Department of
PHYSICS alumni newsletter

www.ndsu.edu/physics

NDSU NORTH DAKOTA STATE UNIVERSITY

Summer 2014

The School of Athens

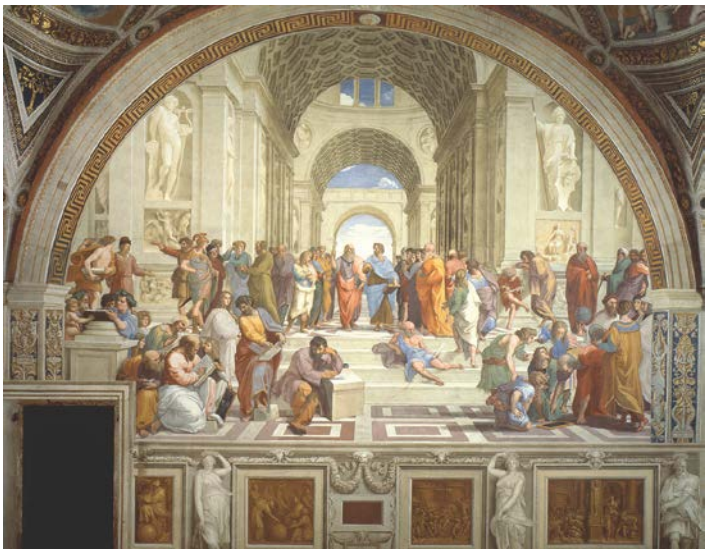
There is a famous fresco painted by the Italian Renaissance artist Raphael in 1509/10. It is called “The School of Athens,” and it is one of four frescoes, representing philosophy, poetry, theology, and law, on the walls of a room now referred to as the Stanze di Raffaello, located within the Vatican Museums. “The School of Athens” embodies the classical spirit of the High Renaissance and is widely considered one of Raphael’s masterpieces. What we see on the fresco are mostly Greek philosophers who all had spent their lives seeking basic knowledge.

The two central figures in the back are Plato and Aristotle, in the foreground we see Pythagoras, writing into a book, Heraclitus, writing on a single sheet of paper, and, on the right, Euclid with the circle as well as Ptolemy holding a globe. We are less certain about the other individual identities, but they likely include Democritus, Socrates, and Diogenes.

As a side note, Raphael did not know how those philosophers looked, so he used a few of his contemporaries as models: Leonardo da Vinci is Plato, Michelangelo is Heraclitus, Bramante is Euclid, and Raphael himself appears just right of Ptolemy as Apelles, who actually was a Greek painter. “The School of Athens” represents a microcosm of knowledge where everything has its place and is in harmony with the other parts.

That includes science and mathematics as represented, for example, by geometry (Euclid, Pythagoras), logos (Heraclitus), physics (Democritus), and astronomy (Ptolemy). The Greek architectural setting has a central arch that lets us gaze into the open space; it sets the stage for Plato and Aristotle, the “fathers of science,” who tell us how to gain knowledge through abstract reasoning and empirical approaches.

The High Renaissance, during which “The School of Athens” was painted, is the culmination of a development in which visual arts accomplished nearly perfection – even measured by today’s standards. Beyond this, it offered a worldview, where Christian tradition was enriched by worldly experiences of beauty, symmetry, and a rediscovery of space.



I like to show and briefly discuss “The School of Athens” in our most basic physics course PHYS 120, “Fundamentals of Physics.” The fresco tells us quite a bit about how society interacts with science, sets standards and values, and creates a system of reference points. We also find in it a physical worldview that, I believe, explained what needed to be explained at that time, among those Aristotle’s theory of the four terrestrial elements (earth, air, fire, and water) and Ptolemy’s refinements of the geocentric model of planetary motion.

Of course, we know that things changed quickly. In 1543, just a generation after “The School of Athens” was painted, Copernicus challenged the geocentric model with his book “On the Revolutions of the Celestial Spheres” and, in the same year, Andreas Vesalius published “On the Fabric of the Human Body,” the first comprehensive and scientific approach to human anatomy.

That was the beginning of what we now call the Scientific Revolution. Aristotle’s theory of the four elements too was soon to be hit by the two cannonballs Galileo is believed to have dropped from the Leaning Tower of Pisa. What I tell my students is that we, as scientifically literate members of our society, should always remain wary, critical, creative, and never pretend our understanding is complete and final.

"The School of Athens" is a masterpiece because we now know the eternal world that Raphael depicted had the seed of change already implanted. After this excursion to a past world of beauty and balance I'll briefly turn to more present-day matters. Our Department continues its growth.

Our previous Head, Daniel Kroll, remains research-active and involved, and we have hired a new faculty member, Yongki Choi, who works in the field of biophysics. Yongki obtained his B.S. from Dong-Eui University in Pusan, Korea, and his Ph.D. from the City University of New York. Following his postdoc at the University of California, Irvine, he will start at NDSU in August 2014.

We also have Bruce Rafert joining our research-active faculty, after serving as NDSU's Provost from 2011-2014. As a side remark, the new Provost, Beth Ingram, grew up in Fargo and has a background in Economics and Mathematics. Bruce will be working in the field of remote sensing, but he brings in much more to our Department through his experience and success in a number of previous administrative positions including Provost, Vice Provost, Dean, and Department Chair. He will be a great resource for advice and help for me with my barely 9 months of Chair experience.

By the way, the Bison continue their success in football. They are the current three-time defending NCAA Division I-FCS National Champions. And in men's basketball, the Bison made it to the NCAA tournament, beating Oklahoma in the round of 32 before losing to San Diego State in Spokane, WA.

In closing, I'd like to reiterate that we very much value the relations with our alumni, and I personally thank all of you who have contributed to one of the department funds. Further information regarding these funds and the scholarships they support are provided in the body of this newsletter. 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
Newsletter Coordinators
Landon Bladow
Patty Hartsoch
Sylvio May

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, materials physics, and physics education research provides a unique environment that students and faculty alike find inspiring and fulfilling.

DEPARTMENT NEWS

Change at the Helm of the Physics Department

By Alexander Wagner

Daniel Kroll, the longstanding head of the Physics Department since 2004, stepped down from his position in August 2013. In 2004, the department had reached a low point with only 4 permanent faculty members (Alan Denton, Charlie Sawicki, Orven Swenson and Alexander Wagner), and Dan was charged to begin a process to grow and enlarge the department with specific research foci. Since Alan and myself (who was only hired in 2002) were already working in the area of computational soft matter, it was decided to make this the initial focus.

At the time there were no suitable internal candidates to serve as chair who could address such a monumental rebuilding task. We were fortunate to be able to attract Daniel Kroll from the Supercomputing Center at the University of Minnesota to come to Fargo to help rebuild the department. During his 9 years at the helm, the department grew significantly, both in numbers and in standing in the university.

The initial hires in soft matter physics were all theoreticians. Dan also oversaw the new focus on physics education, and we are now one of only a handful of institutions with more than one faculty member working in this field (Mila Kryjevskaia and Warren Christensen). Dan was successful at getting the department involved in the new interdisciplinary program in Materials and Nanotechnology, and the director of this program, Erik Hobbie, has a 60% appointment in the Physics Department. (This is only half the story, but the full story must be told elsewhere at another time). This he cleverly

used as a lever to expand the department in the experimental direction. When Charlie retired, he was replaced by Andrew Croll, our first new experimental hire (apart from Erik) since Dan joined the department. With Dan's stepping down, his position became available and has been filled with a new experimentalist, Yongki Choi. This is starting to bring much-needed balance between the experimental and theoretical sides of our department.

Stepping down was not an easy decision for Dan, but family reasons forced him to work only half-time from 2011 to 2013. During this time, Sylvio May was selected to be the Associate Chair to take over important tasks while Dan was away. But it became clear that even this reduced appointment was not compatible with his familial duties, which forced Dan to step down completely last August. However, he insists that he is not retiring, and he is continuing a limited research program in the department. He retains a graduate student shared with Stuart Croll of the Coatings and Polymeric Materials Department. We hope to see more of Dan next year in the department.

Meanwhile, the department had to find new leadership. After some discussion within the department and in consultation with the Dean and the Provost, it was decided that another national search would be approved, with the clear expectation that strong internal candidates would also apply. Among all the possible contenders there was one obvious choice: Sylvio May, who had already served as Dan's second-in-command for the last two years and who is both an outstanding researcher and someone who has shown great dedication to the department. He was elected unanimously to the position of Department Chair.

During his first year, Sylvio has shown an astonishing ability to lead the department. He singlehandedly managed to secure a significant start-up package for our new faculty member, he has finally managed to increase the number of Graduate Teaching Assistants from three to four (still way too few, but we had asked for this without success ever since I came to the department), he has restructured the departmental committees, and he has done much that we expect to bear fruit in the years to come, including securing funding to renovate significant new space in South Engineering that has been committed to the department. So as one successful leadership period ends, the department appears to be invigorated under new leadership and moves ahead to a promising future.

New Accelerated Master of Science in Physics Program

By Alan Denton, Graduate Coordinator

The Department of Physics has instituted a new program that offers Physics majors the opportunity to earn both a Bachelor of Science and a Master of Science degree in five years. By integrating advanced coursework with closely supervised research, the Accelerated Master of Science in Physics program provides superior preparation for Ph.D. studies or industry employment. For students applying to Ph.D. programs beyond NDSU, the additional year of preparation will facilitate journal publications and a competitive score on the Graduate Record Examination (GRE), a requirement of most graduate programs. For industry-oriented students, the enhanced academic and research experience will broaden career opportunities.

Those eligible to apply to the new program are Physics majors who have completed 60 credits (at least 30 earned at NDSU) and who have a cumulative GPA of 3.5 or higher. Acceptance, which is conditional on completion of the Bachelor's degree, is based on performance in the introductory Physics courses and interest in research and teaching. Qualified students commence research by the start of their senior year and complete at least 30 graduate credits, including 7 graduate-level Physics courses and the Master's Thesis. If funding permits, students may be supported as teaching or research assistants in their final year, thereby qualifying for a tuition waiver.

This new program was made possible by the NDSU Graduate School's recent initiative to allow 15 credits to count toward both Bachelor's and Master's programs. To meet the requirements of the program, students typically take upper-level dual-listed (400/600) courses at the graduate level. The Accelerated M.S. Program in Physics is intended to both widen opportunities for our students and expand our graduate program. We welcome applications from all qualified and motivated students.

Physics Department Leading the Charge for Supporting Undergraduate Research

By Warren Christensen

There was a lot of interest and quite a few nerves on display at 1 pm on April 11th. The 2014 North Dakota State University Undergraduate Physics Research Symposium was about to kickoff, and undergraduates from four institutions were prepared to deliver their talks to peers and faculty.

This year's Symposium had excellent attendance and participation. The Dean of the College of Science and Mathematics, Scott Wood, delivered a welcome address that affirmed his commitment to supporting undergraduate research at NDSU, and his gratitude to the Physics Department for taking a lead role in holding this Symposium. Seven undergraduates delivered talks about their research.

In keeping with the format for APS March and April meetings, talks were limited to 15 minutes, with 12 minutes for the talk and 3 minutes for questions. These seven students were joined by five additional students who all presented posters on their research while faculty and

students dined on delicious vittles generously provided by Dean Wood. The presenting undergraduate students hailed from Winona State University, the University of North Dakota, Minnesota State University Moorhead, and NDSU.

Faculty were also well-represented with the chair of the UND Physics Department coming down and nearly the entire Physics departments from both MSUM and NDSU making time for the event. The opportunities for networking with area faculty about undergraduate research were an added bonus. Plans for another Symposium in 2015 are already in the works, with the possibility that the location for the Symposium might travel from year-to-year and find a home next year at UND, with MSUM as a possibility for the following year.

As we look ahead, we recognize that travel costs currently limit some students from participating, and we hope to be able to find a way of supporting these growing scientists.

Longfellow students discover that mixing vinegar and baking soda produces carbon dioxide.

Outreach Activities

By Alan Denton

Over the past year, physics students and faculty alike have volunteered to help make possible a variety of community outreach activities. Last summer, Joe Koteles, a recent NDSU graduate who is currently teaching at Grafton High School (Grafton, ND), brought 11 students to the Department of Physics for hands-on science activities. This summer, Joe brought another cohort of 10 students to campus. Physics faculty, as well as graduate and undergraduate students, worked with the high school students to help them explore a variety of physics phenomena ranging from waves to magnetism to liquids.

In October, we staged another Science Fun Night at Longfellow School in Fargo, where over 80 K-5 students (plus parents) engaged in hands-on activities on topics spanning states of matter, force and motion, electricity and magnetism, and waves and optics. Facilitators included faculty and students from Physics and other NDSU programs, as well as two teachers from Fargo Public Schools (thanks to Vicki Wiisanen and Rachel Consdorf!).

The spring thaw brought more science fun. Several faculty and students volunteered as judges at science fairs, including the Southeast Regional Science and Engineering Fair at NDSU and the State Science and Engineering Fair at UND. At the State Science Olympiad, Alexander Wagner organized the “Sounds of Music” event, where students answered musical questions and played scales and tunes on homemade instruments, while Warren Christensen sang the National Anthem at the opening ceremony and MC’d the awards ceremony.

Finally, in this year’s NATURE Summer Camp program, Andrew Croll mentored a student through an original research project that explored the formation of “suncups” (bowl-shaped depressions commonly seen on snow patches) in piles of polymer beads.

Kryjevski Presents Science Café

Science Cafés, sponsored by NDSU’s College of Science and Mathematics, feature a presentation by a scientist and time for discussion with the scientist and other attendees. They are free and open to the public. This past academic year, one physics faculty member was a presenter.

Science Café to explore Higgs Boson – NDSU News, 1/29/14

A recent, headline-grabbing discovery that has caused excitement in the scientific community was the topic of the Science Café, “Why do things have mass? Discovery of the Higgs Boson,” presented by Andrei Kryjevski, NDSU research assistant professor of physics, on Tuesday, Feb. 11, at 7 p.m. in Stoker’s Basement of the Hotel Donaldson in downtown Fargo.

“Our everyday experience tells us that objects around us have mass. It is harder to move a shopping cart loaded with milk jugs than an empty one. But where does mass come from at the most fundamental level? Until very recently, this seemingly simple question did not have a definitive answer,” explained Kryjevski, noting the discovery of the Higgs Boson at the Large Hadron Collider at the European Organization for Nuclear Research has provided experimental confirmation to an important theory on mass generation.

Kryjevski said the mechanism of mass generation for subatomic particles that constitute ordinary matter, known as the Brout-Englert-Higgs mechanism, was theoretically

proposed in the 1960s. According to the theory, particles acquire mass due to interaction with the so-called Higgs field permeating everything.

“Think of two persons walking through a room full of people. One is a celebrity and the other is not. In this analogy, the two persons are a pair of subatomic particles and people in the room are the Higgs field,” Kryjevski said. “Compared to the unknown person, it is harder for the celebrity to move through the room full of fans who all want to talk to him or her. It appears as though the celebrity is more massive than the less popular person since he or she ‘interacts’ stronger with the fans.”

Some have suggested the discovery of the Higgs Boson may guide other theories and developments in “new” physics.

For more information on upcoming and previous Science Cafés, which are held monthly in downtown Fargo, visit http://earth.physics.ndsu.nodak.edu.

Fourth Visit to NDSU by Slovenian Faculty Member

By Klemen Bohinc

Klemen Bohinc, an Assistant Professor in the Faculty of Health Sciences, University of Ljubljana, Slovenia, visited NDSU’s Physics Department for two weeks in May 2014. The visit was supported by a grant from the Slovenian Research Agency. This was already Klemen’s fourth visit to NDSU since 2006. Here is what he wrote regarding his visit:

During my latest stay at NDSU, I gained new professional experiences, both from an educational and scientific point of view. My general view is that the educational system in the US is more open for students and offers easier access to knowledge. During my third visit to NDSU, I attended lectures in mechanics taught by Sylvio May. I was surprised by the attentiveness of the students in following the lectures given by the professor. I was also impressed by the level of confidence the students demonstrated while discussing derivations of equations and their interpretation.

The university system in the US appears much less hierarchical as compared to European universities. It is interesting that the professors in the US are willing to be available at almost any time for student questions. I think it must be very hard for professors to follow all the student demands. They need to develop a range of approaches and strategies aimed at helping students to gain a deeper understanding of the subject. Quite the opposite occurs in Slovenia where, generally, professors are more closed and accessible only at very limited time spans during the week.

Regarding research, I do not see large differences between the US and Europe. The main deviation is probably in the type of research financing. As an example, Slovenian faculty members are assigned a fixed amount of money and other resources from the Ministry of Science and Technology. In the US, research financing comes mainly through competitive grants from agencies and foundations. That makes the US funding more selective but also more mainstream.

Finally I would like to express my deep gratitude to the Department of Physics at NDSU for a very warm welcome. I certainly plan to continue my collaboration in order to finish our current projects – and start new ones. By the way, all my visits so far were summer visits, but next time I will seriously consider a visit during winter. Maybe at the end of March …

Journal Covers Highlight NDSU Physics Research

By Erik Hobbie

Research by the Department of Physics at NDSU was featured on three journal covers in 2013-2014. A multi-investigator collaboration entitled “Phase Separation and the Coffee-Ring Effect in Polymer-Nanocrystal Mixtures” was featured on the cover of the journal *Soft Matter*. This work was a joint experimental, theoretical, and simulation study carried out by Professors Hobbie, Denton, and Wagner that also involved an undergraduate physics major, Austin Usselman (see later story in this newsletter). This paper was also listed as a *Soft Matter* “Hot Article” right after it was published, which signifies that the journal editors and reviewers were extremely impressed with quality and scope of the work.

The authors revealed new and fundamental insight into the nature of phase separation in drying droplets containing both polymers and nanocrystals in a common solvent, with important implications for coatings science and technology. The work lays the foundation for future collaborations by this team in the field of nanoparticle self-assembly.

Work by the Hobbie group also recently appeared on the cover of *Langmuir*, with an invited feature article entitled “Purifying Colloidal Nanoparticles through ltracentrifugation with Implications for Materials and Interfaces.” The lead authors, Joseph Miller and John Harris, are Ph.D. students in Materials and Nanotechnology and Physics, respectively, at NDSU.

Joseph was also an undergraduate Physics major at NDSU before pursuing a Ph.D. in Materials and Nanotechnology.

The work highlights new approaches to purifying nanoparticles for coatings applications in solar cells, solid-state lighting, and biological labeling. These methods have long been used in the field of biochemistry to isolate proteins and biological polymers, but the approaches have recently found applications in the growing field of nanotechnology. The group at NDSU was one of the first to ever carry out such separations in organic solvents as a way to isolate silicon quantum dots of a very specific size.

Finally, work by department chair Sylvio May was featured on the cover of the *Journal of Controlled Release*, a leading publication in the field of pharmacology and drug delivery. The paper, entitled "Pharmacokinetics of Temoporfin-Loaded Liposome Formulations: Correlation of Liposome and Temoporfin Blood Concentration," represents an international collaboration between NDSU and the University of Jena in Germany.

The research has important implications for the delivery of drugs that are highly insoluble in water by encapsulating them in lipid vesicles, essentially tiny spheres with the drugs inside, and was also featured in a lead editorial in the same issue of the journal. This type of recognition signifies the growing stature of the department in leading areas of research such as biophysics, nanotechnology, and materials.

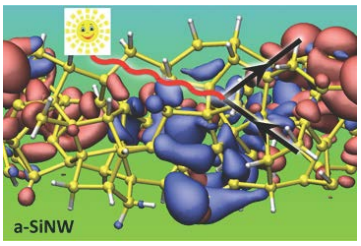
Computer Simulations Help Predict Winner in Solar Power Battle

By NDSU Office of Research and Creative Activity Press Room

Researchers at North Dakota State University and the University of South Dakota are using computer simulations to determine whether quantum dots or nanowires would make better solar collectors for the development of future solar panels. The research team includes Andrei Kryjevski, research assistant professor of physics and NDSU Center for Computationally Assisted Science and Technology, Svetlana Kilina, NDSU assistant professor of chemistry and biochemistry, and Dmitri Kilin, University of South Dakota.

The team's research results are published in the American Institute of Physics' *Journal of Renewable and Sustainable Energy* at http://dx.doi.org/10.1063/1.4817728. The group used computational modeling to examine quantum dots, one-dimensional chains of quantum dots and a nanowire to determine their potential application for solar energy collection.

The results, Kryjevski said, show that placing amorphous quantum dots in an array or merging them into a nanowire results in what may be the most effective approach to maximizing efficiency, but he said additional research needs to be done. The *Journal of Renewable and Sustainable Energy* is an interdisciplinary, peer-reviewed journal covering all areas of renewable and sustainable energy that apply to the physical science and engineering communities.



Read more information about the research at www.sciencedaily.com/releases/2013/10/131001141212.htm and http://phys.org/news/2013-10-simulations-technology-solar-collector-quantum.html.

STUDENT NEWS

Society of Physics Students Activities

By Austin Usselman

Austin Usselman and Matt Ramsett refuse to waste any time as they take their new positions as officers. The Society of Physics Students (SPS) has decided to work on a summer project, with Dr. Andrew Croll supervising, with the hopes of being published.

The officers feel that getting published as an undergraduate student is a big stand-out on a resume, and want every member of SPS to have this opportunity. While this thinking may be a little ambitious, keeping the students active and working in the physics community is a wonderful experience, regardless of whether anything gets published or not.

This project will give everyone first-hand experience at working in a group on something they are truly interested in, instead of just some class project. The project will build bonds between the members; hopefully, word of this project will create a reputation for the SPS among incoming physics students.

This legacy will be the candy that brings new students to SPS, growing the organization and getting students more involved in the Physics Department. The first action newly-elected President Usselman took was implementing official membership to allow students to actually feel they are part of a club, as well as to make them feel more obligated to participate in activities such as Science Fun Night with Dr. Alan Denton, the University Physics competition, and Science Olympiad. The officers have high hopes for the coming year, and the project is a great first step, as well as sprucing up "Orv's Vault" (South Engineering 108) as the SPS room.

Renovated Gathering Place for Physics Students

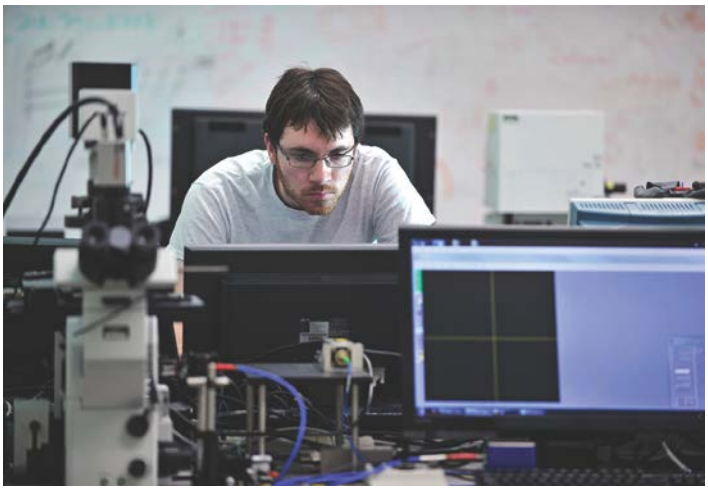
By Warren Christensen

Room 108 of South Engineering has undergone a transformation. The room was configured with three research bays and an office area for Orv Swenson's laser spectroscopy/laser ionization group from 1997 to 2011.

During the renovation of Minard Hall, it became the temporary home to a displaced Psychology lab. Fortunately it came back under the purview of the Physics Department within the last year, and SPS Faculty Advisor Warren Christensen moved quickly to begin renovating the room to serve as a much-needed club room for physics majors. As the department lacked a proper social space for undergraduate students, two of the four rooms within 108 were converted for their use.

The front room is more for eating and lounging with a couch and newly-purchased table and chairs, while the back room has been turned into a collaborative study space, complete with wall-to-wall white boards and a computer. The physics majors, led by SPS Officers Austin Usselman and Matt Ramsett, have a lot of plans for the further renovation of the club's space.

Future plans include a kitchen area and additional study space that hopefully will be enacted when additional funds are acquired. As an homage to the lab space's former user, the students named the space "Orv's Vault," and a more formal plaque is in the works.



Physics Student Makes Quantum Dots Discovery

Reprinted from *NDSU News* – 9/24/13

It's a liquid version of the Hatfields and McCoys.

The relationship between certain polymers and nanocrystal silicon can best be described as unstable. The duo just doesn't like one another, separating like water and oil when drying.

But NDSU physics and math undergraduate student Austin Usselman has found a way to bring some harmony to the predicament. His research could help make solar cells and other electronic devices more efficient.

And he's only a junior.

"I watched a lot of my friends get short-term summer jobs," said Usselman, who worked under the direction of NDSU physics professor Erik Hobbie. "I got one that basically started my career. I didn't expect to be as hands on as I have been. I will always be grateful for the opportunity to do this research."

Usselman, from Hazen, N.D., emailed a handful of professors last year hoping to find any job in a lab to gain experience.

Hobbie invited Usselman to study quantum dots at NDSU's Research and Technology Park. Quantum dots are nanocrystals discovered by scientists in the 1980s. The subject was new to Usselman, who was interested in astrophysics in high school.

"He is gaining hands-on experience doing research, which is valuable for nurturing any type of problem-solving ability," Hobbie said. "He will get his name on a publication as an undergraduate, which will make his resume stand out."

The subject of Usselman's research happened by accident. Usselman was attempting another project when through microscopic projection he and Hobbie noticed the instability within the polymer and nanocrystal mixture. Silicon nanocrystals are tiny pieces of crystalline silicon that are being studied for use in the production of such things as solar cells, solid-state lighting, and biomedical imaging agents.

A coffee-ring effect occurred as the mixture dried. In addition, the nanocrystals and polymer separated. The coffee-ring effect is a term used to describe when a droplet containing small solids dries, and the solids are then deposited at the edge of the droplet. Through a lengthy process of trial-and-error, Usselman learned he could eliminate the separation in low molecular weight solutions by applying the mixture to a glass cover slip with a specialized blade. He tried different application speeds before finding the separation could be eliminated by slowly applying the mixture, pausing every 15 micrometers before starting again.

Hobbie said Usselman's work could help NDSU researchers put a more homogenous coating of a silicon nanocrystal and polymer mix onto solar cells, creating a more efficient product.

"This will have an impact," Hobbie said. "Scientifically, it will have an impact and it will have impact in terms of applications."

The research could also have a positive impact on the efficiency of solid state LEDs and optical sensors.

Usselman's work on the project isn't finished. He is now measuring different concentrations of polystyrene and quantum dots in the polymer-nanocrystal mixture by comparing the strength of photoluminescence during separation.

He's hoping this project can be a springboard to future research success. And it's sparked an intense interest in quantum dots.

"It's really comforting to have such nice people around to guide you through the first couple steps of a new experience," Usselman said. "I believe it has given me the confidence and experience I will need to further succeed in the scientific community, and I am excited to see where I end up and what I end up accomplishing."

This research is supported by National Science Foundation EPSCoR award EPS-0814442.

The Value of Undergraduate Research

By Kyle Mueller

My name is Kyle Mueller. I am a junior at North Dakota State University, and last fall I had the opportunity to take part in an undergraduate research project with the Physics Department at NDSU. I am working on a Physics Education degree, so when a research opportunity in that same field came my way, I jumped at the offer.

I joined Mila Kryjevskaia's research group in January 2014. Since then I helped analyze data related to student reasoning in introductory physics courses. My adviser, Mila Kryjevskaia, and I combined our efforts to identify patterns in student reasoning and problem solving techniques. The overarching goal of the project was to determine possible causes for inconsistencies in student thinking.

After working for a few weeks on the project, I was invited to present our findings at the 2014 Undergraduate Physics Research Symposium. Along with 6 other students, I gave a 12-minute presentation in front of a number of faculty members and fellow students. Although I was deeply nervous beforehand, the presentation was well received, and I had a blast being a part of it.

My experience with undergraduate research was nothing short of spectacular. It gave me the opportunity to study my favorite material in a completely different way than a classroom setting, and it also gave me a unique perspective toward the career field that I am aspiring to. My adviser was very supportive, and I had a fantastic time sharing my work with the science community at NDSU. I would strongly recommend that anyone considering a degree in any science field take a serious look at the research opportunities available to them.

ALUMNI NEWS

Strobel Wins 2014 Henry L. Bolley Academic Achievement Award

By Sylvio May

Darrell F. Strobel, who received his B.S. in 1964 from NDSU's Department of Physics, is the recipient of the 2014 Henry L. Bolley Academic Achievement Award, which recognizes alumni who have excelled in the area of education. Strobel is a professor at Johns Hopkins University, Departments of Earth and Planetary Science and Physics and Astronomy, and earned his master's degree and doctorate at Harvard University.

He was co-investigator of the UV Spectrometer experiment on the Voyager Mission, a key member of a team that used the Hubble Space Telescope to discover oxygen atmospheres on two moons of Jupiter, an interdisciplinary scientist for the Cassini Mission to Saturn, and a co-investigator on the New Horizons Mission to Pluto. He lives in Baltimore.

During his visit to NDSU, April 30-May 1, Darrell gave two presentations: "Spectroscopic Studies of the Jovian Magnetosphere and the Atmospheres of the Galilean Satellites with Voyager, Cassini, and Hubble Space Telescope" in the Physics Department and "The Cassini-Huygens Mission: Exploration of the Saturn System," targeted to a college-wide audience. Darrell's visit, his lectures, and his conversations with faculty and students were major highlights for our Department.

There is perhaps no better way than to quote from an email Ahmed Elbaradei, Ph.D. student in the Materials and Nanotechnology program, had sent to Darrell after his visit: "Hello Dr. Darrell, I'm really glad that I had the honor to attend a lecture for you through the Physics Department in NDSU. Congratulations and I hope I can be as good as you one day. Thanks for your dedication and your huge contributions."

This year's visit to Fargo was one of very few Darrell had made since graduating in 1964. It was a pleasure for me to drive with him and his sister through his old neighborhood, listening to the two pointing out which houses were new

and which ones still looked exactly the same as they did 50 years ago. I believe Darrell liked visiting NDSU and Fargo quite a bit after so many years. A more complete biography of Darrell can be found at http://www.ndsualumni.com/netcommunity/page.aspx?pid=1045.

From Fargo to Fargo: My Journey in Physics

By Marshall Bremer

About a decade ago, I was an engineering student at NDSU. I had landed in the Department of Electrical Engineering because I was good at math in high school and heard that engineers make a good living. I figured I would get a day job as an engineer and do whatever I actually loved in my spare time. It was nearly a disaster.

My peers were much more interested in the material than I was. In their spare time they would build amplifiers for their electric guitars, whereas I had never touched a soldering iron. I only tried to learn enough to get by and then go home and follow my real interests, which were more in line with philosophy, music, and art.

I eventually realized that college should not be treated as vocational training. It is a time to find out who we are and what will drive us to explore in a long life to come. I found this in physics. Physics combines the best of philosophy with challenging problems that require creative solutions. You get to understand the world from the most basic elements and new, creative solutions are always appreciated, something I did not experience in my engineering classes.

As I transitioned to the Department of Physics, the small class sizes helped me become a more engaged student and break some bad study habits. My classes struck a nerve and I was happy to read and re-read my texts to better understand the world. I also found great opportunities to do research at NDSU through the Department of Coatings and Polymeric Materials and later the Center for Nanoscale Science and Engineering. This gave me a taste of what my career could be and an edge when I applied to graduate school.

I was granted my Ph.D. in Physics from Michigan State University last December. It was a great and challenging time for me as I discovered who I was as a scientist and how to solve problems that no one else has solved. I got to use state-of-the-art equipment, travel, and befriend others on similar journeys. I became an expert in my own small area of non-linear optics, and helped develop a way to detect bombs with lasers.

I love all the things about the world I have learned through physics, but as a scientist I prefer to use my talents to solve more immediate and tangible problems than many of my counterparts. My new job at Appareo Systems (in the Tech Park at NDSU) takes me back to where my journey began in more ways than one. I am helping to develop new sensors for agriculture and believe my work will change how farming is done in the near future. As an applied physicist, I am in some ways moving closer to my beginnings as an engineer (on occasion using a soldering iron), but I would not have the perspective, drive, and creativity I need without my journey in physics.

AWARDS, SCHOLARSHIPS, AND GRADUATES

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.

2013 Horvik Award Winners: Mathew Kayser and Wei Kang Lim

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.

2013 Sinha Scholarship Winners: Ryan Dorendorf and Wei Kang Lim

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.

2013 Physics Achievement Award Winner: Tyler Antony

2013 – 2014 Graduates

Bryce Hins (B.S. Fall 2013)
Post-graduation plans unavailable at the time of this printing.

Brandon Johnson (B.S. Spring 2014)
Starting late August, I will be involved in a youth ministry organization called Youth Encounter. This is a year-long commitment in which I will be a member of a worship band that travels around the country playing for congregations and Christian youth events. After my year of travel, I plan on attending graduate school for physics. Depending on where I am accepted, I will either focus on physics education or cosmology/astrophysics. Ultimately, I want to become a professor at a university as teaching is one my main passions.

2013 Donors

Dr. and Mrs. John G. Daly
Mr. and Mrs. Michael P. Olson
Drs. Alan R and Anne Denton
Mr. and Mrs. Charles E. Ramsett
Mr. Scott H. Fricke
Mr. and Mrs. Kevin Roth
Ping and Brenda He
Dr. Michael T. Reich and Ms. Cherish E. Bauer-Reich
Mr. and Mrs. Monte Kaelberer
Dr. and Mrs. Salah S. Sedarous
Dr. and Mrs. Harold W. Korb
Dr. Darrell F. Strobel
Mr. and Mrs. Yongli Ning
Dr. and Mrs. Orven F. Swenson
Dr. Mark A. Novotny
Mr. and Mrs. Dennis Whitson
Mr. and Mrs. Kenneth G. Olson

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.

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.

Physics Development Fund

Name:
_____

Enclosed is my gift of
$_____.

Please detach or copy and mail with your gift to:
NDSU Development Foundation
1241 N. University Dr.
Fargo, ND 58102

Make checks payable to:
NDSU Development Foundation

Please designate your gift to one of the following:
□ Eivind Horvik Memorial Award
□ Sinha Family Scholarship
□ Physics Achievement Award
□ General Purpose Donation

Payment options:
□ Check enclosed #_____

□ Charge my credit card
□ Visa □ MasterCard □ Discover

Name on Card: _____

Card No.: _____

Expiration Date: _____

Billing Address: _____

_____

Phone: _____

Signature: _____

Thank you!

NDSU | PHYSICS

Non-profit Org.
U.S. Postage
PAID
Fargo, ND
Permit No. 818

North Dakota State University
NDSU Dept. 2755
PO Box 6050
Fargo, ND 58108-6050
Tel: 701.231.8974

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