NORTH DAKOTA STATE UNIVERSITY Summer 2011 http://www.ndsu.edu/physics

Physicist Named NDSU Provost!

Physical scientists as top administrators? It's almost a trend in the Upper Midwest. First, Eric Kaler (a distinguished Chemical Engineer – who likes surfactants and colloids, statistical mechanics, and thermodynamics – who had most recently been Provost and Senior Vice President for Academic Affairs at Stony Brook University) was named the 16th President of the University of Minnesota last November, and now Bruce Rafert, Vice Provost and Dean of the Graduate School and Professor of Physics and Astronomy at Clemson University, has been appointed as NDSU's new Provost. A physicist will now be the chief academic officer of NDSU, and provide increased coordination of all university scholarly and instructional activities. The Vice Presidents for Research, Creative Activities and Technology Transfer; Agriculture and University Extension; Information Technology; and Equity, Diversity and Global Outreach will report to the President through the Provost. Dr. Rafert has had a key role in elevating Clemson to one of the top doctoral public institutions in the nation and has helped build a portfolio of graduate programs of national distinction. With his background as a physicist, it will be interesting to see how his appointment impacts our department.

Another physicist, Dr. Martin Ossowski, has been named Director of NDSU's Center for Computationally Assisted Science and Technology (CCAST). Dr. Ossowski will work to enhance the capabilities of the Center to provide scientific computational resources to researchers. Additional goals include partnering with private, government, and university sectors in support of research opportunities. NDSU researchers use CCAST's computing power to make discoveries in nanotechnology, agriculture, computer science, biotechnology, and other fields. Ossowski earned his doctorate in theoretical condensed matter physics from the University of Nebraska-Lincoln. Subsequently, he was a postdoctoral research associate in UN-L's Department of Physics and Astronomy, and worked on first-principles computational extensions to the Gordon-Kim rigid-ion electron-gas model. As a National Research Council Resident Research Associate at the Naval Research Laboratory's Center for Computational Materials Science, he worked to develop methods and algorithms for the efficient (linear-scaling) application of density functional theory. The methods developed at the Naval Research Laboratory were successfully used to study electronic, structural, elastic, and vibrational properties of complex oxides and other materials. The Center is extensively used by our faculty, and is an indispensible asset for our program.

Two major events organized by our faculty are also worth mentioning. First, Alexander Wagner is the Chair of the organizing committee of the 20th International Conference on Discrete Simulation of Fluid Dynamics, which will be held at NDSU on August 8-12, 2011. The conference focuses on the theory and applications of simulation methods for fluid mechanics that, in contrast to traditional Computational Fluid Dynamics methods, are derived from a microscopic model. These methods continue to increase in popularity because of the simplicity of the algorithms and their suitability for high performance parallel computations. More information can be found at http://dsfd.org and on page 6 of this newsletter.

Second, Erik Hobbie organized the "Summer Forum on Materials and Nanotechnology," which was held June 9, 2011, at NDSU's Reineke Fine Arts Center. The forum was planned to spur collaboration: "NDSU has grown so quickly as a research university that it can be challenging at times for faculty and researchers working in related but traditionally distinct fields to find areas of common interest," said Erik Hobbie, Director of the Materials and Nanotechnology Interdisciplinary Program and faculty member in the Departments of Physics and Coatings and Polymeric Materials. "This type of event provides a setting for doing this, with the hope that it will foster larger, higher impact collaborations and grants." The College of Science and Mathematics supported the Forum because of our college's strategic plan goal to "Increase the quality and extent of research."

In other events news, James Kakalios, author of the popular science book *The Physics of Superheroes*, presented the 2011 College of Science and Mathematics Community Lectureship on May 3 at the Fargo Theatre. In his presentation, "The Physics and Materials Science of Superheroes," Dr. Kakalios described the real physics behind Spider-Man's webbing and asked questions such as: What type of metal is used in Wonder Woman's bracelets that enables her to deflect bullets? And what is the chemical composition of Captain America's shield? Dr. Kakalios has a unique ability to use comic book characters to make Physics and Materials Science accessible, interesting, and relevant for people with little if any background in the sciences. The lecture was a great success. See page 7 of this newsletter for more information.

I would also like to encourage you to read the article about our efforts to reform introductory calculus-based physics courses starting on page 4 of this newsletter. Written by Mila Kryjevskaia, a Physics Education faculty member in our department, the article provides a concise discussion of inquiry-based methods of learning, how they work, and why they are found to be effective. We are looking forward to being able to implement the changes discussed in the article.

NDSU continues to grow and improve. As noted in a recent *Wall Street Journal* article, which can be found at http://online.wsj.com/article/SB10001424052702304231204576406042109860376.html, it has also become a "hot draw for out-of-state college students." The combination of an attractive campus, excellent educational opportunities, and comparatively low tuition has made NDSU increasingly popular with out-of-state students. Currently, approximately 45% of college freshmen in North Dakota come from another state. We expect this trend to continue. This, coupled with the dramatic increase in annual research expenditures and quality of research – in February, the Carnegie Commission on Higher Education reclassified NDSU as a "very high research activity" institution, placing it among the nation's top 108 private and public universities – bodes well for the future. It really is an exciting time to be at NDSU.

In closing, I'd like to reiterate that we are particularly interested in developing a closer relationship with our Physics alumni, and want to use this newsletter as a venue for you to communicate information about your life, career, and family to friends from your time at NDSU. Please provide the department with news for our next newsletter.

Finally, I would like to personally thank all of you who have contributed to one of the department funds that have enabled us to recognize outstanding undergraduate scholarship. Further information regarding these funds and scholarships are provided in the body of this newsletter. Please continue to provide support for these very important scholarship funds.

I encourage all of you to send us a note about your life after NDSU and to come by the department when you are in the area. We would enjoy showing you around and sharing stories about physics and NDSU.

Daniel Kroll, Department Head
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NDSU Department of Physics Newsletter
Editorial Staff
Patty Hartsoch
Daniel Kroll
Landon Bladow

What NDSU Physics Has to Offer

The Department of Physics at North Dakota State University provides a rigorous education in physics and its applications. Students acquire knowledge and skills that provide a deeper understanding of nature, ranging from the physical laws' inherent beauty to the latest technological opportunities. We foster a climate of creativity, critical thinking, and investigational curiosity, where students thrive and instructors care. Being part of a research university allows our students to become involved in first-class research projects; i.e., design and perform experiments, develop modeling concepts, and perform computer simulations. Our threefold departmental research focus on soft condensed matter, polymer physics, and physics education research provides a unique environment that students and faculty alike find inspiring and fulfilling.

DEPARTMENT NEWS

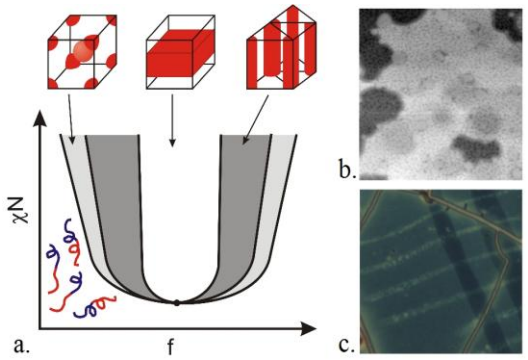
New Faculty

ANDREW CROLL
ASSISTANT PROFESSOR OF PHYSICS
NDSU APPOINTMENT FALL 2010

It has been an exciting and busy first year for me here at NDSU. I have spent this time training graduate and undergraduate students, teaching, building equipment, and setting up my laboratory in a temporary space provided by the Department of Coatings and Polymeric Materials. By the end of this summer my lab will be moved to a state-of-the-art space in the new Batcheller building, as part of the fledgling Materials and Nano-technology Program.

My group is investigating many different problems, but focuses on the physics of diblock copolymers. Polymers are long chain molecules made by repeatedly joining a particular type of molecule (the monomer) together. In the simplest case, a polymer is a spaghetti noodle – all the monomers are joined in a line. However, chemists have many schemes for altering this geometry, for example making loops or multiply-branched structures. Diblocks, as they are known, are a peculiar variation of a polymer chain in which two different linear polymers are joined together at one end. This simple change leads to nanoscopic patterns, unique materials properties and some very complex physics (see Figure 1).

Figure 1



a.) A block copolymer phase diagram. The state is determined by a control parameter (the Flory-Huggins parameter, χ, times the number of units in the polymer, N) and the volume fraction, f (the length of the A block divided by the length of the B block). As χN goes up, the diblock changes from a disordered (mixed) state to one of several microstructures. As f is increased to 0.5 the state changes from spheres of A, to cylinders of A, and then to sheets of A (lamellae) separated by the B polymer. b.) An Atomic Force Microscope (AFM) image of the complex morphology formed in a binary mixture of two diblock copolymers. The grey scale represents height in this image. c.) An optical microscope image of a thin lamellae forming block copolymer film that has been forced to form surface structures. Due to Newton's interference, each greyscale represents a different lamella – and a height difference of 13 nm!

To get a feel for why a diblock might display some unusual behavior, one should think about what happens when two ordinary fluids are mixed. In some cases, the two fluids will stay mixed – such as alcohol mixed with water. In other cases, for example when oil is mixed with water, the fluids separate from one another into oil rich and water rich domains (the fluids phase separate). Now consider a diblock where a polymer of type 'A' is joined to one of type 'B' and imagine how phase separation might look. A is attached to B so it cannot get away – the domains that form are limited to the size of the polymer molecules! With polymers, this means domains that are on the order of nanometers (10^{-9} m) spontaneously form.

From a physical point of view, it is an interesting question to ask how does this material get from a homogeneous (well-mixed) state to one in which all the A polymer and B polymer have separated from one another. This requires the material to traverse a phase transition, similar in spirit to the more familiar change from ice to water. However, the transition does not end in an ideal lattice but in another fluid-like phase which is still dominated by entropy. This kind of phase transition is a very ideal 'soft' phase transition, characteristically dominated by fluctuations. Our group is currently hard at work trying to understand and manipulate the diblock copolymer order to disorder transition.

Education & Research

Materials and Nanotechnology Program

Erik Hobbie

The Materials and Nanotechnology (MNT) Center of Excellence is almost completed, with a tentative move-in date of August 1, 2011. This facility is located on the second floor of the north half of the Batcheller building in the NDSU Research and Technology Park. It will feature state-of-the-art lab facilities, and was designed and outfitted under the guidance of two NDSU Physics faculty, Erik Hobbie (MNT Director) and Andrew Croll. The Physics Department is excited to finally see this facility come to fruition. It will immediately provide graduate students in Physics and Materials and Nanotechnology a world-class venue for conducting competitive research in nanotechnology-related materials.

The June 9th Materials and Nanotechnology campuswide forum held at the Reineke Fine Arts Center here at NDSU was a big success. Presenters from NDSU, Texas A&M University, and Tecton Products participated. The event was open to corporate and university researchers and students in Materials and Nanotechnology. More than 25 presentations and poster sessions were scheduled for the forum.

“The goal of the forum is to provide researchers in materials and nanotechnology at NDSU a venue to communicate with each other and initiate larger, higher impact collaborations,” said Erik Hobbie, organizer of the event and director of NDSU's Materials and Nanotechnology graduate program.

NDSU's Materials and Nanotechnology program offers students an opportunity to participate in interdisciplinary research. It is the only program of its kind in North Dakota. Faculty from Chemistry, Civil Engineering, Coatings and Polymeric Materials, Mechanical Engineering, Physics, and Pharmaceutical Sciences contribute to the Materials and Nanotechnology program. Researchers in the program also collaborate with the Center for Nanoscale Science and Engineering at NDSU.

For more information on the forum or NDSU's Materials and Nanotechnology graduate program, contact Hobbie at erik.hobbie@ndsu.edu or 701-231-7049.

New Ways to Learn About Science

Landon Bladow

Non-science majors now have two new ways to fulfill the university’s general education requirement of 10 credits of science coursework. First is a new course spearheaded by Kevin McCaul, Dean of the College of Science and Mathematics, aimed at students who would benefit from an overview of all the sciences. Titled “Foundations of Science” (University Studies 150), it is a three-credit, team-taught course that covers highlights from the major science disciplines, with each instructor giving 7-8 lectures and an exam from their respective area. The course was first taught Spring Semester 2011, and the instructors included Landon Bladow (Physics), Victoria Johnston-Gelling (Chemistry/Coatings), Bernhardt Saini-Eidukat (Geosciences), Gary Clambey (Biological Sciences), and Mark Nawrot (Psychology/Neuroscience), with McCaul as course coordinator. It is interesting to note that, by neglecting the mathematical details, many of the basic concepts of physics can be surveyed in only seven 50-minute lectures! The course appeared to be well-received by the approximately 40 students who completed it. It is planned to be offered every spring semester.

Secondly, the Department of Physics has ventured into the realm of online courses with an online section of Physics 120 (“Fundamentals of Physics”), which is our three-credit, liberal arts physics course. In addition to being a general education science elective, this course is a requirement for various majors. The online version was developed by Assistant Professor Landon Bladow, who also teaches the traditional version of the course. The online course material includes a series of recorded lectures and course notes by Bladow and links to various web simulations and video demonstrations. Homework is assigned as in our traditional introductory classes with the LON-CAPA online homework system. Exams are generally taken on-campus or with a proctor off-campus. The course was first offered Spring Semester 2010, and we hope to offer it once per academic year in the future.

Reforming Introductory Calculus-Based Physics Courses

Mila Kryjevskaia

It would not be a big exaggeration to say that many of us, at some point, wondered about the nature of the human mind. What processes in our brains allow us to think and learn? Why do some people enjoy pondering over challenging problems, while others want to know the solution right away? Many of us experienced a moment of excitement following a long period of frustration when we finally realized that we “got it” – we solved a problem that preoccupied our mind for a long time. What happened in our brains at the moment when (finally!) all the pieces fell into place? Although I believe the answers to these

questions still lay in mostly undiscovered territory, over the past few decades, cognitive scientists made major progress in studying the human mind and how people learn. At the same time, physicists whose area of expertise is physics education research, using empirical investigations, suggested key principles of how we should teach physics. Combined, the emerging body of research has important implications for new approaches to curriculum development and classroom instruction that are substantially different from traditional methods of teaching.

I would be wrong to suggest that the new approaches to teaching are entirely dictated by resent research findings. While such findings certainly provide a solid research base for reformed instruction, the major push for implementation of instructional innovations is due to the reality of the quickly changing world around us. Indeed, just half a century ago, education typically focused on teaching basic skills of reading, writing, and calculation. Now, however, many educators place greater emphasis on the development of reasoning skills that allow students to determine solutions to challenging problems on their own, transfer their knowledge to unfamiliar situations, and defend their arguments. In other words, the goal is to prepare intelligent thinkers. After all, such individuals have higher chances for success in almost every modern productive work environment and respond more quickly to a rapidly changing, highly competitive world. In order to develop necessary thinking skills, however, traditional instruction based on transmission of facts and problem-solving algorithms is not enough anymore. As an illustrative example, suppose one is to teach younger students how to use a word processing program. An instructor may choose to provide a list of keys with their functions and ask students to memorize this list. This approach may appear to be an effective instructional strategy in the short run. However, guiding students to explore and figure out the principles of the word processing design and organization may prove to be much more beneficial in the long run. Dr. Stanley Pogrow of San Francisco State University uses technology and questioning techniques to help pre-college students develop higher-order thinking skills. Such questions as "What do you think *Escape* key will do?" encourages students to make a prediction and relate the concept of *Escape* command to ordinary usage of this word in everyday language, check their predications, and ultimately generalize their findings. Researchers found that the latter approach not only helps young children develop mastery of a specific computer program, but also leads to an accelerated ability to transfer acquired skills to learning new, more complex, programs as well.

The introductory calculus-based physics courses in our department are currently offered in a fairly traditional format with four hours a week dedicated entirely to lecture instruction. Students are also encouraged to register for an independent laboratory course. In order to place greater emphasis on instruction that will engage students in the active process of learning, we plan to change the current format of our courses. The number of lecture-hours will be reduced from four to three each week, with a 50-minute small-group recitation session dedicated to *Tutorials*. *Tutorials in Introductory Physics* are a set of research-based instructional materials developed by the Physics Education Group at the University of Washington. Typically, tutorial sessions have between 20 and 24 students working in groups of three or four through carefully structured worksheets that are specifically designed to address common student conceptual and reasoning difficulties identified by research. Two teaching assistants (TAs) circulate around the room. Since the ultimate goal of tutorials is to create an environment in which students construct their own understanding, develop good thinking habits, and become accustomed to voicing their own opinion, TAs do not teach by lecturing or by answering student questions. The role of TAs is to stimulate student interactions and to guide students by questioning rather than by simply providing clear explanations: students must be given opportunities to take charge of their own learning and discover reasoning strategies that are productive in helping figure out answers to challenging questions.

Tutorials not only help students refine their thinking skills, but also facilitate a deeper understanding of physics content. Specifically, research shows that students come to classrooms with already existing, often very strong, views about how things work based on everyday life experiences. Students often use their intuition or gut feelings that tend to be in disagreement with basic physics principles and concepts. Typically traditional lecturing does not facilitate the reconciliation of any inconsistencies between student pre-existing ideas and the "correct" ideas suggested by instruction. In fact, traditional lecturing does not make students aware of their pre-existing knowledge. As a result, many students (even those who can successfully repeat the material covered in lecture) when presented with unfamiliar situations often fall into the trap of their pre-existing incorrect ideas and fail to determine a correct answer. "Raw intuitions" or "gut feelings" should not be ignored, but rather directed toward the construction of coherent understanding. Research suggests that during instruction, students must be given explicit opportunities to become aware of their pre-existing ideas, analyze such ideas, modify them, or replace with new ones, if necessary. Tutorials are specifically designed to address the most common incorrect ideas by employing an *Elicit-Confront-Resolve* instructional approach. Asking students to make predictions about an outcome of a particular experiment often serves as an effective tool for eliciting student difficulties. Students commit to their predictions and explain their reasoning. Thoughtful ideas, which may or may not be correct, typically stimulate discussions among students that are more valuable to the learning process than the articulation of a memorized response from a textbook. In order to confront difficulties, students are presented with some evidence that enables them to recognize whether or not their predictions are correct. In the face of contradictory experimental evidence, students who made incorrect predictions are motivated to revise and further develop their understanding. These students are guided through the steps necessary to modify their original ideas or replace them with new concepts consistent with the evidence. The tutorial approach described above also builds students' confidence in their own abilities to solve challenging problems.

The tutorials will provide additional opportunities for involving undergraduate physics majors in teaching and physics education research activities. We plan to recruit our advanced undergraduates to serve as tutorial TAs. We are very excited about this opportunity. In the past years, the department faculty worked with a group of talented, highly motivated undergraduate physics majors who served as TAs in introductory physics courses. One of these students, Cody Gette, a physics senior, received a

prestigious scholarship from the Astronaut Scholarship Foundation. Cody also revealed his passion and high capacity for teaching when he volunteered to guide tutorial sessions offered to our incoming physics majors. Bryce Hins, a physics senior whose name regularly appears on the Dean's List, together with Joseph Miller, currently a graduate student in the Materials and Nanotechnology graduate program, have been successfully teaching introductory laboratories and contributing to grading and providing valuable feedback on exam and homework questions. We are therefore confident that our physics undergrads will contribute substantively to the learning environment in introductory physics courses and, hopefully, also boost our recruitment efforts.

Currently, the department does not have sufficient resources to implement tutorials for *all* introductory students: tutorials are currently only offered for physics majors. Although this method of teaching has proven to be very effective, it is also somewhat costly. With around 300 students enrolled in introductory calculus-based physics courses every semester, the department needs to come up with funding to pay for an additional 24 TA-hours a week. A part of this cost may be covered by a federal grant for which we applied this year. If awarded, the grant will support research on the effectiveness of tutorial implementation with our student population and will provide some financial support for our undergraduate TAs. If readers have questions or comments, or would like to consider a gift in support of our efforts, please contact Mila Kryjevskaia at mila.kryjevskaia@ ndsu.edu (Tel: 701-231-9756).

Events

An International Conference Comes to Fargo

Alexander Wagner

This summer, August 8-12, 2011, we will host the international conference on Discrete Simulation of Fluid Dynamics (http://dsfd.org) in Barry Hall, which is located in downtown Fargo just west of the Federal building. You may remember that we mentioned this conference in our last newsletter when we announced that Fargo had been chosen as the venue for this prestigious conference, which has most recently been held in Rome, Italy, and Beijing, China.

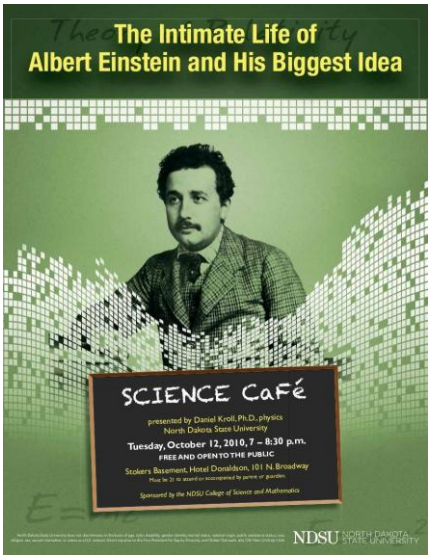
Much has happened in the meantime. We have worked hard to raise over $50,000 in sponsorship from various sources, including the National Science Foundation, the North Dakota Chamber of Commerce, the ND Experimental Program to Stimulate Competitive Research, the Vice President for Research, the College of Science and Mathematics, the Intel Corporation, NVIDIA, the Provost, as well as our Physics Department. We have an impressive field of invited speakers and have accepted over sixty submissions for contributed presentations. If you are interested, you can find the abstracts for the talks of the invited speakers on the website, http://dsfd.org. We expect about 100 attendees from 20 countries with about a third of the participants coming from the United States, making this a truly international conference. This will be the first time that most of the participants have visited Fargo, and for an appreciable fraction, it will be their first time visiting the United States. It puts our Physics Department in the limelight, giving us the opportunity to increase our international stature.

There are two main categories of presentations at the conference. The first contains subjects related to new algorithms or improvements of existing algorithms, including more efficient implementations on specific architectures, notably NVIDIA's graphics processors. The second category includes applications of these methods to problems in a wide variety of fields including basic Physics, Civil, Chemical, and Mechanical Engineering, Geophysics, and Food Processing.

To facilitate the informal exchange between the participants and to give them a flavor of the Great Plains, we will have a conference outing. We have planned a Native American and Nature theme. Participants will be going to Buffalo River State Park, which is conveniently located at the ancient shores of Lake Agassiz and contains some of the last remaining pieces of untilled prairie. We will have a performance by Mandan-Hidatsa storyteller and musician Keith Bearan. We will also have a presentation on Native American culture by Clifford Canku, professor of Dakota Languages and Culture at NDSU.

There is a perception that culinary culture in the Midwest is underdeveloped compared to the coasts. To counteract this impression, we have hired Green Market Catering, led by the immensely talented Andrea Baumgarten, to provide conference lunches prepared from local organic ingredients. Morning and afternoon coffee breaks will be provided by Nichole's Fine Pastry, which many of you will recognize as the best source for fine pastries in the Fargo-Moorhead area. We are planning to hold the conference dinner on August 11 at the HoDo restaurant.

Any questions you may have about the conference can be directed to me at alexander.wagner@ndsu.edu.



Kroll Presents at Science Café

Sylvio May

Science Café is a monthly public event organized by the College of Science and Mathematics that takes place at the Hotel Donaldson (HoDo) in downtown Fargo.

On October 4, 2010, Professor Daniel Kroll, Head of the Department of Physics, presented at the Science Café "The Intimate Life of Albert Einstein and His Biggest Idea." In his talk, Dan gave a fascinating account of the events that led to Einstein's General Theory of Relativity, including his personal situation and the role of David Hilbert. For the audience at the HoDo, being guided through this highlight of Einstein's – in fact, humankind's – thinking was a memorable experience.

For information about upcoming Science Café presentations, see http://earth.physics.ndsu.nodak.edu.

Iranian Student Visits Department

Daniel Kroll

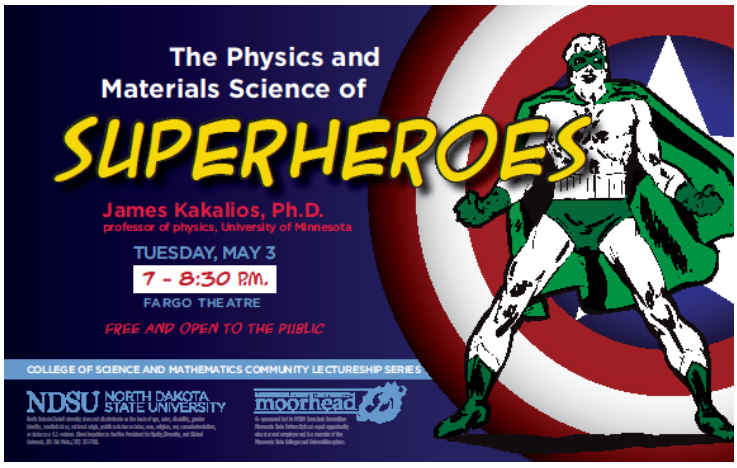
Farzaneh Taslimi, a doctoral candidate at the Institute for Advanced Simulation, Research Center Juelich, Germany, visited the department for two months this past spring. She is a student of Dr. Roland Winkler. Soft matter systems such as polymer and biopolymer solutions can display complex phenomena on the mesoscopic and macroscopic scales which are governed by hydrodynamic interactions between their microscopic constituents. Her research involves simulation studies of the aggregation and structure formation of nano-colloids (semi-flexible rods) under the influence of flow fields. The simulation methods she uses are Multi-particle Collision Dynamics (MPC) and Molecular Dynamics (MD) Simulations, techniques also used and developed by some of our faculty. She presented some of the results of her research at a May 3rd seminar entitled "Structure of End-Functionalized Rods under Shear Flow."

She enjoyed her visit, and hopes to come again before completing her Ph.D. She was particularly impressed with and enjoyed Patty Hartsoch's tradition of baking a birthday cake for faculty birthdays.

Visit from a Superhero

Sylvio May

The 2011 speaker of the College of Science and Mathematics Annual Community Lecture Series was James Kakalios. James is a physicist! In fact, he is a Professor of Physics at the University of Minnesota and is well-known for writing the popular science books *The Physics of Superheroes* and *The Amazing Story of Quantum Mechanics*.



James became our superhero the evening of May 3 at the Fargo Theatre when he gave his amazing presentation about the way Spider-Man, Wonder Woman, The Flash, and many of our other super-heroes take (or do not take) care of the physical laws. The event attracted a big crowd, including many students of our physics courses. Prior to the event James visited the Department of Physics, where he shared some of his secrets of how to make physics teaching more attractive to students. This was James' second visit to NDSU. We hope he'll come again.

Physics Outreach: Fun for All Ages

Alan Denton

What do electric motors and generators have in common? (Hint: Think magnets.) How can a needle float on water, and why does a drop of soap sink the boat? What is the shape of a soap film suspended from a wire box frame, and what happens to the film at -25°C? (Hint: Try it at home and jiggle that frame.) Does a marshmallow shrink or expand in liquid nitrogen, and how soon after dunking can you eat it? What happens when you combine vinegar and baking soda in a plastic bottle and screw on the cap? (Hint: Don't try this one at home!) These are some of the deep questions explored in Physics Outreach activities over the past year.

Last fall, several intrepid faculty and students organized and led the first ever "Science Fun Night" at Longfellow Elementary School in Fargo. Before the big event, we assembled materials for activities and rallied a team of dedicated volunteers. On the evening of October 12, a crew of amazing NDSU students and faculty, with the kind support of school staff and PTA, helped 100 keen young scientists (K-5th graders) and their parents explore the universe right in front of our noses. Participants witnessed a variety of demonstrations and rotated through several activity stations. Demonstrations ranged from cryogenics (dry ice, liquid nitrogen, superconductors) to food physics and electrostatics (everyone's favorite, the Van de Graaff generator). Hands-on activities included States of Matter, Polymer Play, Making Waves, Soapy Science, Magic Magnets, Making Motors, and the Science of Computers.

Students gather around the demonstration table in the school lunchroom.

In January, another troop of hardy volunteers trekked to Moorhead for "Science Fun Day" at the Red River Area Learning Center, hosted by the school's dedicated science teacher, Mrs. Nandini Katti. Highlights of the day – perhaps the coldest of the winter – included freezing soap bubbles outdoors.

In further outreach adventures, Alan Denton and family participated in this year's Sunday Academy, as part of the Nurturing American Tribal Undergraduate Research and Education (NATURE) program. One Sunday per month from September through March (thankfully excluding January and February), we visited tribal colleges across the state to lead a workshop called "Fun with Physics and Computers." In hands-on activities, high school students discovered the physics underlying iPods and cell phones by exploring connections between electricity and magnetism; combining electromagnetic switches (relays) to build logic gates that perform binary arithmetic; and using Game Maker to program a computer.

Students test their strength at one of the classroom-based activity stations.

Rounding out the outreach fun, the department facilitated three events at the State Science Olympiad, hosted by NDSU in April. With expert assistance from Lab Technician Paul Omernik, Alan Denton and Mila Kryjevskaia organized the "Optics" events, while Sylvio May led "Storm the Castle." A number of physics faculty also volunteered as judges at the Regional and State Science and Engineering Fairs.

ALUMNI NEWS

NDSU Alumnus Receives Distinguished Faculty Award

Orven Swenson

Dr. Feng Hong received his Ph.D. in Physics from our department in 2004, working under the supervision of Dr. Orven Swenson. He became a faculty member in the SUNY Canton Canino School of Engineering Technology in 2005, and is the 2010 recipient of SUNY Canton's Distinguished Faculty Award. The following excerpt from a SUNY Canton news release describes his accomplishments:

An innovative faculty member in the SUNY Canton Canino School of Engineering Technology has been selected as the recipient of the College Council's 2010 Distinguished Faculty Award.

Associate Professor of Physics Feng Hong, Ph.D., will be among those recognized at the College's 102nd Commencement Ceremony held at 10:30 a.m. Saturday, May 22, in an outdoor ceremony adjacent to the Richard W. Miller Campus Center.

Students and faculty members have praised Hong for his advanced mastery of the field of physics in addition to his ability to make it tangible for his students.

"Dr. Hong is one our most accomplished and supportive faculty members," said Canino School of Engineering Technology Dean David J. Wells. "Physics is a foundational topic for all of the engineering technology curricula. Dr. Hong helps students acquire the knowledge and ability necessary for their career-driven fields of study."

In addition to his teaching accolades, Hong has been integral in introducing the global community to SUNY Canton by serving as the Chinese program coordinator. He also worked as a liaison to students in the SUNY China 150 program and helped them learn adapt to college life in Canton. Many of his colleagues noted his countless hours of dedication to his volunteer work.

"His efforts and dedication have helped SUNY Canton meet with several potential partner institutions in China," said Ryan P. Deuel, the college's chief of staff. "He has helped to draw visiting scholars from China to the campus, helping SUNY Canton become a more culturally diverse and internationalized institution."

Hong has also worked on numerous grant proposals on behalf of the College for the National Science Foundation, including Women in Engineering Day, a solar energy research project for Girl Scouts funded through Corning Foundation, and a program for the Salmon River School District exposing students to science, technology, and math.

"Anyone who has had the honor of working with Dr. Hong knows that he exceeds all expectations for any given task," said Maureen P. Maiocco, director of the early childhood program and Hong's colleague. "He is passionate about the education of his students, his field of study, his colleagues, and SUNY Canton."

He received his Bachelor of Science degree in physics from Zhejiang University in China in 1986 and went on to earn his master's and doctorate degrees from North Dakota State University in 2001 and 2004, respectively. While at North Dakota State, Hong worked as a research assistant, a lab instructor, and served as a BRIN Graduate Teaching Internship Fellow, teaching both physical science and tutoring mathematics at Fort Berthold Community College.

Upon graduation from North Dakota State, he served as a postdoctoral research associate in the chemistry department at Washington State University until July 2005 when he began his work with SUNY Canton. He has won four golden apple awards from incoming Phi Theta Kappa honor society students denoting his excellence as an educator.

Hong lives in Potsdam with his wife Yimei Zhu; they have one daughter, Kaelynn.

The Distinguished Faculty Award is given annually to a current member of the SUNY Canton faculty who demonstrates a mastery of subject matter, effectiveness in teaching, the ability to contribute to the College in a scholarly way, a commitment to the College, and a desire to continue growing professionally. Hong is the 30th recipient of the award.

SUNY Canton offers a wide variety of career-driven bachelor's, associate, and certificate programs. Most of SUNY Canton's new four-year programs are designed so students can take them on-campus, online, or both. SUNY Canton OnLine features more than 100 courses online each semester. The College's athletic teams belong to the NAIA's Sunrise Conference, enabling students to compete in their respective sports for four years. Construction is now underway for the College's new Convocation, Athletic, and Recreation Center nicknamed the Roos House.

Alumni Contributions

Harold Korb (B.S. Spring 1964, together with Darrell Strobel**)** I enjoyed reading about Darrell's experiences in last year's newsletter. In the four years that I attended NDSU, there were six physics graduates, all of whom went on to receive PhDs elsewhere. Interestingly, three of the six are included in your list of 2009-2010 Donors to the scholarship funds, so you are still in our minds. The department was small, with only a few lecturers for the physics majors. Most of that task fell to Mr. Neil Johnson, who was exceptional. He convinced me that everything could be derived from first principles, a lesson that I had to unlearn later, but a worthy goal.

Following graduation from NDSU, I spent two years at Dartmouth earning a Master's degree, working in cryogenics, and then went to Bell Labs to start a career in the electronics industry. I designed the first MOS static RAM (all 128 bits!) to be manufactured in the Bell System. In those days there were no design tools for layout or circuit design, so pen, paper, and

Fortran were the tools. And if you designed it, you also got to process it and buy, install, program, and debug the test equipment. These were great learning experiences.

After two years, Bell Labs sent me to the University of Illinois to obtain my PhD in Electrical Engineering. I worked on tunneling problems with Nick Holonyak, who was Bardeen's first graduate student at Illinois. Nick invented the LED, the first visible semiconductor laser, several generations of semiconductor lasers, and most recently the transistor laser, in collaboration with grand-students and great-grand-students. He's still active at age 80 and has been quite an inspiration to those who have worked with him at Bell Labs and Illinois. He's the one who taught me that you can't derive everything from first principles; just do the experiment, preferably before tomorrow morning!

Since 1976, I have been working on the physics and engineering of silicon for the electronics industry. During that period, the understanding of silicon and the methods for producing highly perfect silicon wafers grew from a somewhat rudimentary level, where simply making dislocation-free 3-inch wafers was adequate, to a highly-developed level today where we are able to engineer fairly precisely the concentrations of vacancies and interstitials and their interactions with one another and with various dopants in 12-inch wafers. During most of that time I collaborated with and managed R&D groups working on crystal growth and crystal properties at MEMC Electronic Materials, Inc. There were a few especially interesting periods when silicon wafer properties needed improvement to avoid slowing down progress in the IC industry, and various groups in the US, Japan, and Germany were competing to solve the problems first and best. The combination of challenges in solid state physics, high temperature crystal growth, precision machine design, control system design, and manufacturing science have made this an interesting industry.

I retired in 1998, but after a couple years concluded that it was much more interesting to work on real problems, so I formed Korb Consulting to work again on the physics and technology of silicon and silicon applications. This is much more fun!

My wife and I live in a suburb of St. Louis, and we have 3 daughters and 6 grandchildren who inspire travel between Pittsburgh and San Francisco.

Riley Casper (B.S. Winter 2009) For the past year, Riley has been working at Los Alamos National Lab on a handful of projects in the area of geophysical fluid dynamics. “The largest project involves combining ensemble Kalman filter data assimilation routines with the Parallel Ocean Program (POP) ocean simulation in order to produce better approximations of the state of the ocean at a specific time. Data assimilation routines provide a probabilistic means of combining real-world observations with a simulation of a physical system to increase the accuracy of both. The basic idea is that if we can obtain a more accurate picture of the state of the ocean at a specific point in time, we can then obtain more accurate predictions of the ocean state at future times.” This fall, Riley intends to pursue a Ph.D. in Mathematics at the University of Washington in Seattle.

AWARDS, SCHOLARSHIPS, & GRADUATES

Eivind Horvik Memorial Award: A cash award of $150 plus a recognition certificate for the best overall performance in the calculus-based physics sequence. The recipient’s name is recorded on a permanent plaque in the Physics Department office. Funds are provided by friends and associates of Eivind Horvik.

2010 Horvik Award Winners: Bryce Hins & Ahis Shrestha

Sinha Family Scholarship: Initial funds to support this endowment in the amount of $5,000 were provided by Dr. and Mrs. Mahendra K. Sinha in memory of Mr. and Mrs. Pratap Narain, the parents of Dr. Mahendra K. Sinha, Emeritus Professor of Physics. It is understood that the recipient of this award will meet the following preferred criteria: (1) Be properly enrolled at North Dakota State University at the time of application and disbursement. (2) Be a Physics major with Junior or Senior standing. (3) Special consideration should be given by the selection committee to the applicant’s academic merit and financial need.

2010 Sinha Scholarship Winners: Daniel Ingebretson & Matthew Semler

Physics Achievement Award: Up to four awards will be made annually to Physics majors based upon their academic performance. A minimum GPA of at least 3.3 is expected, but more emphasis will be given to excellence in Physics and Mathematics and distinction in undergraduate research. Awards may be extended for one additional year, subject to excellent performance and availability of funds.

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.

2010 – 2011 Donors

John and Janice Daly
Harold and Anne Korb
Michael Reich and Cherish Bauer-Reich
Craig and Brenda Semler
Darrell and Carol Strobel
Orven and Deborah Swenson
Dennis and Sandra Whitson

2010 – 2011 Graduates

Daniel Ingebretson (B.S. Spring 2011) Dan will be pursuing a Ph.D. in Mathematics at the University of Illinois-Chicago, beginning in fall 2011. His interests are in commutative algebra, and he anticipates specializing in this field, particularly in algebraic topology or homological algebra. Dan will be working as a teaching assistant in the Mathematics Department.

Liisa Locker (B.S. Winter 2010) Post-graduation plans unavailable.

Michael Schmidt (B.S. Spring 2011) Post-graduation plans unavailable.

Matthew Semler (B.S. Spring 2011) Fall 2011, Matthew plans on attending graduate school at NDSU to earn his Master's degree in Physics. After that, he is uncertain as to whether or not he will pursue a Ph.D. in Physics or enter the job market. Matthew would like to eventually end up working in a lab doing hands-on research involving renewable energy or working with lasers.

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

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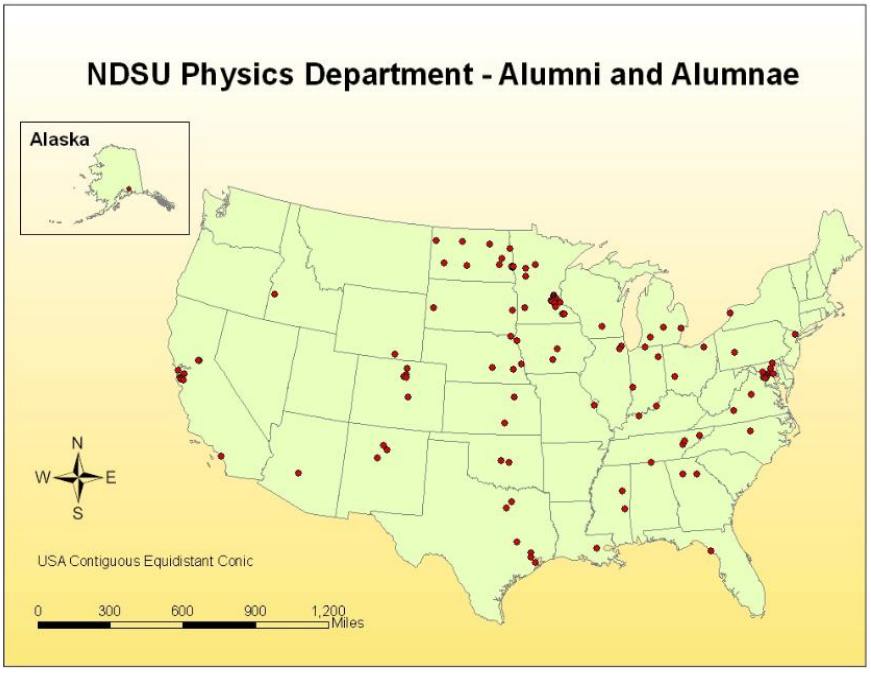

Graduates from the NDSU Physics Department are scattered throughout the United States and across the globe. We are eager to hear from our alums. Please send an email or note to update us on what's happening in your world.

Email updates to:
patty.hartsoch@ndsu.edu