Department of
PHYSICS alumni newsletter
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NDSU NORTH DAKOTA STATE UNIVERSITY

December 23, 2018

Greetings Alumni and Friends

I wish one day I would teach a 700-level graduate course, say in electromagnetism (one of my favored subjects), and there would be more female than male students in my class.

Diversity is an issue for many physics departments nationwide. We too struggle with it, both in terms of gender and minorities. For as long as I have been a faculty member at NDSU, physics students and faculty alike were dominated by whites and males. Like many other departments, we are trying our best to create a welcoming climate for everyone and to foster an inclusive culture. But the process of diversifying the student and faculty body is slow and less straightforward than I anticipated: Encouraging qualified woman to apply to a faculty position in our department becomes meaningless when there hasn't been an open faculty position for years. Pursuing the goal to recruit more female undergraduate physics majors is laudable but we actually need to attract more physics majors irrespective of their gender if we want our program to remain competitive and have a continuing impact. And this all applies to woman as well as to minority students and faculty. There are some physics programs in the US that face discontinuation, others have managed to diversify and grow. Where are we, and where will we go? What I know is that we must play an active role in this process; being passive makes us part of the problem.

There is some light on the horizon. I do actually teach a 700-level graduate course in electromagnetism this semester – and out of my seven students four are female. In fact, I found my students – all of them – creative, collaborative and inspiring each other. And there is more. We hired our first graduate student through the APS Bridge program, which aims to increase the number of physics Ph.Ds awarded to underrepresented minority students. So the light (that on the horizon) is faint but it is clearly there.

Sylvio May,
Department Chair

Reflections on Transitioning to Graduate School

By THOMAS BLOMMEL

Now that I have completed my first few months of graduate school at the University of Michigan, I look back and realize just how well my undergraduate education at NDSU prepared me. The three things you will do in graduate school are take classes, do research, and TA for courses, a successful student must be able to balance all three while still remaining sane. At NDSU, I was able to do all three of these things through undergraduate research, being a lab TA and Learning Assistant and taking my normal course load. I learned how to properly allocate time to all three of these things while still having time for myself and my hobbies. This has proved invaluable in graduate school and has allowed for a seamless transition into life as a graduate student.

First off, I cannot stress enough the importance of participating in undergraduate research and taking advantage of opportunities to present your research. Through the application and admission process, I was made aware of how strongly schools consider an individual's research experience. After all, you are primarily in graduate school to conduct research. During my time at NDSU, I found that the faculty were more than happy to take on undergraduate research students. I worked with Dr. Wagner for close to three years and at first I was nervous to approach him and ask him to do a research project with me, but I was welcomed into the research group quickly and was given the time and resources necessary to succeed.

Not only is conducting research important, you must also be able to convey your results to an audience. NDSU also offers many opportunities to present your research, something that will look very impressive on an application. The NDSU Explore Undergraduate Research Showcase is a great opportunity to present either a talk or a poster. The Physics Department also holds the Red River Valley Physics & Astrophysics Undergraduate Research Symposium where you can present alongside other physics students from nearby universities.

I also encourage anyone with an interest in research to apply for REUs, NASA internships, etc. These give you the opportunity to do exciting research for a summer and have the added benefit of paying well and being incredibly fun. My Junior year I applied to 12 REUs and 15 NASA internships and ended up spending the summer in Davis, California doing physics research and making a lot of new friends. The faculty in the physics department were very helpful in applying to these opportunities and anyone interested should look into them and talk to faculty about applying.

NDSU also offers many opportunities to teach labs and be a learning assistant for introductory courses. Taking advantage of these opportunities helped me to more fully understand the fundamental concepts taught in undergrad and use them as a base to build upon in my upper level classes. Graduate schools also see this as a good indicator for success as you will be expected to teach intro courses in order to receive funding. I have found that my ability to effectively teach lab sections in graduate school stems from my experiences teaching in undergrad.

Within the Physics department at NDSU, I found that the faculty really want you to succeed and will do anything they can to help you along the way. I am very thankful for my time spent there and owe the faculty and my fellow classmates a great deal of gratitude for taking the time to invest in me as a student, researcher, and person.

Visiting Student from Germany

By ALEXANDER WAGNER

Aleksandra Pachalieva is a Ph.D student in the Department of Mechanical Engineering at the Technical University of Munich since July 2016. She completed her MS degree at Scientific Computing and Engineering in the Department of Informatics also at the Technical University of Munich. Her research interests encompass a wide range of fluid mechanics and thermodynamics using high-performance computing. The major project for her Ph.D. is the modeling of heat transfer using lattice Boltzmann methods. From the end of August until the end of November 2018, Aleksandra was a visiting scholar in the Department of Physics at North Dakota State University working on a Molecular-Dynamics-Lattice-Gas (MDLG) analysis tool with Dr. Alexander Wagner. The main goal of her stay was to continue the development of the MDLG analysis tool in order to define a unique collision operator. Briefly after departing Aleksandra emailed the following lines:

"Thank you for the amazing time at NDSU's Department of Physics. It was a pleasure for me to work with Dr. Alexander Wagner and his group. We made significant progress during my short stay at NDSU and obtained very interesting results that we are planning to publish in the foreseeable future. I collected valuable experience, and I am looking forward to coming back to Fargo in order to continue the research on the MDLG analysis tool with Dr. Alexander Wagner."

Aleksandra Pachalieva and Skye

Private Sector Physics

By MARSHALL BREMER, R&D SCIENTIST, APPAREO SYSTEMS

I entered NDSU as an electrical engineering major because I thought school was where I would learn an occupation. After a couple of years of soul searching, I found that physics and its creative way to solve problems was my real passion. In a way, this is a typical experience of college students: start somewhere and find what you love. Eventually, however, you have to find a job.

Marshall Bremer

Industry or academia? Although there are other options, that is a common question for physics students looking toward the future. I didn't know any scientists until I met my professors at the university, and for many years after, that was the occupation of every scientist I met. It becomes hard to see any alternative careers. On the other side, the seeming rarity of industry scientists means that the job descriptions and the human resource pipelines are geared toward those with engineering degrees.

Companies that have physicists, however, love physicists! Once a few physicist "seeds" take root in a company, the job descriptions shift and there is more patience for applicants that don't have some specific software knowledge that is ubiquitous in engineering. This is what is happening at Appareo Systems. We

have a strong focus on R&D and need more people that can dive deep into difficult problems and rapidly learn new skills. Certainly, we are not the only ones. The rapidly changing technological landscape puts a premium on adaptation, breadth of knowledge, and the ability to solve hard problems. Physicists are highly valued in industry, you just might have to do a bit more work in convincing them to give you a chance.

So why choose industry over academia? Let me just speak from experience. I have worked on diverse projects in my 4+ years at Appareo, including: applications of spectroscopy, machine vision, fluid dynamics, inertial measurements, artificial neural networks, acoustics, sensor fusion, and camera development for agricultural or other applications. I've written embedded software that is deployed on products out in the world and I think I am making a real impact on my industry. There are drawbacks, too. It can be exhausting to learn new skills or dive into a new problem only to have the project canceled because the business case is weak, and sometimes I have to leave a deeper understanding of a physical concept on the table because there are more pressing problems. Overall, I love the opportunity to learn broadly about new technologies and look for solutions at the confluence of multiple disciplines.

I hope you will explore the opportunities that industry can offer as you ponder the future, and keep in mind that there is no "soul selling" needed to work at a company. Revenue is required to keep the business alive, but talented people are attracted to interesting work and the best work is produced when people believe in what they are doing. Business leaders, too (at least at Appareo), want to make a big and good impact on the world, even at the expense of the bottom line. While you explore, keep in mind that the job/internship descriptions may have been written for engineers, but you are still qualified. You will probably have to learn to deal with rejection, but there are plenty of opportunities for physicists hungry for a job in industry.

Avenues of Scientific Discovery

The winners of the booth competition present their awards. The Physics booth leader, Wyatt Davis, is on the right.

Avenues of Scientific Discovery is an annual outreach event that makes science approachable for high school students and is run by graduate students. It showcases different scientific fields of study and allows high school students to experience what science is all about. The 2018 Avenues of Scientific Discovery event was another big success thanks to the many graduate students who offered a workshop booth and/or volunteered as an event coordinator. In total there were 183 students from 5 area schools that had the opportunity to visit 13 booths. Wyatt Davis, Brian Farlow, Tim Twohig, Reza Parsa, Alistair McInerny, Jamie Froberg, Brianna Santangelo, and Deyan Mihaylov prepared and conducted experiments for the physics booth. After the event, the high school students cast their vote for their favorite booth. The Physics booth came in at a 3rd place. Congratulations to all winners!

Graduate Student Wyatt Davies (right) presents the van de Graaff generator, April 2018.

Orv Swenson Wins Teaching Award

Our faculty member Orv Swenson is the recipient of the 2017-18 Teaching Award of the College of Science and Mathematics. Orv received his BS and MS degrees from NDSU and his PhD degree in the field of Laser optics from the Air Force Institute of Technology. He has been employed through NDSU since 1993, first as a Research Associate in the Department of Chemistry and then, since 1997, as Associate Professor in the Department of Physics.

Among the essential components of our physics curriculum are the interdisciplinary optics/photonics course sequence and a state-of-the-art optics teaching laboratory. Both were designed and further developed by Orv over a timespan of almost two decades. His teaching of our three optics-related courses and their corresponding lab components have resulted in excellent student evaluations that are well above our departmental averages. Our department has benefited tremendously from Orv's experience as teacher and from his recommendations regarding course and lab design. In his role as long-time chair of

our departmental lab committee, Orv has been responsible for maintaining and improving our lab design and equipment. The Department of Physics teaches about 50 lab sections for 14 courses every year. We also wish to point out Orv's numerous other instruction-related service contributions that range from judging at Science Fairs/Olympiads, mentoring Governor's School students and McNair scholars, and working in a multitude of graduate committees, to serving as our college representative for the General Education Committee, and in the College Curriculum Committee.

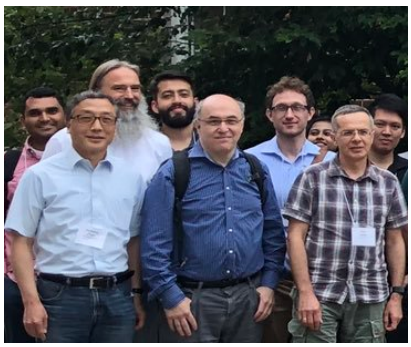

Orv Swenson

When looking retrospectively and asking who made truly significant and lasting contributions to our instructional facilities and to the learning of our students, Orv stands as a rock in an ever-changing (and occasionally turbulent) sea. Orv is a humble person who cares about how his students learn much more than how other people perceive the learning of his students. Our college's Teaching Award is a well-deserved recognition for Orv's long and successful instructional career.

Discrete Simulations of Fluid Dynamics Conference

By ALEXANDER WAGNER

As some of you may remember, we organized a Discrete Simulations of Fluid Dynamics (dsfd.org) conference at NDSU in 2011. In 2018 the conference returned to the US to Worcester Polytechnic Institute in Massachusetts. The local organizer was Erkan Tüzel who did most of his graduate work at NDSU with Daniel Kroll. This years' conference was co-organized by Alexander Wagner, who also revived the conference's twitter account `@DSFD_Conference` where you can find more pictures from the conference. The best poster award was given to Aleksandra Pachalieva, who wrote about her visit at NDSU elsewhere in this newsletter.


Alexander Wagner, 3rd from left

The conference had a good attendance, and included a number of excellent speakers. The most recognizable to you would probably have been Stephen Wolfram (5th from the left on the image), the founder of Wolfram Research and creator of Mathematica. His scientific heritage is also with lattice gases and cellular automata. In fact the reason for his leaving academia was that a Physical Review Letter submission of his on this subject was rejected, while a rival publication by Frisch, Hasslacher and Pomeau was accepted. The latter is now regarded as the seminal paper that started the discrete simulation of fluid dynamics sub-field, and in an unexpected twist, by deflating Wolfram's enthusiasm for academia, the paper also accelerated the development of the Mathematica software. Next years' conference will be held in Bangalore, India.

2017-18 Awards, Graduates, Donors

Faculty Awards:

CSM Award for Excellence in Teaching: Orv Swenson

Student Awards:

Horvik Award: Jordan Brainard, Alexandra Haines, Patrick Pochant

Sinha Scholarship: Tucker Lehr, Vijay Shah, Christopher Sorensen

Physics Achievement Award: Thomas Blommel, Vijay Shah, Carly Snell, Braden Weight

Darrell and Carol Strobel Graduate Student Research Award: Jamie Froberg

Darrell and Carol Strobel Undergraduate Student Research Award: Carly Snell, Thomas Blommel, Braden Weight, Tyler Weyer

Graduates:

Gabriel Ferragut (BS Physics, Fall 2017); Thomas Blommel, Thomas Krizan, Tyler Weyer, Carly Snell, Braden Weight (BS Physics, Spring 2018); Daron Dykes (BS Physics, Summer 2018); Kent Ridl, Cody Gette, Vijay Shah, Brian Farlow, Wyatt Davis (MS Physics, Spring 2018); Guilherme Volpe Bossa (PhD Physics, Fall 2017); Aaron Feickert (PhD Physics, Spring 2018)

Donors:

Darrell Strobel, Dan Chen, Harold and Anne Korb, Scott Fricke, Kevin and Harriette McCaul, Scott A. Wood, Ping and Yun He, John Daly, Mark Novotny

The Department of Physics wishes to thank all donors who have contributed to our scholarship programs. You are making a significant difference in the lives of our students.

Your continued financial support is requested to keep the scholarship and awards programs growing.

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Thank you!

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PO Box 6050
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patty.hartsoch@ndsu.edu