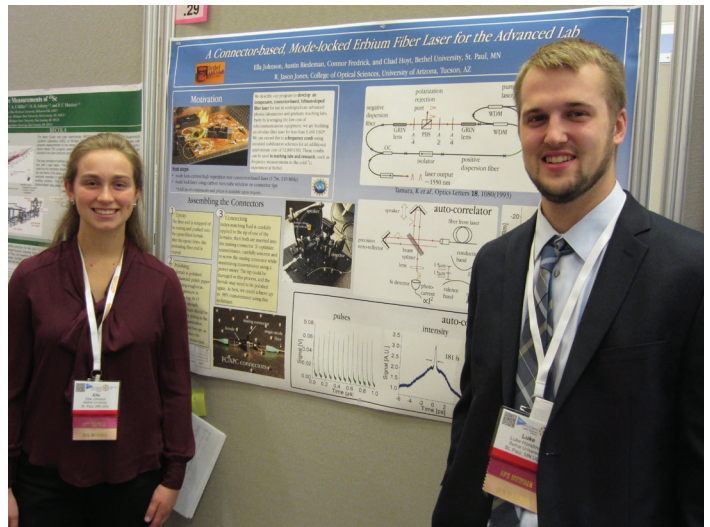
Students and Dr. Greenlee stand at an old x-ray machine.

Students Present at Laser Science Symposium

By Chad Hoyt

Bethel physics majors Ella Johnson '17 and Luke Horstman '16 gave presentations at the Symposium for Undergraduate Research in San Jose, CA, sponsored by the American Physical Society's Division of Laser Science (DLS). The Symposium was held on October 18, 2015 in conjunction with the annual meetings of the Optical Society of America and the DLS. Forty-five students reported on projects done at about 40 universities or research institutes.

Johnson gave a poster presentation on her work with connector-based, mode-locked fiber lasers in Bethel's atomic, molecular and optical physics lab. Horstman gave a talk entitled, "Dynamics of a Lithium Magneto Optical Trap by High Speed Video Analysis." Several Bethel graduates have given presentations at previous Symposia, including Jessica Doehrmann '12, Dan Mohr '14, and Dan Klemme '13, who are all currently in Ph.D. programs in Optical Sciences or Electrical Engineering. •



Students Ella Johnson '17 and Luke Horstman '16 at the Symposium for Undergraduate Research in San Jose, CA.

This Journey of Faith and Collateral Learning

By David Swenson '11

Growing up, my experiences with Christianity were reserved for Sunday services at a small church in Minnesota. The time spent there was genuine and sincere, but largely divorced from the events of my everyday life at public school. My faith was apathetic and unbelieving at best. It wasn't until my junior year at Bethel that I would say my "conversion" experience began. I was a physics major with far-reaching academic aspirations and a firm grasp on life. But after reading C.S. Lewis' *Mere Christianity*, I was a bit shaken up. Apathy had been the true source of my inability to logically understand or believe in God. I determined to investigate Christian faith for myself, both intellectually and experientially. Then I would either commit to following Jesus wholeheartedly or walk away for good.

Fast-forward two years: I deferred graduate school and a fellowship to join Youth With A Mission (YWAM). Five weeks into my Discipleship Training School (DTS) I had a life-changing experience one night after class. The gathering came to a close late and withdrawing from the crowds, I escaped

to an isolated parking lot on campus and began to weep. The cerebral confrontation that was stirred by C.S. Lewis' books had gone deeper and my Christian rhetoric was collapsing in on itself. I became aware of the truth that I didn't believe in God. I prayed, "Father, I can't do this anymore. I'm so tired. If

this is real, if you are there, I need you to send someone to come find me in this parking lot or I'm walking away." Moments after my silent prayer, movement caught my eye and a man walked out of the woods next to campus. I was paralyzed in a mixture of fear and awe as he came towards me. Passing a few



David Swenson '11 and his wife, Kaity '13, during their time in Istanbul, Turkey.

Journey of Faith continued on p. 7.

Journey of Faith continued from p. 6.

feet from me he smiled warmly and stared. Then as swiftly as he'd come he retraced his path and disappeared. Something in my mind broke in that moment—an awareness of God I never knew, flooded into an empty part of me. I felt His weighty finger as I experienced a strong sense of awe, fear, and love all at once. Tears streamed slowly as I remained suspended in that existential encounter of sorts, and all I know is my life was changed forever. There was a tangible, empirical, real side to life following Jesus.

When I returned home, I declined a Ph.D. fellowship in Biomedical Engineering to accept a full-time staff role at YWAM. I still loved physics, but my identity was entangled in my academic career, achievement was my remedy for insecurities and comparing myself with other people. I knew I needed to let go of that part of my life or it would continue to control me.

For the last five years, I have been taking teams and leading Discipleship Training Schools all over the world. And I mean that quite literally: my wife and I have worked in the Philippines, New Zealand, South Korea, Thailand, Cambodia, Bangladesh, Nepal, Kyrgyzstan, Jordan, Turkey, Spain, Mozambique, and South Africa. Our schools utilize a hybrid of traditional and progressive education techniques to disciple, develop, and train young adults to live as missionaries amidst cultural and denominational variations. Practically, this means some of our training comes through the traditional classroom setting, but a large amount of it is generated through life-on-life experiences. There is a certain type of collateral learning that mediates not through PowerPoints and pens, but from the choices and embodied actions we take. It is one thing to hear a lecture on the virtue of patience, it is an entirely different lesson to take a 42-hour train ride across China. Every day we are learning, forming, and life is shaping us into who we will become.

This brings me full circle back to my time in the Bethel Physics Department. I've been reflecting a bit on the last five years and how dramatically different my life is from what I had expected. Next month, I am going back to graduate school to study theology at Denver Seminary (no more Biomedical Engineering). To be honest, I'm a bit nervous; I was always a numbers guy, thinking in matrices, and even organizing my thoughts for this article was a slightly tiring endeavor. I don't know if I will be a successful student or go on to do "great things" in ministry or the academic world. However, I do know that my life feels rich, full of purpose, and excitement. I have rediscovered my love and desire for learning, which is something that is at the very core of what it means to be human and be a disciple of Jesus. It was the feeling that I got watching Dr. Peterson's General Physics demos or listening to Dr. Greenlee read *Screwtape Letters*, then immediately diving into the wild world of special relativity. The skillset of mathematics and physics is beneficial in and of itself, but the collateral learning I experienced in those undergrad years instilled in me



Swenson with the rest of the 2015 YWAM Discipleship Training School staff in Kona, Hawaii.



Students of the YWAM Discipleship Training School in Kona, Hawaii.



The 2015 class graduates from the YWAM Discipleship Training School in Kona, Hawaii.

something even deeper. They taught me to enjoy the process of solving problems, not merely having all the right answers. I'm not sure what you're doing as you read this. Perhaps you are polishing up your defense for your Ph.D., or maybe you have strayed far from the labs into the business world or an entirely different career altogether. Maybe you've never felt so close to God, or possibly your faith has lulled to an all-time low. I pray that the beauty and desire of learning would stir in a fresh way in your heart; that any apathy that has crept in would be cast off, and you'd find fresh purpose in your faith, family, and work. Blessings, friends. •

Physics Professor Honored with Prestigious American Physical Society Award

By Whitney Bak '15, content specialist

University Professor of Physics Emeritus Richard “Dick” Peterson is the 2017 honoree of the American Physical Society (APS) Jonathan F. Reichert and Barbara Wolf-Reichert Award for Excellence in Advanced Laboratory Instruction. The award—presented by the largest physics community in the U.S. (and, arguably, the world)—seeks to recognize “outstanding achievement in teaching, sustaining, and enhancing an advanced undergraduate laboratory course or courses at a U.S. institution.” Peterson will be the 4th U.S. physics professor to receive the award, which was established in 2012.

In his 36 years at Bethel, Peterson has been a champion for advanced lab efforts—playing a key leadership role in advancing the physics and engineering programs and helping the school garner national recognition. At its most basic level, “advanced lab” refers to almost any student laboratory experience beyond a general physics course. But Bethel’s advanced labs seek to blur the boundary between “class” and “research” with a unique, project-oriented approach.

“As you can imagine, if you’re doing [lab projects] at a high level—and we do—some of this stuff is publishable as research,” Peterson says. “Project-oriented means you don’t just do standard, cut-and-dry things.” In addition to the educational benefits, Peterson explains that such an approach helps students determine whether they enjoy research or want to pursue a different career path. “Our job is to help students find their calling.”

Chad Hoyt, associate professor of physics and engineering, is one of three Bethel physics professors who were first influenced by Peterson as undergraduate students. Hoyt nominated Peterson for the award. “A lot of us in [the Department of Physics]



Dick Peterson, University Professor of Physics Emeritus, was named the 2017 honoree of the American Physical Society.

who now try to inspire students, were inspired by Dick Peterson,” he says. Hoyt, who studied under Peterson from 1990 to 1994 and has since worked alongside him for 10 years, says that the nomination was a no-brainer. “The description of the award is pretty much a description of Dick Peterson,” he says. “He’s done a lot for the department, he’s done a lot for Bethel, and he’s done a lot for the advanced lab community.”

This is not the first time that Peterson—an APS Fellow since 2004—has been recognized by the prestigious society. He has received accolades throughout his career, including the 1998 Prize for a Faculty Member for Research in an Undergraduate Institution, “for establishing an outstanding research program in applied optics.” Peterson says Bethel’s advanced lab efforts have, to some extent, come out of the nationally-recognized laser and optics work conducted by the physics department for many years. But Hoyt attributes

even that success—in large part—to Peterson, who found ways to supply the school with quality optical equipment and lasers in the years before the department could apply for federal grants.

Despite all that he has achieved, Peterson remains humble—refusing to take sole credit for his success. “It’s really a department award, even though it’s given to me personally,” he says. “It’s a whole department endeavor.” Peterson will be presented with the award at the APS March meeting—a gathering that will attract over 10,000 physicists—where he will also be giving a talk on the evolution of advanced lab programs. “Because I’m old,” he jokes.

Peterson has been a key player in advanced lab efforts from the start, and was one of many renowned physicists who helped to form the Advanced Laboratory Physics Association (ALPhA) in 2007. “He’s invested his career in these types of things,” says Hoyt. “This is a legacy that he’ll have.” •

Women in Physics & Engineering Events

By Alyssa Hamre

During November 2015, Bethel Student Government added an exciting new student group – the Women in Physics & Engineering (WPE) Club. Bethel Physics & Engineering has hosted events for the women in the department periodically over the years, but within the past year, some students decided that it was time to make the group official. Through the leadership of Morgan Wittner '18 and Justine Boecker '17, the group became an official student club, offering them wider access to BSG resources and providing more structure for the group.

The intent of the WPE club is to foster a community and sense of belonging to the present and future women within the Bethel Physics department and Engineering program. This group is intended to create connections between women throughout the department that might not otherwise spontaneously occur, particularly across all years of their college experience. Those connections can then help students to feel well-supported in such a way that strengthens them and in turn strengthens the department community.

WPE sponsors events specifically for the women in the department to help them network, such as “field trips,” speakers, and a retreat this past April. WPE also sponsors department-wide events (yes, that means guys included, too!) such as a game night and an astronomy night. •



WPE members enjoying hot chocolate during one of the speaker events.



WPE students work to balance resources on an orbit simulator at the Minnesota Science Museum.



WPE members at the Marshall W. Alworth Planetarium in Duluth.



WPE members take a break from the fun at the Minnesota Science Museum for a group picture.



WPE members inside of the Lake Superior Maritime Visitor Center (operated by the United States Army Corps of Engineers) in Duluth.

Society of Physics Students (SPS) Events

The last year was filled with fun at our annual SPS events – fall Ice Cream Social, Pumpkin Carving, the Christmas Party, Spring Banquet, and the Spring Picnic!



Nothing like a bowlful of ice cream to take the edge off the beginning of freshman year!



Students hard at work carving physics equations into pumpkins at the annual SPS Pumpkin Carving event.



Some of the freshly-carved pumpkins boasting equations from all varieties of physics.



Students with the multitude of equation-carved pumpkins.



Robbie, Tyler, Ben, and Cole tackle physics word finds at the SPS Christmas Party.



Students gather in Dr. Stein's living room in preparation for singing Physics Carols.

Society of Physics Students (SPS) Events



Sigma Pi Sigma Honor Society inductees at the 2016 SPS Banquet.



Dr. Greenlee was, as always, the grill-master for the SPS Spring Picnic.



Students enjoying grill food at the SPS Spring picnic.



Scarves and sweatshirts in May? Yes - this year's SPS Picnic was a chilly one, with temps in the mid-40's and a stiff 20mph breeze adding extra challenge to the usual Frisbee games.

It's been a while since the last issue of *PhysicsFocus*, so we have two graduating classes to celebrate!

Spring 2015 Graduates



(L-R) *Front row:* Andrew Stephan, Christopher Ertsgaard, Sarah Elliott, Andrew Schaffer, Tayt Eiden, Caleb Logemann, Michelle Hofeldt. *Middle row:* Frank Carlson, Connor Fredrick, Luke Ness, Austin Woetzel, Ian Frei. *Back:* Benjamin Copan. *Not pictured:* Mark Madsen, Mark Thompson.

Spring 2016 Graduates



(L-R) *Front row:* Cole Wiskow, Peter Heppner, Adam Doehrmann, Benjamin Fuglestad, Shane Dirks, Brian McCollough, Luke Riveness. *Second row:* Andrew Norlander, Curtis Graber, Luke Horstman, Kellan Moore, Stephen Gronseth, Jared Negaard. *Not pictured:* Rachel Hagen, Alex Wiedmann.