



Spring 2013  
Editor: Lauren Otto '12

Volume 7, Issue 1

### Inside this issue:

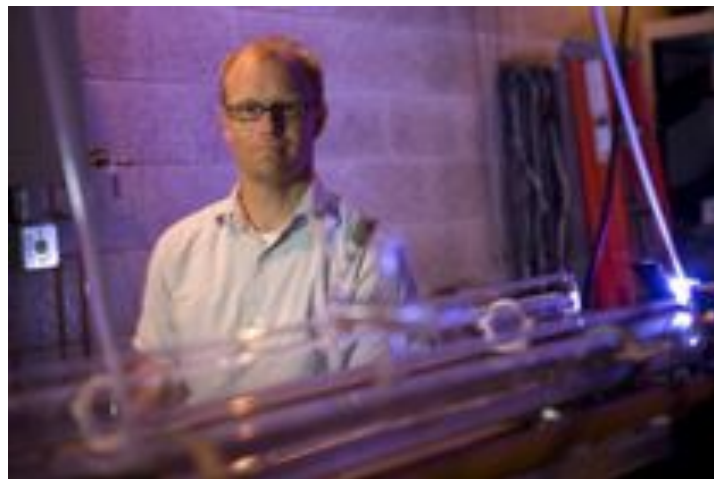
International Activities of BU Physics Alumni	2
Dr. Hoyt Spends Sabbatical in China	8
Update from Dr. Peterson	10
Students and Professors Attend Conferences in 2012	12
Research Update from Dr. Lindquist	15
Class of 2012	16

### Dr. Chad Hoyt Awarded Prestigious NSF Grant

Chad Hoyt, associate professor of physics, has been awarded a National Science Foundation (NSF) research grant totaling \$230,349 for his project "Fiber Laser Frequency Combs for the Advanced Laboratory."

The project will develop fiber laser frequency combs (FLCs) to use in Bethel's upper-level undergraduate physics courses and in graduate level teaching lab courses at the University of Arizona, Hoyt explains. "Fiber laser frequency combs are like rulers, but instead of measuring the length dimension like a normal ruler would, frequency combs can precisely measure light wavelengths," says Hoyt. "Picture a comb for one's hair. The teeth are regularly spaced at a millimeter or so. A frequency comb is like that, except the 'teeth' are portions of the light spectrum that are spaced regularly apart at a certain wavelength interval."

The grant provides funding for student researchers to work with Hoyt '94 in his lab during the academic year, interim, and summers until fall 2015. Hoyt will collaborate with R. Jason Jones at the University of Arizona, who is also a 1994 Bethel graduate. Two of Hoyt's students will spend a summer with Jones' research group building a fiber laser frequency comb, and bring



**Chad Hoyt, associate professor of physics, received a National Science Foundation research grant.**

their expertise back to Bethel to build one in an upper-level physics class. While the process may seem complicated, Hoyt anticipates the students will enjoy it. "Experimental work in the lab with students, to me, is the best kind of classroom. Students can learn to be inquisitive and resourceful, and they can catch the excitement of physics," says Hoyt.

If the project is successful at Bethel and the University of Arizona, the goal will be to explain how to replicate it in other schools and teaching labs. "We will carefully look for new, simpler, cheaper ways to make high performance FLCs such that other undergraduate institutions can adopt this wonderful advanced laboratory," Hoyt explains.

"Chad has been a trail-

blazer in applying for federal grants, so we are delighted that he has been awarded this federal research grant," says Deborah Sullivan-Trainor, associate dean for general education and faculty development.

"The success of this proposal is built on some strong shoulders at Bethel," adds Hoyt. "Dr. Richard Peterson has built the optics part of the Bethel physics department into a nationally recognized success over the past few decades. Bethel has been supportive of my research with students that has led to this grant."

Hoyt has received additional private funding for his research, including from Creative Integration & Design, Inc., in Saint Paul, Minn.

*Article first appeared 2012 October 23 on the Bethel News page (<http://www.bethel.edu/news/articles/2012/october/nsf-grant>) and is courtesy of Suzanne McInroy, Director of Communications. Adapted and used with permission.*

“Skills that I never imagined could also be applied beyond the context of physics to theology, language and life.” –David Swenson

## International Activities of Bethel Physics Alumni

As part of its mission as a University, Bethel has committed to instilling seven values into its students: Christ-followers, learners, truth-seekers, character-builders, reconcilers, salt and light, and world-changers.

While being a world-

changer does not require long-term overseas adventures, this value can certainly be lived out through overseas experiences. In recent months, many Bethel physics alumni have spent an extended period of time overseas for research or mission work. In addition to

the following stories, Jared Sturdy '06 has been working on his PhD at the European Organization for Nuclear Research (CERN) and Katie Toop '03 has been working to promote clean water and hygiene in Sri Lanka and Afghanistan after completing graduate school in England.

### David Swenson '11 Ministers in Asia with YWAM

After graduating from Bethel in spring of 2011 I took a year of deferment from the University of Minnesota Biomedical Engineering program. I traveled to Hawaii to go through a discipleship training school offered by missions training organization called Youth With A Mission (YWAM).

During my time there God began to lay a new foundation, a new value system, in my heart and mind. I was

awakened to a deeper reality that the God of the Bible is still the God of today. God became real to me, undeniably real. It was as if I had been scanning frequencies all these years never hitting a resonance, but now for the first time I began to see flashes of light. My own little heart experiment was underway, complete with real tangible data flooding my senses, God was real. I traveled to Battambang, Cambo-

dia for three months and spent my days teaching English and physics to kids at a school. Then evenings and weekends were spent doing discipleship and church planting. The experience changed my life as new perspective sank in and a deeper understanding of Jesus began to grow in my heart.

Coming home I realized the program I was accepted into wasn't right for me so I withdrew my acceptance. God had opened my eyes to a broader spectrum of possibilities. I realized industry wasn't for me and that I wanted to give my life to teaching. My education at Bethel developed my mind to solve problems and understand the world. It had planted a hunger in me for truth and equipped me with the tools of diligence and the ability to explain and simplify the complex. Skills that I never imagined could also be applied beyond the context of physics to theology, language and life.

I wanted to share the same awakening I had gone through with others, so I signed up for a two-year commitment to staff discipleship training schools. I

*(Continued on page 3)*



Learning about gravity and air resistance with the parachute egg drop in Battambang, Cambodia. David is pictured on the right.

*(Continued from page 2)*

am currently half way through this time frame and I just returned home from leading a team to Turkey. We immersed ourselves into this Muslim culture with the goal of being Jesus and sharing Jesus with a people group that simply does not know what he taught or who He was. As it stands Turkey exceeds ninety-nine percent Muslim and is per capita the most unreached nation on earth.

To live amongst a people group who are blanketed with false stereotypes was a sobering experience. I could not believe the warmth, gentleness and hospitality we were shown by so many. I got to sit and share life with people who are in many ways very different, but on a deeper level they are seeking the same things in life. They are passionate about the same values as you and me. I would ask them what they treasure most and they would reply, "God and my family." Their dreams were to meet someone and fall in love, to find a career that fulfills them and to travel and learn about other cultures. And I was amazed to see that when we spoke about Jesus and shared what he taught they agreed. They agreed that just going to a building to pray and following a set of rules wouldn't work. They agreed that faith had to come from the heart and they were amazed to hear about forgiveness and love that is available to those who seek wholeheartedly. And they



**David's team in Turkey with one of their closest friends, Yusuf, and his family. David is pictured on the bottom right.**

left softened, even curious about this man Jesus. Who may after all be more than just another prophet as they have been told.

My studies in physics and now my time with YWAM has taught me one thing. I am incapable of knowing it all. It always seems like the deeper I probe the further and higher it all goes. I am often now slow or even reluctant to think that out of all the people, all of the brilliant minds in this world, I have stumbled upon the answer, upon the narrow path. However, the more cultures I see, the more religions I experience and the more people I talk to the more clear it becomes that life and truth is found in the words of Christ. I am far from all the answers, but I

know any search for a unifying theory is in vain if it lacks Jesus at the beginning, middle and end; there is no unifying theory grander than Him.

I am so grateful for my years at Bethel, the education I received there, but perhaps more importantly the relationships and community that was built during those years. I am excited to return with YWAM in a couple months and continue to learn how and what it is God wants me to teach. I see now that God can use us on such a broad spectrum of callings, careers and even countries. Wherever we go, be it in a lab, a classroom or a jungle we can bring change and hope that many do not know of.

**"Wherever we go, be it in a lab, a classroom or a jungle we can bring change and hope that many do not know of."  
-David Swenson**

*To stay up to date and hear more stories from David, visit his blog ([www.takeheartinitiative.wordpress.com](http://www.takeheartinitiative.wordpress.com)) or email him ([swedav9@gmail.com](mailto:swedav9@gmail.com)) to be added to his email list.*



“...we are grateful for the genuine kindness of the fellow scientists who hosted us...”  
-Nathan Lemke

## Nathan Lemke '06 Fulfills Postdoctoral Position in Germany

As our graduate school days at University of Colorado Boulder were coming to an end, my wife and I pondered our next move. We decided to postpone our plan to look for employment near our Midwestern families in favor of an adventure overseas. Ultimately, we decided on a six-month trip to Germany, where I would work as a postdoc at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig. Our concerns about traveling abroad with our infant daughter were assuaged by trust in God's provision, together with our new mantra “it's only for six months.” On the flip side, we hoped that this relatively short amount of time (in scientific terms) could still be sufficient for me to accomplish something in the

laboratory; to aid in this regard, I worked on a project that closely mirrored my thesis experiment in graduate school.

We moved to Braunschweig in July 2012 and stayed through Christmas. Somewhat unfathomably, our apartment building predated Columbus's discovery of North America, though the interior has since been renovated. We lived near the city center so that Kristen and Adeline would be close to its lively cultural activities and shopping opportunities. Our inability to speak German made even the simplest errand quite challenging (and sometimes extremely frustrating), though eventually we learned the ropes.

The scientists I worked with at PTB were friendly

and helpful, and they spoke exquisite English. At PTB, there are two optical clocks in operation, one a lattice clock using ultracold strontium atoms (my project) and the other a single ion clock based on ytterbium. We decided that my time should be spent refining the strontium lattice clock for highest possible accuracy in preparation for measuring the ratio of the two clocks' frequencies. As it turned out, six months was just enough time to accomplish this goal, and the final measurements produced a number accurate out to the seventeenth decimal place. The measurement will be repeated over the coming years to see if the result changes, which could indicate that the fine structure constant is not constant.

In keeping with European standards, I was given a generous number of vacation days, so we traveled via rail throughout Deutschland (Hamburg, Munich, Berlin, Cologne, Hannover, etc.) with brief trips also to Austria and Belgium. As it turns out, 1-year-old girls are not very impressed by daunting cathedrals or beautiful artistry, so our travels tended to focus on Germany's bustling pedestrian malls, ice cream parlors, coffee shops, and bodies of water with hungry ducks. Self-guided city walking tours were also a big hit with our family – a great way to take in the sights while keeping the stroller rolling.

Since returning to the U.S., many people have asked if we are glad we

*(Continued on page 5)*



Nathan, Kristen, and daughter Adeline from atop the mysterious and legendary Brocken, the highest peak in northern Germany.

*(Continued from page 4)*

went, and whether we would do it again. My answer is yes – but I wouldn't want to stay any longer than we did. While the cultural and scientific experiences were en-

riching, we found ourselves missing home. It was difficult to meet new people and form friendships, and we missed our families and our church community. Still, we are grateful for the genuine

kindness of the fellow scientists who hosted us, and we will carry some fun German traditions with us as we embark on our next adventure to the less distant (but still foreign) land of Chicago.

**“There are no ‘secular’ and ‘spiritual’ jobs, majors, or careers because God wants His kingdom to be expanded to every area of society.”**  
-Jessica Doehrmann

## **YWAM Ministry in Nicaragua and Brazil with Jessica Doehrmann ‘11**

Soon after graduation from Bethel in December of 2011, I crammed all I could into one suitcase, flew to Nicaragua, and settled into the place that became my home for the next five months. I went to Nicaragua to attend a Discipleship Training School through Youth With A Mission (YWAM). The first three months were much like a Bible school; we had classes every day and studied topics like the Character and Nature of God, Father Heart of God, Missions, Evangelism, the Kingdom of God, etc. YWAM is a non-denominational organization, and there were people in my school from Guatemala, Nicaragua, Belize, Mexico, Switzerland, and the United States. The base there is bilingual so all the classes were translated, but I like to say that the official language of our school was Spanglish. My Spanish skills were quickly tested as I became a translator on the base and the base worship leader singing in Spanish and English. Outside of classes, we also had times of worship, prayer, work duties, kid's ministry, drama practice, and an hour of quiet time every morning where we focused on spending personal time with God

and growing in our relationship with Him.

One aspect of my Christian walk that I really grew in during these first three months was being able to give up total control of my life to God. This is something that I have always struggled with, wanting my own plan and having a hard time giving it up to God and trusting Him. However, God showed me that He is the only one in His wisdom and love capable to lead my life. The more time I spent with Him to really experience and know his character, I was able to trust and give up the control I had fought so long to keep in my life. God taught me so many other lessons during this time as well, but over all I grew to have a much more personal relationship with my savior.

The motto of YWAM is knowing God and making Him known, so the first three months focused more on the knowing God part. The last two months are called the outreach phase and are focused on mak-

ing God known to the nations. For our outreach, we went to Boaco in the mountains of Nicaragua, Bluefields on the Atlantic coast, and Sao Paul and Brasilia, Brazil. In Boaco, we partnered with a Medical Missions group from the United States. They ran free clinics and I translated for the doctors that only spoke English. We prayed with the patients after treating them and were able to show God's love in a practical way through free medical care. We also did house to house evangelism, performed dra-

*(Continued on page 6)*



**Jessica with two girls that she met while doing house visits in Bluefields, Nicaragua.**



**Doing kid's ministry with kids that live in a garbage dump on the outskirts of Brasilia, Brazil. Jessica is pictured in the center, top.**

**"I knew that God was calling me to go back to school to get my PhD and expand His kingdom in graduate school."  
-Jessica Doehrmann**

*(Continued from page 5)*

mas that showed the gospel, helped build an orphanage, taught in schools, prayed for people, and helped out in churches with whatever they needed. During these two months of the outreach phase, we put into practice what God had been teaching us during the school. I experienced the power of the Holy Spirit to change lives, felt God's broken heart for those far from Him and those suffering in poverty and injustice, saw the beauty in diversity of God's creation and His people, and became part of a family of believers that have

a piece of my heart even though I am gone. While in Nicaragua, I also had the opportunity to travel and do different touristy things on the weekends. I climbed a volcano, went to the ocean, traveled to the Colonial city of Granada, went to the local market, bought lots of souvenirs, ate so many mangos and coconuts,

and played soccer all the time. We also had many dance parties. And if you haven't experienced a dance party in Latin America, they are the best! Overall, it was an amazing experience not only in how I grew in my relationship with God but also in just doing life with people from all around the world united in belief and purpose.

During my five months with YWAM, I was trying to figure out what God wanted me to do next: go to graduate school, move across the world, stay in Nicaragua, or become a full-time missionary. There were times during

the outreach phase when I thought that I could just stay in Nicaragua forever and become a missionary (maybe that will still happen someday). However, during our week on the Kingdom of God, God really spoke to me about His calling for my life. The teacher talked about how God gives us all individual gifts and talents to expand His kingdom in a unique way. There are no "secular" and "spiritual" jobs, majors, or careers because God wants His kingdom to be expanded to every area of society. At that moment, I knew that God was calling me to go back to school to get my PhD and expand His kingdom in graduate school. Now, I am in my second semester at the University of Arizona in the Optical Science Department. I absolutely love it and am learning so much! I am here for school, but really I am here to be a light and give a reason for the hope that I have in Christ. God changed me and molded me in many ways while I was in YWAM. He took my plans and motives and gave me His own, and there is so much peace and fulfillment when we are doing what God has called us to do.

*To hear more stories from Jessica, visit her blog ([www.jessicainnicaragua.blogspot.com](http://www.jessicainnicaragua.blogspot.com)).*

## **Summer Research in Japan: Konnichiwa from Lauren Otto '12**

Less than forty-eight hours after walking in commencement, I found myself on a Japan-bound aircraft for a summer of research at the National Institute for Materials Science (NIMS) in Tsukuba, Japan. After completing the 2011 National

Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU) program, I applied for the second year international REU program and was chosen to do research on quantum well solar cells with indirect

band gaps under a Japanese mentor and adviser. I was very grateful that I had just taken the Quantum Mechanics (QM) and Computer Methods (CM) courses at Bethel before heading to Japan. I had not learned any

*(Continued on page 7)*



(Continued from page 6)  
solid state physics, so the QM was an essential foundation to build off of. Also, my lab group often used LabVIEW to control data collection experiments, but the interfaces were all in Japanese! Having recently worked with LabVIEW in CM was extremely helpful. My previous experience with optics in Dr. Hoyt's lab was also handy.

Although, nothing in my education prepared me for the feeling of illiteracy at the grocery store (and everywhere else). Fortunately my coworkers mostly functioned in English, and travel was relatively easy due to the fantastic public transportation systems throughout Japan and the general public safety within its culture.

While I was in Japan, I lived in Ninomiya House, an apartment building that is Japanese government housing for foreign researchers, along with seven other American students in my program and other researchers from around the world. On the weekends, we had plenty of time to travel Japan. Every weekend we took a forty-five minute train ride to Tokyo either to explore the city or catch a train or bus to somewhere else in Japan, including Kyoto, Nagoya, Osaka, Nara, Hiroshima, and Mt. Fuji. Hiroshima was a must-see since after taking the "bombs class" from Dr. Peterson I have become very interested in learning more perspectives on WWII and nuclear energy and weapons from other nations and peoples around the world. Mt. Fuji was defi-

nately a highlight, but climbing it was also one of the most physically difficult things I have ever done. In addition to our leisure travel, NNIN sent us to the embassy in Tokyo to meet with National Science Foundation (NSF, which funded our program) officials and on a business trip to Nagoya to meet with a professor and his research group at Toyota Technological Institute. We even participated in the NIMS conference where we met Dr. Subra Suresh, the director of NSF.

In addition to travel experiences, I also enjoyed immersing myself in Japan's culture through classes offered by NIMS and Ninomiya House. I took an origami class, learned how to prepare a couple varieties of green tea, and I learned how to wear a yukata, which is traditional Japanese dress similar to a kimono but meant for more casual purposes and hot summer weather. I was even brought to a kimono class by a lady that I worked with!

Through my Bethel education, I also gained a broader and more coherent understanding of my faith in Christ, as well as a sense of urgency in sharing my faith and developing relationships. This and cultural lessons I gained throughout the summer helped me navigate my new relationships and



**Lauren (front left) with the seven people in her program and a friend from high school.**

several conversations that I had with fellow Americans in my program as well as with some people that I worked with who were from Japan and other nations. By the end of the summer, I absolutely adored my labmates, the wonderful lady who worked at the NIMS coffee shop, and Japan in general. I wished I could have stayed for a couple more months, but it was time to go. Saying goodbye was very difficult, and I miss them a lot.

The NNIN program concluded with a conference in Washington, D. C., which allowed me to meet up with a few friends from the physics department and Dr. Peterson and his wife, Donna. Shortly after arriving back in Minnesota, I began a PhD program in Electrical Engineering at the University of Minnesota.



**The kimono class instructor teaching Lauren how to pose for some photographs.**

To hear more stories from Lauren, visit her blog ([www.lmotto.wordpress.com](http://www.lmotto.wordpress.com)).



## Dr. Chad Hoyt Spends Sabbatical in China

*Dr. Chad Hoyt spent his first sabbatical as a Bethel physics professor performing research at East China Normal University (ECNU) working with Professor Long-Sheng Ma in Shanghai, China. Professor Ma is a leader in Chinese research efforts toward optical lattice clocks based on ytterbium laser transitions. Hoyt worked previously with Ma during his postdoctoral research at the National Institute of Standards and Technology (NIST) in Boulder, CO and also visited with Ma's Shanghai group back in 2006. This fall, Dr. Hoyt worked toward the design and eventual implementation of a new ytterbium laser system that is extraordinarily compact and stable. It is anticipated that this is a Bethel/ECNU research collaboration that can continue in the future as this new system is completed, tested and applied to time measurements. Dr. Hoyt's family also traveled with him to China. Wife, Jenny, and kids, Samuel, Lukas, Karin, and Zachary are also seen in the photo collage. All photographs are also on Dr. Hoyt's blog ([www.chineseclocks.tumblr.com](http://www.chineseclocks.tumblr.com)).*









**“Indeed the two years made me increasingly aware of the richness and quality of Bethel physics and engineering and the students we recruit and mentor.” -Dr. Peterson**

## **Dr. Peterson Returns from Two Years at NSF with Possible Future Physics Teaching in Pyongyang, North Korea**

It was a big change to transition from typically riding a bike from Roseville to Bethel (past the ducks and sometimes frozen ponds) toward our two-year habitation of an apartment in Arlington, VA. The eighth floor apartment was a very short walk from the National Science Foundation (NSF) headquarters of Arlington - and also only two blocks from the Ballston stop of the metro's Orange Line that runs under the Potomac past the Washington, D. C. (DC) mall and beyond.

I served as a program director within the Division of Undergraduate Education (DUE) of NSF. The broad goal of such a position is to work with about twenty colleagues in DUE (representing all areas of Science, Technology, Engineering and Mathematics (STEM) education) in finding

the best uses of all too meager funds for helping students across the country thrive within undergraduate STEM areas. For example in the case of physics this process starts with the formation of physicist peer review panels for the hundreds of annual proposals. Ultimately the program directors decide which of the most highly regarded proposals can be funded (about ten or fifteen percent of those submitted) and then work on all the subsequent details of past and present awards, plus more sadly to also deal with the many declines. It is a challenging team job that builds on almost hourly interactions with DUE colleagues with emails steadily flowing to and fro each day.

The NSF foundation-wide policy is to continually bring in “fresh blood” by engaging

“rotators” such as myself who are still close to being “in the trenches” of teaching and research. These rotator positions are for two years of time (usually funded by NSF by awards to your home institution), and I continued with a Bethel physics position during the time in Arlington. My mentor for much of the physics education review work was the permanent DUE program officer for physics and astronomy, Dr. Duncan McBride, and we had fun leading several NSF presentations together during the two years. Because of Bethel's former policy of declining to apply for federal funds, I may have been unique as a NSF program director with almost no past experience as an awarded principal investigator (PI). Program directors are usually chosen on the basis of a multitude of past NSF awards, and I surely had more to learn than most.

High points of the two years included a chance to read and evaluate many dozens of proposal ideas for physics education in DUE. While I knew many people in physics through my American Association of Physics Teachers (AAPT) and American Physical Society (APS) work in the past, I was able to expand upon that list of contacts and get to know many very sharp and dedicated workers in physics education at all undergraduate levels. Some of this work was within the Transforming Undergraduate Education in STEM (TUES) program, and

*(Continued on page 11)*



**Dr. Peterson and his mentor, Dr. Duncan McBride taken at a NSF TUES program PI conference in Washington in 2011.**



*(Continued from page 10)*

also within the Scholarships in STEM (S-STEM) and the Math/Science Partnership (MSP) programs. We were able to invite seven different Bethel faculty members to DC as review panelists within these programs, and this has assisted in Bethel's increasing awareness of priorities and procedures for each of the programs. Because of the especially strong professional excellence within Bethel physics and engineering, I have strong expectations that we will have more NSF awards within the next year (in addition to the recent grant awarded to Dr. Hoyt and Dr. R. Jason Jones at the University of Arizona). Indeed the two years made me increasingly aware of the richness and quality of Bethel physics and engineering and the students we recruit and mentor.

The years in the DC area also provided opportunities for my wife Donna and me to enjoy so much of that area in more depth than mere tourists. Those of you who know Donna will be aware that she wonderfully seeks and achieves some broadening of my world beyond optical measurements and physics teaching. She helped get me out of the NSF office and into the broader real world of DC. We tried to share our two-bedroom apartment with friends and family visitors as much as possible. And our time in DC also included one significant earthquake that served to quickly empty the



**Donna and Dr. Peterson on one of their several trips to Mount Vernon (George Washington's farm and estate south of Alexandria, VA).**

shaking twelve floors of the NSF complex and damaged several DC area buildings and monuments. We also endured one really big storm with straight-line winds that shut down parts of the area for almost a week and a hurricane that zoomed past us on its path up the east coast.

This rich experience also afforded an opportunity to hear many guest speakers at NSF. One of those that both Donna and I heard was the recent Pyongyang University for Science and Technology (PUST) Chancellor, Dr. Chan-Mo Park, who informed the NSF audience of a rather unique effort to build an undergraduate and graduate level private university PUST in North Korea (DPRK) with the support of the DPRK and many individuals and churches in the

United States and South Korea. Donna also introduced me to Norman P. Neureiter (the recent American Association for the Advancement of Science (AAAS) director of science, technology, and security policy) through her contacts at our Arlington church, as Norm had also visited PUST and leads AAAS with scientific diplomacy and security issues around the globe. Consequently I may be traveling to North Korea in May and June of 2013 to teach some physics if visa, security, and other assorted complications can be conquered. Please stay tuned and pray that ultimate good can come from this small part of an effort to overcome tragic walls that separate the Korean people.

**“[Donna] wonderfully seeks and achieves some broadening of my world beyond optical measurements and physics teaching. She helped get me out of the NSF office and into the broader real world of DC.” -Dr. Peterson**

*Article courtesy of Dr. Richard Peterson. For more information on PUST, please visit: ([http://en.wikipedia.org/wiki/Pyongyang\\_University\\_of\\_Science\\_and\\_Technology](http://en.wikipedia.org/wiki/Pyongyang_University_of_Science_and_Technology)) and ([http://money.cnn.com/2009/09/14/magazines/fortune/pyongyang\\_university\\_north\\_korea.fortune/index.htm](http://money.cnn.com/2009/09/14/magazines/fortune/pyongyang_university_north_korea.fortune/index.htm)).*

## Bethel Physics Invades East Coast at the 2012 APS and BFY Conferences



**Bethel physics gathering at the No Name restaurant in Boston (left to right): Carl Schreck, Gus Olson, Nathan Lindquist, Carolyn Kan, Keith Stein, Jennifer Schommer, Lauren Otto, Dan Klemme, Richard Peterson, Donna Peterson, Chad Hoyt.**

2012 was a year in which the Bethel physics department had a strong presence in two national conferences on the east coast; the American Physical Society (APS) March Meeting in Boston, and the Advanced Laboratory Physics Association (ALPhA) conference on lab instruction Beyond the First Year (BFY) of College at the University of Pennsylvania and Drexel University in Philadelphia.

### **American Physical Society (APS) March Meeting, Boston:**

As the first stage of its 2012 east coast invasion, Bethel Physics showed up in full force at the APS 2012 March Meeting in Boston. This APS meeting is the largest physics meeting world-

wide and is a chance for schools, industry professionals and teaching institutions to share their research. Three faculty and three physics majors presented joint papers in a session entitled "Research Collaboration between Mentors and Undergraduate Students." The session was organized by our own Dr. Richard Peterson. In addition to the current faculty and students, Bethel alumni Carl Schreck'06 (PhD, Yale University), Gus Olson '07 (PhD candidate, University of Illinois Urbana-Champaign) and Carolyn Kan '10 (PhD candidate, University of Illinois Urbana-Champaign) presented their doctoral research at the conference. This brought Bethel partici-

pation up to ten people.

Over the years, Bethel has established a national reputation for advanced laboratory work and undergraduate research in physics and engineering. At the APS conference, physics faculty and student researchers gave paired talks, with the faculty member giving a broader presentation of their research program and the student giving a more focused presentation on their research project. In this conference, Dr. Chad Hoyt gave a presentation on Bethel's Atomic, Molecular and Optical (AMO) lab, providing an overview of the ongoing research effort on laser-cooling and trapping of lithium atoms in a magneto-optical trap (MOT). Dan Klemme presented student research on "Lithium in a Magneto-Optical Trap."

Dr. Keith Stein gave a presentation entitled "Undergraduate Studies on Compressible Flows and Shock Waves," which focused on advanced lab project work in Bethel's Fluid Mechanics course and related undergraduate student research. Jennifer Schommer gave a presentation of her fall senior research entitled "Graphical User Interface for Supersonic Flow and Shock Waves in a Converging-Diverging Nozzle."

Dr. Nathan Lindquist gave a talk on "Surface Plasmon Microscopy with Low-Cost Metallic Nanostructures for Biosensing," a collaborative research effort with the University of Minnesota in the

*(Continued on page 13)*





**Bethel faculty and physics majors were colorful participants at the APS conference: Lauren Otto<sup>3</sup>, Keith Stein<sup>4</sup>, Nathan Lindquist<sup>5</sup>, Jennifer Schommer<sup>6</sup>, Dan Klemme<sup>7</sup>, Chad Hoyt<sup>8</sup>, and Richard Peterson<sup>11</sup> (Superscript identifies position from the left).**

*(Continued from page 12)*

field of plasmonics. Lauren Otto spoke about student research on the development of a microscopy setup for surface plasmon bio-sensing and the use of reliable, repeatable, low-cost nanofabrication techniques based on template stripping.

**Advanced Laboratory Physics Association (ALPhA) Conference on Lab Instruction Beyond the First Year (BFY) of College, Philadelphia:**

Bethel physics made a second 2012 appearance on the east coast at the ALPhA conference on lab instruction BFY of College at the University of Pennsylvania and Drexel University. The conference took place in July 2012, immediately

*(Continued on page 14)*



**From left: Dan Klemme, Jennifer Schommer, Chad Hoyt, Keith Stein, and Nathan Lindquist celebrate the "fall of Quincy Market" during their "siege of Boston" with the obligatory "jump" photo.**



**Bethel participants at the 2012 ALPhA BFY Conference: Chad Hoyt, Richard Peterson, Sarah Venditto, Keith Stein, Ben Heppner (not shown – Nathan Lindquist)**

*(Continued from page 13)*

preceding the 2012 American Association of Physics Teachers (AAPT) Summer Meeting. Four Bethel physics faculty and two physics majors participated at the BFY conference in the following capacities:

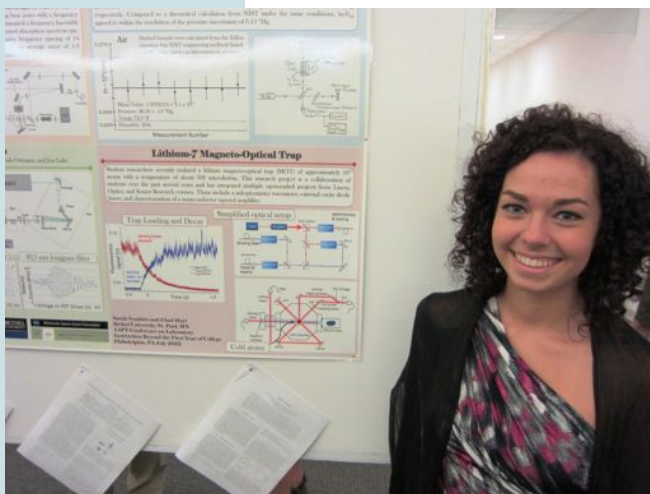
Professors Chad Hoyt,

Nathan Lindquist, and Keith Stein each led workshops to audiences of physics instructors on active advanced laboratory project areas in the Bethel physics department. The workshop titles were “External cavity diode lasers and iodine spectroscopy” (Hoyt),

“Surface plasmons, atomically-smooth patterned gold, and bio-sensing” (Lindquist), and “Fluid Diagnostics: Compressible Flow and Shock Waves in a Benchtop Blowdown Tunnel” (Stein). Professor Richard Peterson led a workshop on the review of NSF advanced laboratory Transforming Undergraduate Education in STEM (TUES) program proposals.

Physics students Ben Heppner and Sara Venditto both presented student research at the BFY poster session. The poster presentations were entitled “The supersonic blowdown tunnel: a flexible apparatus for open-ended undergraduate research” (Heppner, Stein, Pengxue Her, and Mark Turner) and “Lasers and Optics open-ended projects at Bethel University” (Venditto, Hoyt, Dan Mohr, and Andrew Stephan).

*Article courtesy of Dr. Keith Stein.*



**Sarah and Ben in action during the BFY poster session.**

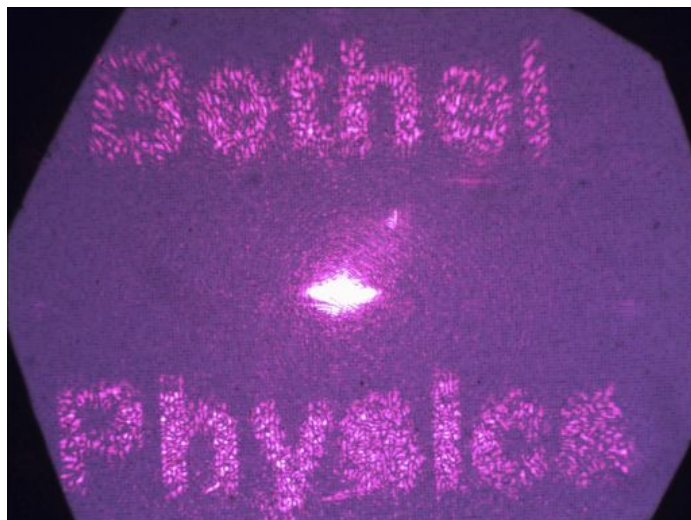


## Research Update: Dr. Nathan Lindquist

There was a lot happening in Dr. Lindquist's labs this last year. Projects ranged from microfluidics and biosensing, to nanofabrication and atomic force microscopy, to surface plasmon optics and computer generated holography. Dr. Lindquist's research tends to focus on the very small: micro- and nano-structures, and how light and matter interact on those scales. This particular field of nanotechnology and physics is called "plasmonics" because of the "plasmons" that are created by light interacting with electrons. These "plasmons" can have a wide variety of interesting applications, from solar technology to biosensing, or from optical computing to data storage. Dr. Lindquist's research, with the help of some very capable students (Carter Eiden, Pengxue Her, Miranda Olson, Lauren Otto, Matt Robbins, Ben Stein,

Mark Turner, and Andrew Zabel), is currently all about "sensors." How do we detect small (and potentially dangerous) molecules? How do we tell what molecules they are? How do we deliver small amounts of those molecules to our sensors? How do we make such small optical sensors? Can we detect just one molecule at a time? How cheaply can we make these small sensors?

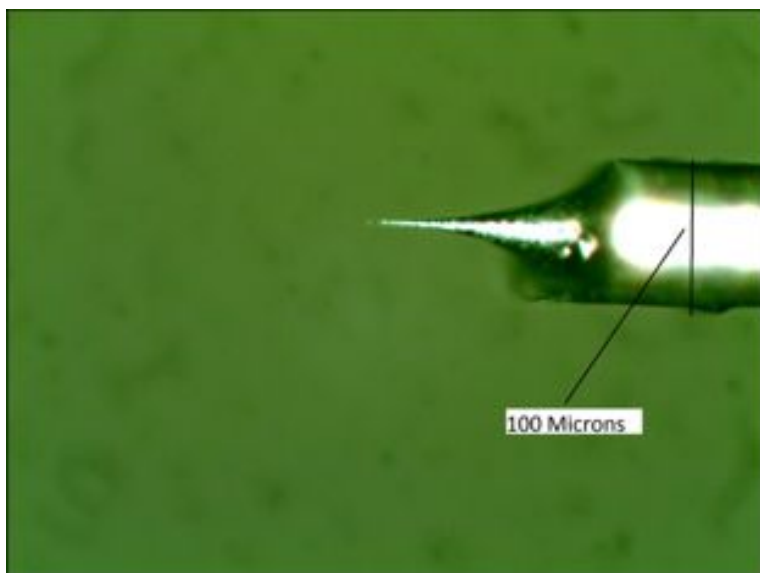
Dr. Lindquist has been spending some time consulting for two companies. These projects had the help of students (Pengxue Her, Miranda Olson, and Mark Turner) over the summer of 2012. One of the projects was building an "electronic nose." By the end of the summer, we were able to "smell" small amounts of ethanol in the air. The other project dealt with making plasmonic sensors as cheap as possible for the detection of diseases and pathogens.



**A micro-sized computer generated hologram. Dr. Lindquist likes studying very small-scale optics, especially the interaction of "shaped light" with nanostructures. The letters here are only a few micrometers wide. By controlling light on these small scales, Dr. Lindquist hopes to find applications in biosensing, "chemical imaging," and diagnostics. Image courtesy of Lauren Otto, 2012.**

Both of these projects are funded and ongoing.

*Article courtesy of Dr. Nathan Lindquist.*



**(left) An extremely sharp tungsten wire produced in Lindquist's labs. The tip is only a few 10's to 100's of nanometers wide. (right) A small "BU" etched in a soft gold surface with the tip and then imaged, like a record player, with the same tip. The letters are a few micrometers tall, and the lines are less than 500 nm wide. Images courtesy of Matt Robbins, 2012.**

## **Bethel University Physics & Engineering Newsletter**

*Newsletter article and photo submissions to Dr. Beecken (beebri@bethel.edu) or Dr. Stein (k-stein@bethel.edu) are welcome and appreciated.*



### **About Us**

We normally graduate more than twenty students each year, including engineering students. Most of the engineering majors get a double major in physics. The American Institute of Physics lists us as one of the top ten undergraduate physics departments in the nation in terms of number of physics majors. We rank second in the state of Minnesota.

Both physics and engineering courses strengthen students' problem-solving skills and analysis abilities. Our engineering program has a stronger emphasis on practical application of course material for solving real-life problems, whereas our physics program has a stronger emphasis on how the fundamental laws of physics undergird these problems.

<http://cas.bethel.edu/academics/departments/physics/>

# **CLASS OF 2012**



**(Above) Spring 2012** Back row from left: Dr. Beecken, Dr. Lindquist, Steve Olson, Andrew Zabel, Tim Peterson, DJ Arend, Luke Eberly, Tim Gustafson. Middle row from left: Kayse (Lee) Maass, Jennifer Schommer, Lauren Otto, Dr. Hoyt. Front row from left: Dr. Greenlee, Dr. Stein. Not pictured: Carter Eiden, Nathan Holm.



**(Right) Fall 2012** From left: Dr. Greenlee, Jay Ripley, Luke Thompson, Dr. Beecken.