October 12, 2015

Greetings Alumni and Friends

This summer when walking through a sculpture gallery in the Palace of Versailles, close to Paris in France, I came across the statue of Pierre-Simon Laplace (1749–1827). I realized that he might be the only scientist whose name is (almost) certain to appear in all our upper-level physics courses (sorry Newton, Maxwell, Einstein, Boltzmann – and Nabla, you could complain if you originated in a person instead of a harp). Indeed, the Laplacian operator is the local embodiment of the $1/r$-potential that is so fundamental in physics and appears virtually everywhere. I was humbled, decided to take a picture (which is a rare event for me) and then moved on in this stone temple to greet some of the other eternalized guys, including Descartes, Voltaire, Cassini, and Delacroix.

Pierre-Simon Laplace

That was a busy year again, but good things came out. Our Department is growing in space – six offices on the third floor of South Engineering have been renovated and returned to Physics. Dr. John Buncher has been hired as a new Assistant Professor of Practice. Dr. Mila Kryjevskaia has been promoted to Associate Professor with tenure, and Dr. Andrei Kryjevski is now an Assistant Professor on a tenure-track position. We have also decided to change our course sequence from a two-year to a one-year rotation. Starting Fall 2016, all our major upper-level physics courses will be taught every year. This is good news for our students and a result of our continuous growth. Another upcoming event will be the opening of NDSU's new STEM building at the beginning of 2016. Almost all of our large service courses will be taught in that building, which provides excellent conditions to engage students in active learning.

As every year, I would like to emphasize that we value the relations with our alumni. I would like to thank all of you who have contributed to one of the department funds. Please continue to provide support for the Department and its students. 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.

Sylvio May
Department Chair
NDSU Department of Physics

What NDSU Physics Has to Offer

The Department of Physics at North Dakota State University provides a rigorous education in physics and 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 carry out experiments, develop modeling concepts, and perform computer simulations.

Our threefold departmental research focus on soft condensed matter, materials physics, and physics education research provides a unique environment that students and faculty alike find inspiring and fulfilling.

New STEM Building

By MILA KRYJEVSKAIA

Rendering of the new STEM building
(Image courtesy of Zerr Berg Architects/BWBR)

NDSU faculty teaching Science, Technology, Engineering and Mathematics (STEM) courses are eagerly awaiting the completion of the new STEM building. The building is opening its doors to students and instructors in January 2016. The building features "state-of the art" classroom spaces, which will support student-centered active-learning instruction.

Research on the teaching and student learning provides ample evidence that students learn at a deeper level when they are given opportunities to construct their own understanding. The role of an instructor is to guide students through the process of learning, instead of telling students how "things work." This is particularly relevant for disciplines that require reasoning and independent thinking as opposed to memorization and factual knowledge. In order to create adequate opportunities for active learning, classroom spaces must be designed to allow students to work in groups, share their ideas with each other and with instructional staff, and receive rapid feedback. While existing NDSU classrooms allow for the implementation of some elements of student-centered teaching (such as peer instruction and small group work), the new building will extend these efforts to the next level. Indeed, the new classroom spaces are designed with significant input from faculty, staff, and students. They will include modern and safe laboratories as well as classrooms with movable furniture (in order to accommodate a wider variety of activities) and SCALE-UP classrooms (designed to bring student-centered group work to large-enrollment STEM courses).

SCALE-UP stands for "Student-Centered Active Learning Environment for Undergraduate Programs." SCALE-UP classrooms feature large round tables that can seat three groups of students working on common assignments while a team of instructors guide students by questioning rather than telling them the answers. Large projector screens, table computers, document cameras, and white boards increase visibility of student thinking and allow students to share their thoughts with each other, other teams, and instructors.

Physics faculty, together with graduate and undergraduate teaching assistants, will form instructional teams that will teach introductory physics courses in the new STEM building starting in January 2016.

University Physics Competition

By SYLVIO MAY

Two teams from the Department of Physics participated in the 5th annual University Physics Competition on November 14-16, 2014. The University Physics Competition is an international contest for undergraduate students, who work in teams of three at their home colleges and universities all over the world, and spend a weekend in November, 48 hours, analyzing a real-world scenario using the principles of physics, and writing a formal paper describing their work. In this year's competition 131 teams submitted papers for judging. Both NDSU teams were ranked on the level of a Bronze Medal.

One of NDSU's two teams, with Austin Usselman, Joseph Roth, and Tyler Antony, investigated the problem Circumbinary Planets: "Consider two stars, one with 50% of the mass of our Sun and one equal in mass to our Sun. This binary star system has an orbital period of 30 Earth days. Where could a planet have a stable orbit in this system? Describe the possible stable planetary orbits."

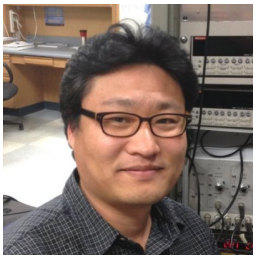
The other NDSU team, with Wei Kang Lim, Mitchell Zubich, and Lane Morrison, studied the problem A Water Fountain: "A water fountain located at the middle of a circular pond ejects water straight up, and the water spreads out into a cone shape with the axis of the cone being vertical. As the water moves, its molecules collide with each other. Determine the probability that any molecule of the ejected water hits the pond at the point (x, y). Assume that the fountain's ejection point is at (0, 0). From your model, determine the most probable place where the water lands and also the median circle, that is, that circle around the fountain inside which exactly half of the water lands."

New Faculty Workshop Experience

By YONGKI CHOI

I joined the Physics department in August 2014. As a physics instructor, my goal is to help students nurture creativity, imagination, and innovation so that they can successfully compete and grow into future leaders in any field. To enhance my teaching skills, I attended the "AAPT New Faculty Workshop". The

workshop provided a wide spectrum of new teaching and learning experiences, including effective demonstrations, hands-on activities, small-group discussions, and new-technologies. More interestingly, the workshop demonstrated how to effectively teach intangible, abstract physics concepts (imagine Gauss's law), not by a traditional lecture but by a small-group discussion. The two-day intensive workshop gave me an opportunity to retune and recalibrate my teaching approaches in order to successfully achieve my teaching goals. Such improvements in the quality of my teaching have resulted in excellent student evaluations for my first teaching class, University Physics II (calculus-based Physics). I will continuously strive to improve my teaching effectiveness in order to interact with, engage, and encourage students at NDSU.



Yongki Choi

West Fargo High Schoolers Come to Campus

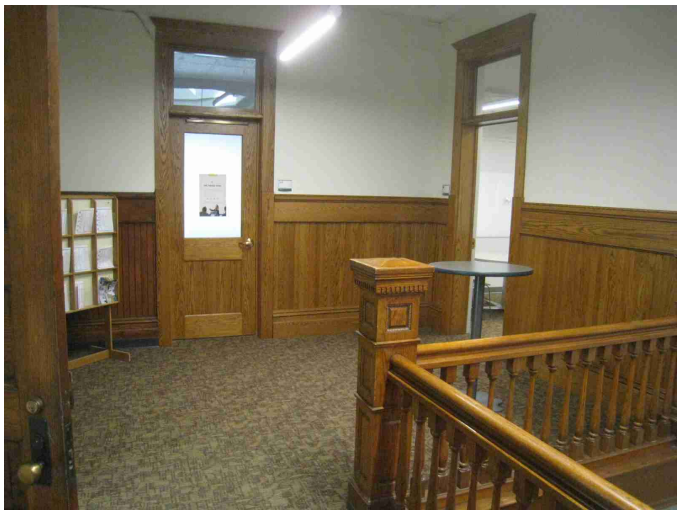
By ALAN DENTON

On a sunny Friday afternoon in November, the Department of Physics hosted a visit by students from West Fargo High School. Guided by their intrepid AP Physics teacher, Michelle Strand, a group of about 30 curious students engaged in a science outreach program. Following a welcome and introductions, the students rotated through three stations spread throughout South Engineering. One group started with hands-on activities, exploring angular momentum of a spinning wheel on a swivel stool and oscillations with standing waves on a string. They also observed demonstrations of high-voltage electrostatics with a van de Graaff generator and magnetic levitation with a liquid-nitrogen-cooled superconductor. Meanwhile, a second group climbed the stairs to our modern physics lab, where they learned about relativistic time dilation of cosmic-ray muons and the quantum paradox exposed by single-photon, double-slit diffraction. The third group experienced life in an introductory physics lab, working through a condensed version of a geometric optics lab under the guidance of graduate teaching assistants. After getting hands dirty, we took a break to eat pizza while chatting about NDSU's Physics program. Next, we rode the school bus up to the Batcheller Technology Center, home of our experimental facilities. Once settled, students rotated between more science activities and a tour of our modern research labs in polymer physics and nanotechnology. Several of our graduate students kindly facilitated activities and demonstrations, including electromagnetic induction, air pressure, and soapy science (bubbles and films). We thank Mrs. Strand and her students for taking the time to visit and look forward to welcoming more high school groups in the near future.

South Engineering 3rd Floor Renovation

By SYLVIO MAY

For a long time the Physics Department had shared South Engineering with other Departments, most recently with the English Department. Due to our growth over the last decade–from 7 to 13 faculty–we also needed to expand our physical space. With generous support from the Provost Office and the occasion of the English Department moving back to Minard Hall, the south-west part on the third floor of South Engineering underwent a major renovation, resulting in 6 new offices and a lounge space. The new offices will provide space not only for students and faculty but also for visitors and guests. We are excited about this big improvement (and the great views over campus from the windows in 4 of the 6 new offices).



Change in Advanced Placement Physics Courses

By ALAN DENTON

Advanced Placement (AP) is a College Board program that offers high school students the opportunity to take rigorous, college-level courses and earn college credit while in high school. The 2015-2016 academic year marks a nationwide change in the organization of AP Physics courses. The old algebra-based AP Physics B course, which was widely accepted as equivalent to the two-semester algebra-based sequence taught at colleges and universities, has been replaced by new AP Physics 1 and 2 courses. The most important consequence for students and teachers will be an improved distribution of material, representing a unique opportunity to improve physics teaching in our nation's high schools.

While year-long AP courses are generally intended to cover the material in a one semester-long college course, Physics B covered the material from the two-semester algebra-based physics sequence. Thus, Physics B students covered the algebra-based physics curriculum at twice the pace they were working through other AP courses, such as calculus, often resulting in poor exposure to certain topics that college faculty consider important. AP Physics 1 is a one-year course that thoroughly covers only mechanics and related material in the standard first-semester algebra-based college course. After completing Physics 1, students may choose to continue on to AP Physics 2 as a second one-year course, which focuses on electricity, magnetism, and related topics covered in a second-semester algebra-based college course.

In response to these changes at the national level, the NDSU Department of Physics will accept a score of 4 or 5 on the Physics 1/2 exam as equivalent to PHYS 211/212 College Physics I/II. Furthermore, although the AP Physics C exam remains unchanged, the Department is taking the opportunity to align its requirements more closely with national standards. Henceforth, we will accept a score of 4 or 5 on the AP Physics C Mechanics/Electricity & Magnetism exam as equivalent to PHYS 251/252 University Physics I/II, and a score of 3 as equivalent to PHYS 211/212.

Moving forward, a significant challenge for our program is that very few high schools in North Dakota offer AP courses, let alone AP Physics. According to College Board data from 2014, North Dakota ranked behind all other 49 states and the District of Columbia in the percentage of students who took at least one AP examination in high school. North Dakota's percentage was 13.8%; the national average was 35.7%. Earlier this year, the American Physical Society Forum on Education published "A State-by-State Science and Engineering Readiness Index (SERI): Grading States on Their K-12 Preparation of Future Scientists and Engineers":

http://www.aps.org/units/fed/newsletters/summer2011/white-cottle.cfm

From this analysis, based on the ratio of passing scores on AP Physics exams to the number of high school seniors, North Dakota ranks last in the nation at 0.3%, compared with a national average of 2%, with New York topping the list at 4.3%. While North Dakota is rated "below average", Minnesota is rated "well above average". Clearly, North Dakota has far to go in broadening access to and successful completion of AP courses. We hope that the new AP Physics 1 and 2 courses will help to attract more students (and teachers) to our favorite subject.

Revitalized Seminar Series

By ALEXANDER WAGNER

A seminar series is the backbone of a research intensive department. Seminars allow faculty and students to share their results with their colleagues, students develop their presentation skills in a friendly environment before they represent North Dakota State University at national and international meetings.

There is, however, another important aspect to a seminar series, that had not been fully present at NDSU: invited speakers from other institutions expand the material that faculty and students get to see, and they provide important opportunities for networking. For the first time in recent memory we were able to allocate a portion of our annual budget specifically to inviting seminar speakers on a regular basis (we had invited speakers before, but the money had to be collected from different sources in a haphazard way). Last year we learned from Kyung-Suk Kim (Brown University) about the folding of atomic layer nanostructures, from Tereza Pereira de Souza (Harvard University) about encapsulating materials

in lipid vesicles, from Alfred Fahr (University of Jena, Germany) about transdermal therapeutic systems, from Cristián Huepe (who manages to be an independent researcher) on active matter, from Gerard Wong (UCLA) about the biophysics of immune responses, from the legendary Frank Bates (University of Minnesota Twin Cities) about using basic physics for the development of new epoxies, from Alfredo Alexander Katz (MIT) about the development of novel nanoparticles, and from Zhiqun Lin (Georgia Institute of Technology) about new strategies for developing precise hairy nanocrystals.

We hope to continue this impressive effort at increasing our national and international visibility and our ability to learn from top experts from the comfort of our own Department.

Physics Major interns at NASA

Early this spring, Joseph Roth, an undergraduate Physics student was offered an internship at NASA's Goddard Space Flight Center. He worked with Dr. Richard Barry and other interns on a project to combine the current all-sky surveys of the galactic bulge into one set of data for preliminary science on the Wide-Field Infrared Survey Telescope (WFIRST) mission. Here is what he had to say about his experience:

Joseph Roth

Working at NASA was an intense change of pace. As soon as I met with my group I was put to work. Most of the work involved writing python code to process raw telescope data into easily accessible and useable tables, graphs, and figures. For the WFIRST preliminary science we only wanted to look at stars located in the galactic bulge. Since Earth is in the disk of the Milky Way Galaxy, our view toward the galactic bulge is cluttered with disk stars so we had to determine a method for separating the two groups of stars. This turned out to be a larger problem than expected. We eventually devised a method that used a 'tile' of bulge and disk stars and a 'tile' of control disk stars, 30 degrees to the right of the bulge tile. Both tiles were plotted on the same color-magnitude diagram (CMD). The disk stars from each tile typically group on one side of the CMD while the bulge stars stay on the other side due to their difference in metallicities. We then used a subtraction method to remove the disk stars from the bulge tile within some tolerance. This method was not perfect but it removed the majority of the disk stars. Once this was done we had to convert the data from each telescope into the same magnitude system. We also worked on many smaller parts of the project such as plotting and matching isochrones to the data, producing luminosity functions, and expanding the code to encompass additional surveys.

Participating in this project gave me an appreciation for working in a research group. When there is something you have trouble understanding, you are always able to ask your colleagues for help. The coding experience I received is also invaluable. The internship required tremendous amounts of work but given the choice I would do it again. The project is currently on hiatus but it will hopefully be resumed soon. I would like to thank the North Dakota Space Grant Program for funding my internship.

Research Experience for Undergraduates Program Wraps Up Third Year

By WARREN CHRISTENSEN

For the past three years, Assistant Professor Warren Christensen has directed the Growing Up STEM Research Experience for Undergraduates (REU) with co-PI Jennifer Momsen of Biological Sciences. This program invites undergraduate applicants from across the country and selects ten students to come to NDSU for a 10-week summer research program in Discipline-based Education Research. The program has been wildly successful, and a renewal grant has been submitted to provide funding for the program for an additional three years. If funded, our program will increase efforts to recruit students from indigenous populations, especially those within the state.

Awards and Scholarships

Eivind Horvik Memorial Award: A cash award plus a recognition certificate for the best overall performance in the calculus-based physics sequence. The recipients' names are recorded on the Physics Department website. Funds are provided by friends and associates of Eivind Horvik.

2014/15 Horvik Award Winners: Jacob Schulze and Damon Hage

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. Each recipient will receive a cash award plus a recognition certificate, and the recipients' names will be recorded on the Physics Department website.

2014/15 Sinha Scholarship Winners: Jacob Schulze and Matthew Donahue

Physics Achievement Award: Up to four awards may be given annually to Physics majors based upon their academic performance and the availability of funds. 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. Each recipient will receive a cash award plus a recognition certificate, and the recipients' names will be recorded on the Physics Department website.

2014/15 Physics Achievement Award Winners: Joseph Roth and Austin Usselman

New Faculty Member

Dr. John Buncher had joined our department as a Visiting Assistant Professor during the academic year 2014/15; he has now been hired as Assistant Professor of Practice. John's main focus is teaching large-enrollment physics courses, but he also plays an active role in student advising and in the curriculum committee. John received his PhD in physics from Purdue University.

Darrell and Karen Strobel Endowment Fund

By THE DEPARTMENT OF PHYSICS

We feel very thankful to Dr. Darrell Strobel, recipient of the 2014 Henry L. Bolley Academic Achievement Award, for his major donation into the Darrell and Karen Strobel Endowment Fund. The endowment will benefit us for years to come and will have a significant impact on our ability to fulfill the mission "To engage students, campus and community in the most fundamental of all sciences through excellence in teaching, first-class research, and dedicated outreach." Thank you, Darrell.

2014 – 2015 Graduates

Peggy Willenbring	(BS Fall 2014)
Ryan Dorendorf	(BS Spring 2015)
Wei Kang Lim	(BS Spring 2015)
Levi Remily	(BS Spring 2015)
Austin Usselman	(BS Spring 2015)
Bekele Gurmessa	(PhD Summer 2015)
Stephan Loew	(PhD Spring 2015)
John Harris	(PhD Spring 2015)

2014 Donors

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Mr. and Mrs. Kenneth G. Olson
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Dr. and Mrs. Orven F. Swenson

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.

The north entrance of South Engineering with two Einstein banners that were donated by Angie Dickinson, an American actress and native of North Dakota.

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

Donations can also be made at www.ndsualumni.com/donate. Please select "Other" from the "Designation drop-down box and type "Physics Development Fund" or the name of a particular award (see below) in the box that appears.

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Please designate your gift to one of the following:
☐ Eivind Horvik Memorial Award
☐ Sinha Family scholarship
☐ Physics Achievement Award
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Thank you!

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We are eager to hear from our alumni. Please send an email or note to update us on what's happening in your world.

Email updates to:
patty.hartsoch@ndsu.edu