Summer 2019

CrossSections, Summer 2019

University of Northern Iowa. Department of Physics.

CROSSSECTIONS

SUMMER 2019

A MESSAGE FROM THE DEPARTMENT HEAD, DR. PAUL SHAND

Physics alumni and friends, I am pleased to be able to again use this medium to provide an update on some of the major issues and events affecting the university and the Physics Department. First, I'll zoom out to items impacting the university as a whole and then zoom in to recount events of importance to the department.

In last year's issue of *Cross Sections*, I informed you about the activities of the Faculty Evaluation Committee (FEC), which is responsible for constructing a comprehensive new evaluation system for faculty, including post-tenure review. (I am a member of this committee.) Well, the work of the FEC is almost done. The new system will be officially codified in a completely rewritten Chapter 3 of the Faculty Handbook on July 1. Each department has already revised its faculty evaluation documents to be consistent with the new university-wide guiding standards. Review committees have been set up at the college level to ensure consistent standards among the departments of each college. There will also be monetary awards for full professors for outstanding post-tenure performance.

The General Education Re-envisioning Committee also continues to do its work. The charge of the committee is to create a new general education program that is outcomes-based and shorter (36 credit hours instead of the current 45). With extensive input from across campus, the committee has developed a new mission and 12 learning outcomes. The outcomes are associated with learning areas such as creativity, ethical reasoning and scientific inquiry. The next phase of the committee's work involves developing a program structure that allows students to achieve the desired learning outcomes from existing courses and perhaps new ones. Given the 9-credit hour reduction in the length of the program, some existing requirements will be dropped. My hope is that the current requirement of exposure to both life science and physical science remains embedded in the new program.

As you know, undergraduate tuition rates at UNI, Iowa State and the University of Iowa have been in lockstep for decades. This is about to end. The decoupling of tuition effectively starts next fall when ISU and Iowa will both hike their undergraduate tuition by about 4%, while UNI's will not change. This will result in UNI's annual tuition being about $300 less than ISU's and Iowa's. It seems likely that this gap will grow with time. (Both ISU and Iowa are near the bottom of their respective conferences for tuition and fees.) The expectation is that a large enough tuition differential with ISU and Iowa will be advantageous for recruiting students to attend UNI. Given the predicted demographic decline in high-school students attending regional universities, I hope that price-conscious college selection does in fact prove to be a boon to UNI.

On the departmental front, there were many noteworthy events. I'll mention just a few here. The department underwent an academic program review, which is conducted every 7 years. We wrote a self-study of department operations. External reviewers from Illinois State University and the University of Wisconsin at LaCrosse visited the department and wrote a report that was quite complimentary. They were gobsmacked by the level of support for undergraduate research, which I will come back to later. They also recognized our long-standing challenges with small upper-level class sizes and more generally, growing the number of physics majors. (They did note that with an average of 10.3 graduates per year, our department falls in the top 13% of undergraduate-only physics departments in the country.) Among the recommendations were consolidating General Physics sections (to "pay for" smaller junior/senior-level class sizes) and more community outreach/recruiting via a traveling physics demonstration show. The department will discuss the review team's recommendations and adopt an action plan in the fall.

The department has had an enduring emphasis on programming and computation across the curriculum. We are broadening that effort to include data science. A new B.A. Physics: Data Science Emphasis will be available for the first time in Fall 2019. The program combines the traditional physics core with focused course work in statistics and business analytics. Given its employment-ready orientation, we hope this program will attract the interest of community colleges across the state. We have also worked together with the computer science and math departments to develop a minor in data science. This program will have a relatively low threshold for entry to make it feasible for students in a wide spectrum of majors to enroll. The new minor will become available in Fall 2020.

The department was awarded a $574,000 grant from the Roy J. Carver Charitable Trust (with matching funds from UNI) to acquire two pieces of advanced instrumentation that will be used for career preparation and research. A cryogen-free Physical Property Measurement System (PPMS) and a focused ion beam microscope will be installed this summer. Students will use these instruments in courses throughout the curriculum and, of course, for their undergraduate research projects. This represents yet another effort to ensure that our students are prepared for the modern work force.

Last year in this space, I mentioned that physics and biochemistry major Joseph Tibbs received an Honorable Mention for the prestigious national Goldwater Scholarship. This year, Joseph superseded that performance and won a Goldwater Scholarship. This is quite a rare honor for UNI. That said, during my nearly 27 years at UNI, physics majors have been awarded two Honorable Mentions and two Goldwater Scholarships. Not bad.

Yes, it was a hectic and successful year. Your very kind support contributed to this success. Sixteen students will be conducting summer research this year, each one receiving a stipend of $4,000. This was only possible because of the generosity of Jerry and Chris Intemann, Gayl and Kathy Hopkins, and others, too many to name here, who donated to the department. Thank you from the bottom of my heart. The year was also touched by sadness, with the passing of Frances Jourdan and Dale Olson. As always, please stop by the Physics Department for a visit at any time. A really good time for a visit is our annual Homecoming Picnic on October 5, 2019. Please plan to attend. Until then, take care.

Dr. Paul Shand
Professor and Head of the
UNI Department of Physics

CONTENTS

FACULTY PROFILE

Ali Tabei
Assistant Professor of Physics

As a child, Seyed M. Ali Tabei was fascinated by science in general. In particular, he was in high school when he solved his first problem in mechanics and was amazed by the power of predicting nature using the language of mathematics. "I remember that I went to the bookstore and purchased a copy of Fundamentals of Physics and started reading and solving the problems. I had discovered my passion!", Tabei enthuses. "Later, an older friend introduced me to the Feynman Lectures on Physics." As a teenager, Tabei's interest in physics grew more by reading biographies of physicists and hearing more about relativity, quantum mechanics, cosmology and particle physics. As an undergraduate in physics, he discovered his main area of interest: emergent phenomena and statistical physics.

Tabei earned a B.Sc. degree from the Sharif University of Technology in Iran and a Ph.D. in theoretical physics from the University of Waterloo, which is a major hub for physics research in Canada. Tabei's doctoral research was in the area of disordered quantum magnetic materials. After his Ph.D., he moved to the University of Chicago and did postdoctoral research at the James Franck Institute in the field of biological physics. "I was fortunate enough to receive the Cross-Disciplinary postdoctoral fellowship from the Human Frontiers of Science, which facilitated my switch from condensed matter systems to biological systems," Tabei says.

When it was time to look for a faculty position, Tabei's preference was for institutions that valued both teaching and research. "I was looking for a school that values research and teaching together, with a reasonable balance between the two," he declares. UNI is appealing to Tabei because of the small classroom sizes and the friendly interaction with students. "Although UNI is not a major research institute, the research facilities and the computational resources are good enough for establishing an independent research program," he says. "Also, the supportive atmosphere in the department, and overall, the Iowa niceness is very appealing to me."

Recently, Tabei has been teaching General Physics, Computational Physics, and Physics III: Theory and Simulation. "I have found the Computational Physics course exciting for both students and me," he states. In Computational Physics, students learn how to employ computational and numerical methods to solve advanced problems in physics and other fields of science. The objective is to obtain the experience of solving realistic non-textbook problems, which occurs in real research and industry situations (an experience they do not gain by just taking programming courses). Due to the modern nature of computational science, the majority of materials, problems, and class projects are very close to the exciting ongoing research in different fields of physics. "One of the fun parts of teaching this course is that in many cases students come up with innovative approaches to write their code or find a brilliant way to employ built-in functions, which is educational for me," Tabei says.

In general, Tabei is interested in studying biological systems as a manifestation of far-from-equilibrium physics. "Although we have a complete formalism for describing equilibrium systems through statistical physics and thermodynamics, our understanding of non-equilibrium systems is not complete," he asserts. "I am interested in how spatial and temporal fluctuations lead to precise emergent properties in living systems." Recently, in a collaboration with his experimentalist colleagues at different universities, Tabei has been studying the dynamics of active cytoskeleton structures and the intracellular transport associated with the interaction with nanoscale molecular motors with the cytoskeleton. Through the University of Iowa FUTURE in Biomedicine Program, he has been awarded a fellowship to collaborate with Dr. Maria Spies at the University of Iowa biochemistry department. With the active involvement of undergraduate student Joseph Tibbs, they developed software to classify biochemical interactions of binding and unbinding proteins involved in DNA repair from the extensive time-series data obtained from Single-Molecule Microscopy. Single Molecule Microscopy is a state of the art experimental technique which enables one to observe molecular-level interactions in real time. A result of this collaboration has been featured on the cover of the Nature Structural & Molecular Biology journal. Tabei and Spies have also been awarded a collaborative grant from the Iowa Space Grant Consortium to analyze paleo-enzymology data of homologous genetic recombination. Mary Sutton, a biochemistry/physics double major, is involved in this project.

When not teaching or doing scholarly work, Tabei has been involved with the development of the new Data Science minor in collaboration with the computer science and math departments. He is also a member of the steering committee for a Data Science and Data Analytics Institute, which will be essential for equipping our students for this data-driven era. Tabei is also active outside of academia. "Moving to Iowa, I have found gardening interesting," he says. "I enjoy art and reading history and love traveling and watching movies and documentaries with my family," he continues. Tabei is also interested in promoting diversity and inclusion in the community.

DEPARTMENT HAPPENINGS

Homecoming Picnic

The 2019 Homecoming Picnic was held indoors for the second consecutive year because of uncooperative weather (this time, very strong winds). Attendees again gathered in Room 114, the main lecture room in Begeman Hall. The catering was done by Cottonwood Canyon, a local Jamaica-themed restaurant.

Room 114 viewed from the southeastern corner, showing most of the picnickers.

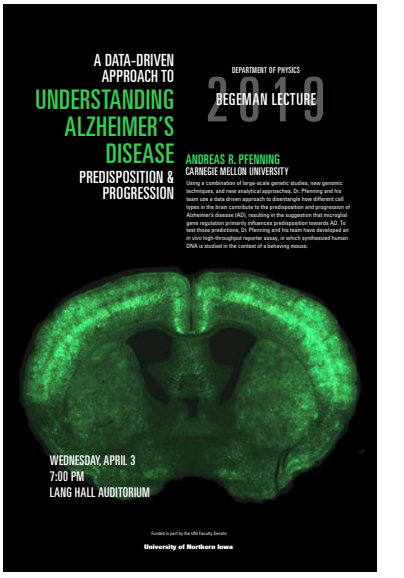
Attendees helping themselves to delicious jerk chicken, curried chicken, rice and kidney beans, and salad.

Students chat with faculty member Ali Tabei as they await their turn at the food trays. From left: Ernest Toutant III, Tyler Nelsen, Joseph Tibbs, Paul White, and Ali Tabei (standing).

Begeman Lecture

The 2019 Begeman Lecture was held on April 3rd at the Lang Hall Auditorium. The lecture was given by Dr. Andreas Pfenning of Carnegie Mellon University and was titled "A data-driven approach to understanding Alzheimer's disease." It was an enthralling look at the use of genomic techniques to disentangle how different cell types in the brain contribute to the predisposition and progression of Alzheimer's disease. The annual Begeman Lecture is sponsored by Richard Jourdan and Frances Jourdan.

Dr. Andreas Pfenning presents his work on Alzheimer's disease at the 2019 Begeman Lecture.



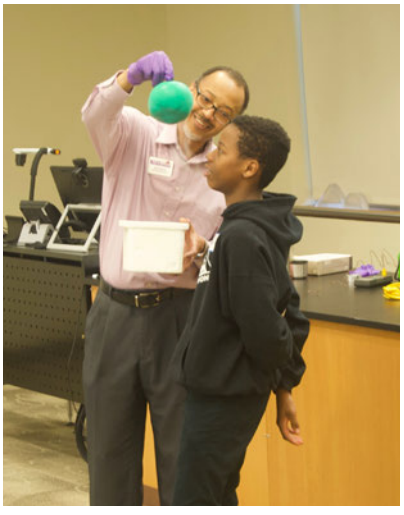
First-Year students get to know UNI Staff

Students in the fall of 2018 First-year Projects in Physics course pose with Angel the mail carrier (front, center).

DEPARTMENT HAPPENINGS

Middle-school students Visit Physics Department

Faculty member Andy Stollenwerk pops a dark-colored balloon with a blue laser as Beckman Middle School students watch in amazement.



Department head Paul Shand shows an attentive Harding Middle School Student what happens when an air-filled balloon is removed from liquid nitrogen.

Students gaze at fluorescent ceiling lights through their diffraction-grating glasses. Science is a many-splendored thing!

Academic Decathlon

Each year, the UNI Honors Program hosts a study day for regional high-school Academic Decathlon teams. The science portion of this year's competition was focused on laser technology and its applications. Faculty members Tim Kidd, Jeff Morgan and Pavel Lukashev enlightened and entertained over 100 students with optics and laser-themed activities and demonstrations.

Physics Banquet

The annual Physics Awards Banquet was held in the Georgian Lounge in the Commons Building on April 26. Students were presented with awards for excellence in academics and service to the department. Graduating students also received farewell gifts. Everyone present was rewarded with good food.

A view of the stately Georgian Lounge and Physics Banquet attendees.

Physics Club co-president Taylor Harris gives her report on Physics Club activities. She is flanked by co-president Joseph Tibbs (left) and social activities coordinator Ernest Toutant III.

Physics Competition

Faculty member Larry Escalada continues to organize and coordinate both the regional (Central Rivers AEA) and state-level Physics Competitions for high-school students. The students compete in five events: The soda-straw arm, the mousetrap car, the catapult, the toothpick bridge, and the challenge problem.

Measurements are made on a soda-straw arm during the competition.

Student positions a toothpick bridge on the bridge tester, which will test its strength, often to destruction.

DEPARTMENT HAPPENINGS

Holiday Colloquium

The Holiday Colloquium is held at the end of each fall semester. Gifts are presented to the staff members of the department as an expression of gratitude for their excellent work throughout the year. The Holiday Colloquium also features performances of demonstrations, "magic" tricks and minor miracles by faculty or their children, staff, and students. It is a wonderful event and great fun for all.

Paul Shand provides an overview of the scintillating performances to come.

Shand presents a gift to custodian Lyle Langstraat. Lyle is a regular purveyor of magic tricks and minor miracles.

Tim Kidd Receives Award

Faculty member Tim Kidd received a 2019 Regents' Award for Faculty Excellence. This award is given to faculty members who have consistently done outstanding work in teaching, research, and service. Congratulations to Tim!

Tim Kidd holds his award plaque at the annual Faculty Awards Dinner. Tim is flanked by Provost Jim Wohlpart (left) and President Mark Nook.

STUDENT PROFILE

Krissy Nielsen

Kristine (Krissy) Nielsen grew up on a small family farm between Cedar Falls and Dike. She graduated from Dike-New Hartford high school in 2014. She did not initially plan on attending UNI. When she was younger, Krissy wanted to study engineering, therefore, she had always thought she would attend Iowa State University. However, after a campus visit to ISU during her senior year of high school, she knew ISU was not the right fit for her at that point in time. Krissy came from a graduating class of about sixty kids, so Iowa State was a bit intimidating. But also, during her campus visit, "I felt like I was just another number to them," she says.

Krissy had also learned about the 3+2 program at UNI and visited the campus to learn more about the program. During this visit, she met with the department head, visited some of the physics labs, and met a few of her future professors. She felt comfortable in the department and could actually see herself as a student there. But also, Krissy knew that this program would provide her with a strong background in physics before studying engineering. Therefore, Krissy chose to attend UNI and "It was the best decision I ever made," she states emphatically.

What Krissy likes most about UNI is the size. The classes are fairly small and the professors seem to care about their students. Most of her professors at UNI were willing to help at any time, even if it was not their office hours. At ISU, Krissy had professors who preferred that you talked to the teaching assistant before coming to them. "At UNI, I was given many opportunities that I was probably less likely to get at a larger university," she asserts.

Krissy's love of physics started with her high-school physics class. "I would take home my physics book every night and read a chapter or two because I wanted to learn more," she recalls. She also realized that having a strong background in physics would give her an edge over other engineers. In 2017, after 3 years at UNI, Krissy transferred to Iowa State to study mechanical engineering. Though there were some things she had to catch up on, like Solidworks, "UNI definitely prepared me for my coursework at ISU," she states firmly.

> At UNI, I was given many opportunities that I was probably less likely to get at a larger university.

Krissy did undergraduate research with Dr. Tim Kidd from Summer 2015 to Fall 2017. Her research projects were a bit different from those of other physics students in that her projects involved a significant amount of engineering. Krissy's first project was a life-size electric go-kart. It contained three Arduinos, multiple relays (both solid state and mechanical), a motor controller, and was controlled by a Nintendo Wii remote via Bluetooth. The go-kart had multiple gears so that the user could adjust their speed. The second project she worked on was a 3D Chocolate Printer. It was like any ordinary 3D printer; however, it used chocolate as the filament. "I stripped down an old CNC machine in the lab and replaced the appropriate mechanisms to be able to print chocolate. I designed my own syringe holder, cooling mechanism, and heating mechanism in order to keep the chocolate at the appropriate temperatures," she says with relish. The chocolate was first tempered then placed in a heated baking syringe before being printed. A pre-written code used for RepRap's 3D printers was adjusted to accommodate for the chocolate filament.

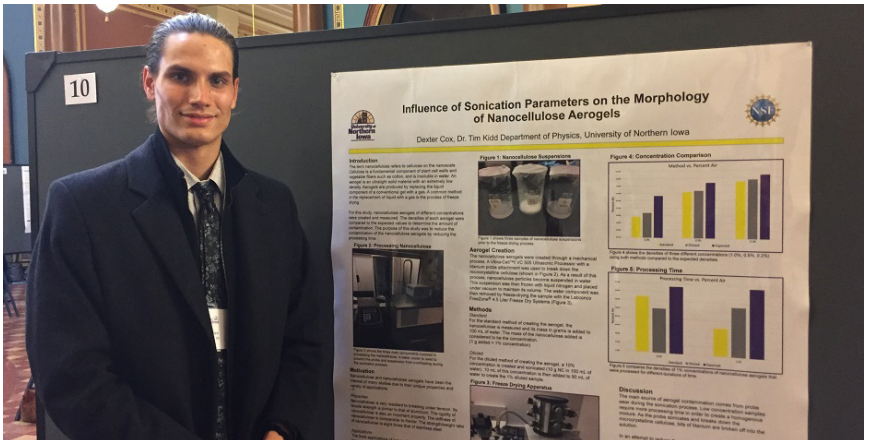
During Krissy's time at UNI, she participated in many activities outside of the Physics Department. She was a member of Lawther Hall and Shull Hall Senates. As a senator, she collaborated with other residents to organize activities for students living in the dorms. Krissy was also involved in the Women in Physics Club, where she served as the Vice President and eventually President.

For fun, Krissy plays the trumpet every chance she gets. She also picked up the ukulele a few years ago. In addition, she loves to read, draw, crochet, sew, and quilt. Krissy's future looks bright. "I have recently accepted the role of Design Engineer at Vermeer in Pella, Iowa," she says. " I also plan on taking the Fundamentals of Engineering Exam soon."

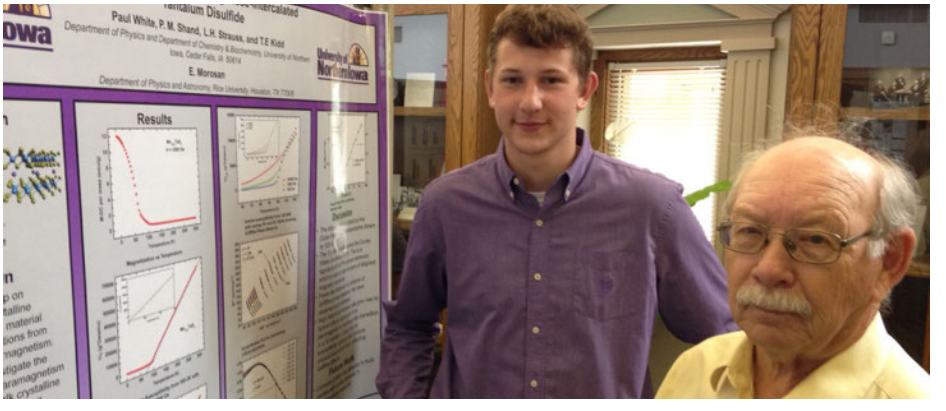
FOCUS ON STUDENTS

Student Research

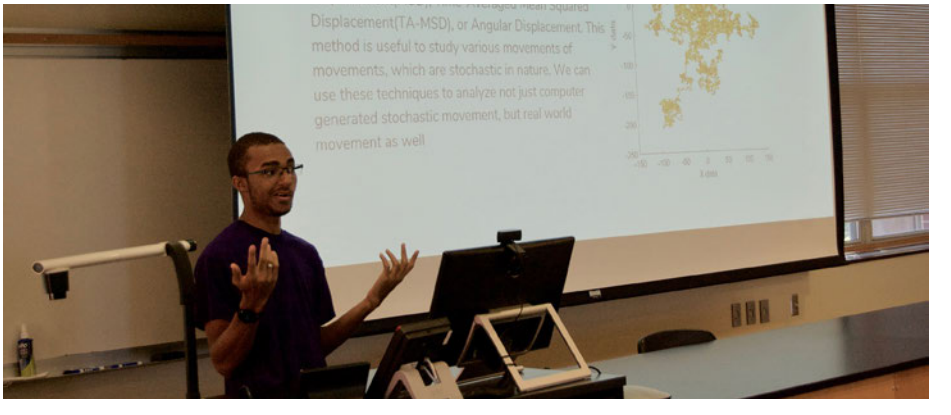
Our majors continue to seek and pursue research projects guided by faculty. Though undergraduate research is required only for the B.S. physics degree program, students enrolled in B.A. programs also avail themselves of research opportunities. The students present their results at departmental colloquia as well as local, regional, or national conferences.



Physics major Dexter Cox presented his research on nanocellulose aerogels at the annual Research at the Capitol meeting at the Iowa state capitol in Des Moines.



Physics major Paul White discusses his research on the magnetic behavior of intercalated dichalcogenides with UNI physics alumnus and donor Gayl Hopkins.

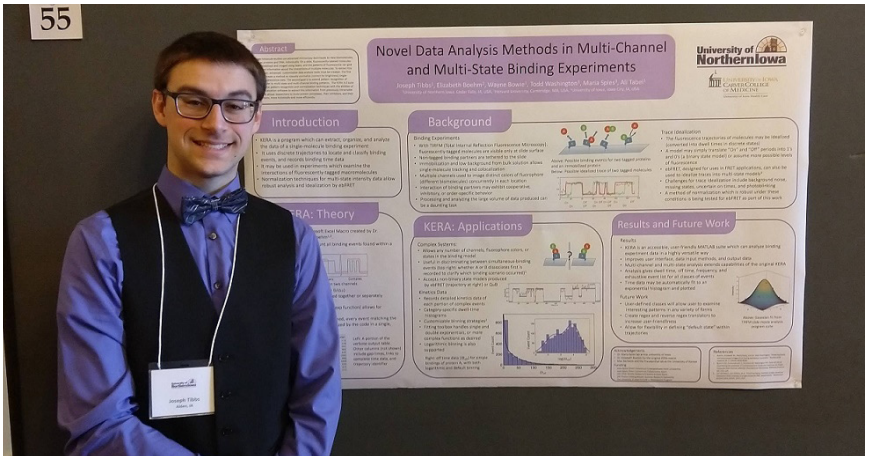


Sophomore physics major Wayne Bowie presents his research on random walks at a special physics colloquium for summer undergraduate research students.

FOCUS ON STUDENTS

2019 Goldwater Scholarship

Junior physics and biochemistry major Joseph Tibbs won a 2019 Goldwater Scholarship. 496 scholarships were awarded from a national pool of 1223 nominations. Joseph intends to pursue a Ph.D. in the biomedical sciences. Joseph will enhance his already impressive research portfolio with stint at NIST – Gaithersburg this summer.



Joseph at his poster at the 2019 Research at the Capitol meeting in Des Moines.

Physics Scholarships and Awards

Louis Begeman Memorial Scholarships
Paul White
Joseph Tibbs
Zach Heinzman

Grossman-Perrine Scholarship
Erica Oler

Begeman Fund for Excellence in Physics Scholarship
Sophie Roberts
Patrick Skretta
Aaron Kirchman

C. Clifton Chancey Scholarship in Physics
Katherine Ulaszek

Outstanding Performance in Introductory Physics
Aaron Kirchman
Sophie Roberts

First Year Projects in Physics Awards
Troy Buzynski
Erica Oler

Outstanding Research Presentation
Evan O'Leary

Physics Department Service Award
Taylor Harris
Joseph Tibbs

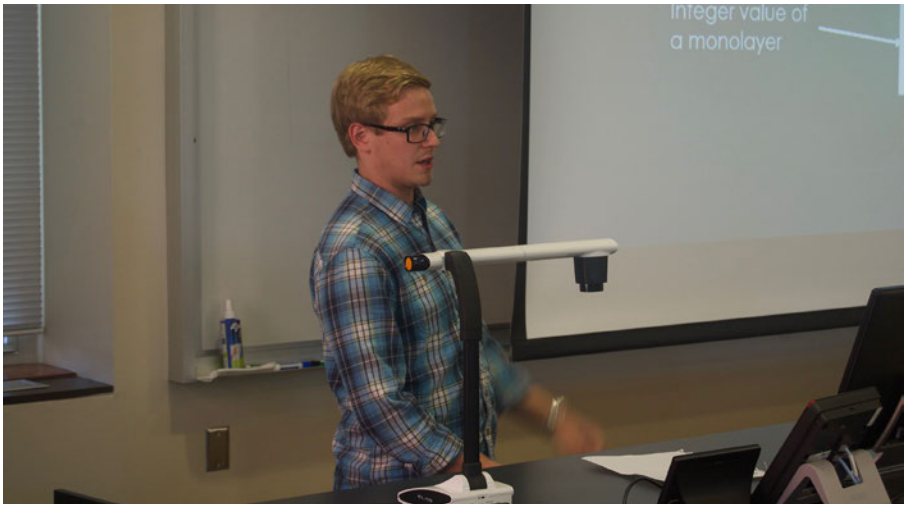
Physics Summer 2018 Undergraduate Research Fellowships

Brent Anderson
Sam Prophet
Wayne Bowie
Nathan Schmidt
Dexter Cox
Paul White
Evan O'Leary

Scholarship awardees join Dr. Shand at the annual Scholarship Luncheon. From left: Noah Haack, Colin Gorgen, Shand, Taylor Harris, Dexter Cox.

FOCUS ON STUDENTS

Undergraduate Research Report



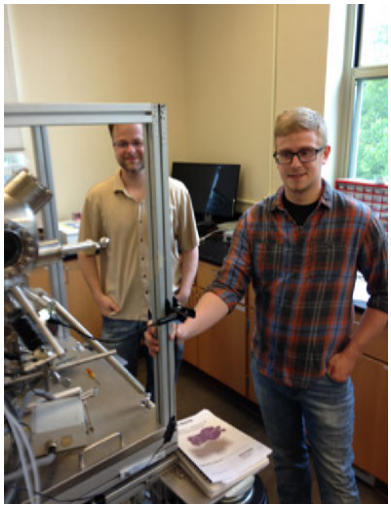
Evan O'Leary is a senior at the University of Northern Iowa pursuing a B.S. in Physics. He came to UNI with the intention of being a 3+2 Physics/ Engineering major but Dr. Shand's Modern Physics class made him realize that he wanted to go deeper into Physics. It was around this same time that Evan heard Dr. Andrew Stollenwerk give a presentation at a Physics Colloquium. Dr. Stollenwerk indicated he was looking for a student who was interested in looking at the growth of thin-film materials. This seemed to Evan like a great opportunity to jump head-first into physics research, so he approached Dr. Stollenwerk about a summer research fellowship. Shortly after approaching Dr. Stollenwerk, the Physics Department awarded Evan an undergraduate summer research fellowship to work with Dr. Stollenwerk. Thus, at the beginning of Summer 2018, Evan began working in Dr. Stollenwerk's lab.

Dr. Stollenwerk's work is primarily focused on the growth of thin-film materials on molybdenum disulfide (MoS_2). The main focus of the research was determining if silver grows in quantized heights on MoS_2 due to quantum confinement. The process of growing a thin-film material began with preparing a sample plate. The sample plates were small metal plates that could easily be slid into Dr. Stollenwerk's scanning-tunneling microscope (STM). The plates had a small sample of MoS_2 glued to them with conductive paste. After the paste cured, the slides were transferred to the STM. The STM is operated under ultra-high vacuum. Because of this, there is a specific procedure to transfer samples in and out of the STM. This was a process Evan became very familiar with over the summer. Next, the silver was deposited on the MoS_2. This was done via electron-beam deposition. Electron-beam deposition requires an e-beam evaporator. The e-beam evaporator contained a small silver rod embedded in the chamber of the evaporator. A beam of electrons bombarded the end of the silver rod, ejecting silver atoms off the end of the rod towards the sample plate. Evan used the e-beam evaporator to deposit silver onto the sample plate. After this was complete, the sample was heated and allowed to cool. After cooling, the sample was scanned with the STM.

Evan spent the majority of his summer working with the STM in Dr. Stollenwerk's lab. The STM makes use of a small tip to scan the surface of our material. These tips can become misshapen and therefore unusable if they crash into the surface of the material. Thus, over the summer, the tip required multiple replacements. This was another activity that Evan spent quite a bit of time on. First, he made a tip out of tungsten wire using electrochemical etching. After this, the tip had to be carefully attached to the tip holder. This was a process that required a very steady hand. Once the tip was attached to the tip holder, it was brought into the STM and docked using a manual controller. The STM produced images of the surface on the nanoscale. Evan spent most of his time scanning samples with the STM.

After the STM scans were completed, the images were brought into image analysis software called Gwyddion. Using Gwyddion, Evan created height distributions of the silver films that were used for subsequent data analysis. This process of scanning and image analysis was done a multitude of times by Evan over the summer. Along with making tips for the STM, Evan had a full summer.

Although he regrets departing Dr. Stollenwerk's lab, Evan is excited to be participating in an undergraduate research program at the University of Nebraska-Lincoln in Summer 2019. He will be working with Dr. Christos Argyropoulos to learn more about the up and coming field of plasmonics.



Physics Club

Among the many activities the Physics Club undertook this year was a trip to Fermilab. Though Fermilab is no longer the world's most powerful collider, it is still a pretty cool place and much important research is still conducted there.

Physics Club members gather in a control room at Fermilab.

After Fermilab, Physics Club members explore Chicago with one stop being the Cloud Gate sculpture.

Larry Escalada, Beth Van Meeteren, and host.

Dr. Escalada goes to China

Physics and Science Education faculty member Larry Escalada and Department of Curriculum and Instruction faculty member and director of the Iowa Regents' Center for Early Developmental Education Beth VanMeeteren gave invited presentations at two STEM education conferences in China in October of last year. They describe their experiences below.

We were invited to Shanghai, China, where we gave three presentations at two different conferences last October. We were selected as guest speakers based on collaborative efforts with our colleagues summarized in the STEM Learning with Young Children: Inquiry Teaching with Ramps & Pathways publication. This book was published by Teachers College Press in 2016 and is based on the Regents' Center for Early Developmental Education curriculum development work funded by the National Science Foundation.

On October 16, 2018, we participated in the Second International Conference on STEAM in Preschool Education. Dr. Escalada delivered the presentation titled "Assessment of STEM Content and Practices in Young Children and the Inquiry Teaching Model." Dr. VanMeeteren delivered the presentation titled "Investigating Force and Motion with Ramps & Pathways in Early Childhood Classrooms." On October 17, 2018, we participated in the 4th International Early Childhood Summit Forum by MATT Education Group in which we co-presented the joint session titled "STEM Experiences at the Center of Early Education: An American Perspective." At these two conferences, we were the only representatives from the United States. Our work was cited by other presenters from other countries. Finally, our presentations were referenced several times by presenters who followed us as exemplars of high quality STEM experiences for young learners.

We were invited by Dr. Jiaxiong Zhu who holds prestigious positions in China. He is a Professor in the College of Early Childhood & Special Education in the East China Normal University. He is an Executive in The Chinese Society of Education (CSE) and a Council member of the Pacific Early Childhood Education Research Association (PECERA).

PHYSICS EDUCATION

> The progressive and modern nature of Shanghai could lead to a productive collaboration between UNI and the East China Normal University.

The Iowa Regents' Center for Early Developmental Education has a history of influence on preschool education in Shanghai, China. Former Director, Dr. Rheta DeVries, was an invited guest by Dr. Zhu. Dr. Zhu came to visit the Freeburg Early Childhood Program in mid-2000. Dr. Zhu's former student, Dr. Yeh Hsueh, who is currently an Associate Professor at University of Memphis, was mentored by Dr. DeVries in her retirement.

On October 18th, we visited a China Public Model Preschool in Shanghai where we toured the school and observed a science lesson on flight with other guests. The influence of Dr. DeVries' work was quite evident with the emphasis on teachers actively engaging children to develop autonomy and contribute to their own learning. Dr. Zhu shared with us that he would like to pursue a collaboration with UNI and the Iowa Regents' Center for Early Developmental Education. We shared information about UNI with our hosts including Early Childhood, Science Education, Physics, and International Programs. We were treated with utmost respect and kindness during our visit. Our hosts were very hospitable and gracious. The progressive and modern nature of Shanghai could lead to a productive collaboration between UNI and the East China Normal University. The school we visited aligned well with the coursework goals of UNI's Early Childhood program. We feel it would be highly beneficial to pursue a collaborative relationship with Dr. Zhu and his university. It is also our hope that a collaborative relationship could be expanded to include other programs including secondary education as well as non-teaching programs.

ALUMNI PROFILE

Chuck Pelton

Charles (Chuck) Pelton graduated from UNI with a B.A. in Physics (focusing on applied physics) in 2006 and with a Professional Science Master's (PSM) degree in Applied Physics in 2007. Chuck transferred to UNI from a community college and started in the B.S. in Physics program. However, having a family to think about, he made the transition to the B.A. program in order to secure his bachelor's degree in a timely fashion. Chuck finished his B.A. and worked on his PSM while courting a job in industry at Rockwell Collins.

"I chose UNI for the people," Chuck declares. He had recently left the Unites States Army and had finished his associate's degree and wanted a school where he would not be just another number in the grade book. He met with Dr. Chancey, Dr. Shand, and the other professors at UNI and he decided that was where he wanted to go to school. "The Physics Department was like a family," Chuck recalls. "We had rules and boundaries, but we also had fun."

Chuck loved all of the courses he took at UNI. He remembers being constantly challenged and learning new things. In particular, in Physics III: Theory and Simulation, he started using MATLAB to solve problems numerically for the first time. "The sense of accomplishment I had from this class and its labs still sticks with me to this day," he says with emotion.

Chuck recalls many indelible moments during his time at UNI, but one that sticks out is the humor of the faculty in the Physics Department. From Dr. Roth's never-ending stream of corny jokes, to Dr. Shand's dry, but sharp humor, he remembers his interactions with the faculty as a fun and rewarding time. Chuck recounts, "When doing one of the labs for the Modern Physics Laboratory course, I one time made a joke about whether or not it was safe to lick the lead sheets we were using. I almost didn't catch the fact that Dr. Shand also made a joke, so solid was his deadpan response of: "If you have to ask, perhaps you already have?"

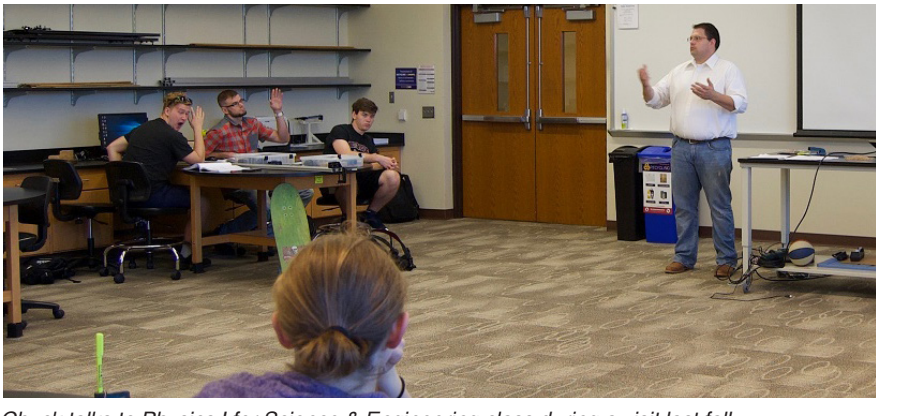
After leaving UNI, Chuck obtained a job at Rockwell Collins working in aerospace and defense. He chose this path as a veteran to ensure that he was supporting the warfighter, and of course, providing for his family. After working as a systems engineer in the Washington, D.C. area for a few years, Chuck is back at Collins Aerospace (formerly Rockwell Collins) as a Senior Systems Engineer. He has worked as a systems engineer on radios, communication systems, maritime systems, landing systems, Unmanned Aerial Vehicles, and lately in GPS and navigation. "I have been in every position as an engineer, to a project lead, to engineering manager and I am currently working as a Systems Engineer on a product that provides protection to the military GPS signal in space and ensures that the GPS receivers in everything from aircraft, to projectiles, continue to function in hostile environments," Chuck explains.

Chuck's career path has led him away from the implementation of complex algorithms in software and the detailed analysis of the physics-related portions of the system. However, he knows that his physics degree has definitely provided him with an advantage. "First, I always have a unique perspective," he says. "Where most of my peers were trained with a usual "engineering toolbox" of skills, I have learned to approach a problem from a more abstract base ('Assume a spherical cow') and as such can generally find a way to bring value to any problem we are trying to solve." Chuck acquired the necessary coding skills in school (MATLAB, C) to enable him to read the code the teams develop, as well as just enough thermal analysis to be able to understand and engage with the hardware developers when the box overheats. "Every experience I had at UNI in coding, troubleshooting, algorithm implementation, and yes, even the lessons in humility, has helped to shape who I am as an engineer," Chuck avers.

Chuck advises current students to focus on the skills that they have acquired during their time in school. "You have had more coding experience in your four years than many of the folks who have computer engineering and electrical engineering degrees," he says. "Also, if you have a lot of hands-on experience in the lab, make sure it is on your resume."

For fun, Chuck still finds himself playing video games. He also enjoys woodturning and working on cars. "My favorite pastime is road trips with my family," he declares.

Chuck and his family live in Vinton, Iowa. His oldest daughter will be attending UNI in the fall of 2019.



Chuck talks to Physics I for Science & Engineering class during a visit last fall.

Richard Kroeger

I "retired" in 2018 after 29 years of research and development working for the Navy, landing in San Diego for the last 11 years of my federal career. This might be misleading. I now work part-time doing the same job but with less of the bureaucracy and hassles than is life de rigueur in the civil service. I've had the privilege of working on an amazing and diverse range of projects ranging from space and astrophysics, working in underground laboratories, building and testing sensors on underwater robotic vehicles, to development of technologies to manage radiological threats. I now have the time and flexibility to take on other work that wasn't possible with a full-time job. In the last year I supported three NASA peer reviews which involve some amazing new missions, methods and science which we will see in the next four or five years. I also look forward to other ways my life of experiences can be put to work.

I was interested in reading another alumni's story in the 2018 issue of Cross Sections: Cody Wilson's work scanning shipping containers is relevant to some of the things I've worked on in the past. I too have commented that UNI's Physics Department was a springboard that launched my career in physics. I'll go on to say, I found that I was better prepared than a good many of my incoming class in graduate school. The whole UNI Physics Department deserves credit for giving all of us the attention we needed to grow, but I credit Dale Olson, Ralph Engardt, and Roger Hanson in particular who gave me opportunities to experiment and try things that, frankly, I don't think would be possible for an undergraduate in a larger institution.

> "UNI's Physics Department was a springboard that launched my career in physics."

Retired guys get to offer unsolicited advice. It is written somewhere. It might seem odd to some who knew me as an undergraduate, but the ability to write well and communicate will take you far. I wasn't a very good writer when I graduated from UNI, or for that matter graduate school later on (I might suggest the Physics Department consider this as an explicit part of the curricula). Knowledge of physics is very important too, but that is lost if no one else understands or appreciates your work. It turns out that no one was going to write for me. I had to learn or be marginalized. It also turns out that good writing was something most new hires and even mid-career employees needed to develop; I was not alone. It even turns out that "good" doesn't mean the Pulitzer prize, it simply means putting down the facts so the intended audience walks away understanding what you wrote about. They all want you to succeed; it makes their jobs easier. Every organization, every manager, every sponsor wants you to write reports. It is frustrating that most of these never get critically read; they are merely a required contractual deliverable that checks a box. Of course, some do get read. The author gets recognized, and ultimately the good writer gets more things to do and more things to write about, and of course, promoted. As a project manager, if I was to assign a task to calibrate a what-not, I will give that task to the person who will give me a good report – that, and check his or her work, of course. Of course, you should also exercise (take care of your brain and body), spend quality time with your family (best way to stay married), and eat well, but this is all obvious.

Steve Guyer

Steve Guyer grew up on a farm near Clermont, Iowa. He attended UNI from 1982 to May 1985, graduating with a Bachelor of Arts in physics and a math minor. "UNI was a great place to further my education," Guyer says. "The smaller class sizes provided learning opportunities for which I am grateful." Professor Kent Macomber was his advisor. "He shaped my future in ways that I didn't recognize at the time," Guyer declares. "Many a time, I would visit him in his office with what I thought was a perplexing physics problem. Predictably, he would deftly guide me through the complexities. He encouraged me to take a step back, break down the problem into the basic knowns, and building upon them to solve the problem." In his usual thorough way, Professor Macomber also provided Guyer with advice regarding his plans after graduation. Guyer ultimately decided to attend the University of Iowa, where he obtained a Juris Doctorate in August 1987.

After law school, Guyer worked as a Senior Attorney for Iowa Southern Utilities and as an environmental manager for Alliant Energy. He then worked as Director of Environmental Affairs and Environmental Counsel for MidAmerican Energy.

In 2008, Guyer started GWA International. GWA focuses on alternative energy, in particular, solar energy. "I design and build solar energy systems, which allows me to use all of my education," he says. "Unlike electricity generation from other sources that rely on some form of energy to turn a generator, solar power generation uses electronics to transform the sun's energy into electricity for your home or business."

Guyer's work is multifaceted and allows him follow his passions. From the first day he meets a solar energy customer, he is excited to take on the challenge of solar design to facilitate their goals. "I start with how many kilowatt hours they use in a year and what portion of that they want to replace with kilowatt hours from their solar," he explains. "With that information, I run modeling that determines the system size necessary to produce the desired amount of solar energy."

System design involves many elements that need to be incorporated. All solar energy systems use solar panels that transform the sun's rays into a direct current that feeds into the core of all solar energy systems, the inverter. Choosing the right solar panel is more about the cost of generation in cents per kilowatt hour than the panel efficiency. However, choosing the right inverter for the job is more dependent on overall system size and reliability.

"Once I know what panel and inverter I will use, I can do the electrical and mechanical designs for the system," Guyer states. "The electrical design involves everything from calculating string sizes (number of panels connected in series) adjusted for the low and high temperatures where the system will operate, to the appropriate wire sizes and circuit protection. I also need to calculate the line losses to ensure that the system will operate reliably and maximize the production, especially when using microinverters."

The mechanical design involves choosing the appropriate racking structure (the rails and substructure to which the panels fasten to form the solar array) for either a roof-mounted system or a ground-mounted system. In designing a roof-mounted system, modeling needs to be performed to ensure that the system can withstand the appropriate wind load and snow load for a particular geographic area. Once the loading is known, calculations are performed to ensure that all of the brackets used to fasten the system to the roof substructure are designed to withstand the loading.

When designing a ground-mounted system, similar modeling needs to be performed. For ground mounts, the geology in the particular area needs to be known. In this case, calculations need to be performed to ensure that all of the supporting piers are designed to withstand the wind and snow load, taking the specific geology into account. In addition, when the system will have multiple rows of panels, calculations need to be performed to determine the appropriate space between rows to prevent interrow shading.

"After the electrical and mechanical systems have been designed, I also need to ensure that the system will comply with the applicable laws, regulations and ordinances," Guyer emphasizes. "This is crucial to ensure that the permitting process goes smoothly." Applications are submitted to the customers utility company, seeking permission to interconnect the solar energy system with the electric grid. After the utility approves, the system is built, inspected, and approved for operation by the utility.

Guyer is excited about the prospects for solar energy. "I believe solar has an excellent outlook for the future, he says. "The costs continue to come down including the costs of batteries. Solar is truly transformative in its ability to provide personal sustainability, reliability, and energy independence. Also, utilities are building solar energy farms because it now represents one of their lowest cost generating sources."

Guyer thinks that there will be many opportunities in the solar industry for physics majors. "Certainly, I believe a physics education provides the foundation for system design," he affirms. "Additional opportunities include product design of new panels and new inverters, material science, or failure mode analysis."

In his spare time, Guyer enjoys biking or hiking the trails, and traveling. He lives in Altoona, Iowa with his wife Rhonda and son Skyler.

Kenton Swartley

Kenton Swartley attended UNI from 1991-1993. He obtained an M.A. degree in Science Education, with a Physics Emphasis. While at UNI, Swartley had many memorable experiences. "It is difficult to pick just one or two highlights," he muses. Some of his most notable experiences included opportunities to work closely with Physics faculty members who very much valued education along with their research. "It was always clear that the professors were concerned about their teaching as much as their research and this extended beyond just the science education faculty," Swartley says. He also valued the many challenging and worthwhile Physics classes he took. "One of the best was a Vibrations and Sounds course taken at the same time I was taking Differential Equations," Swartley recalls. "This provided one of the best chances to connect a math course with physics applications of that math at the same time." Swartley also very much appreciated opportunities to teach lab sections for the General Physics courses and to work with Roy Unruh (now emeritus) on a variety of special summer programs for local youth.

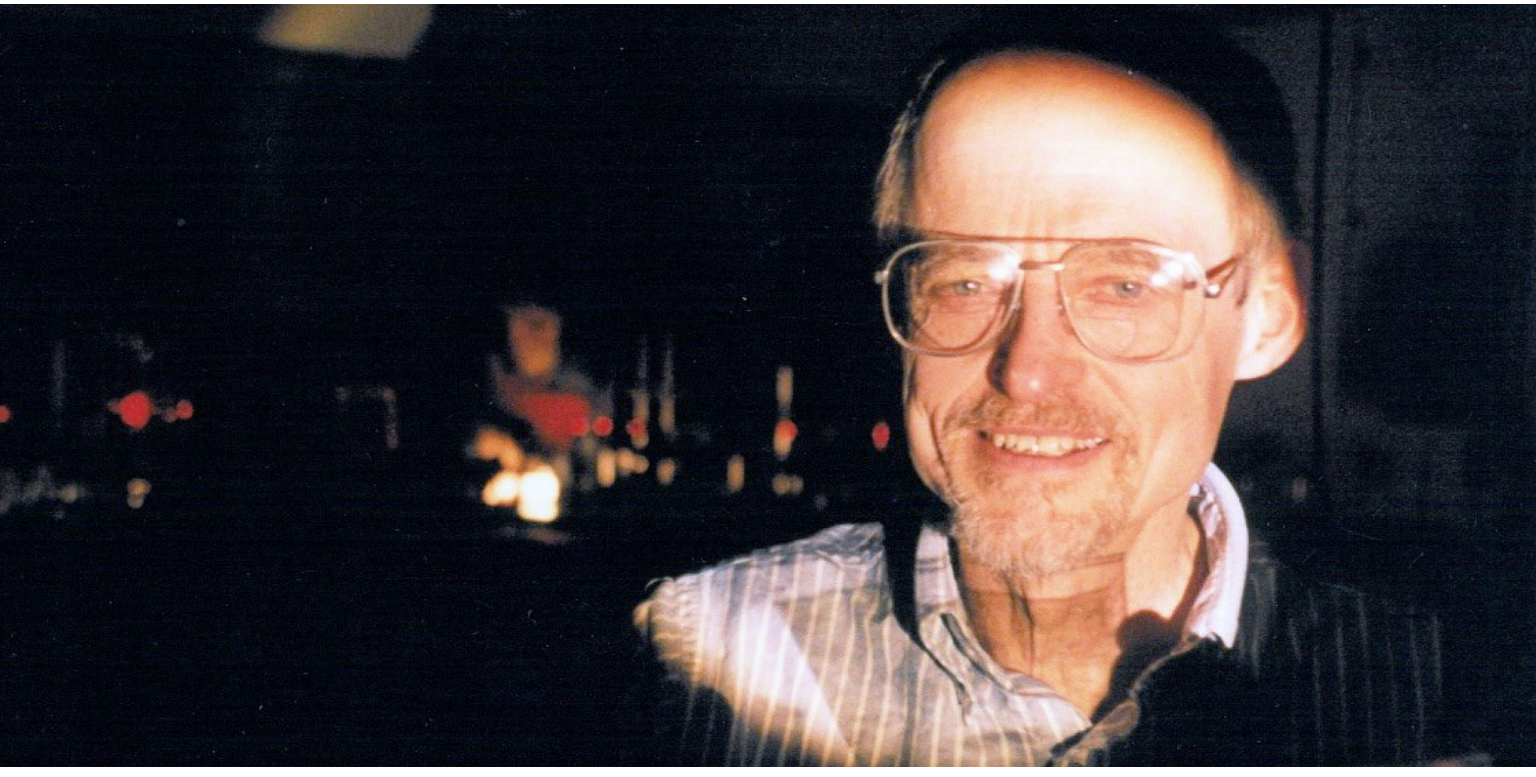
After graduating from UNI, Swartley taught physics and electronics at Marshalltown High School and then taught math at Peet Jr. High School in Cedar Falls before landing a job as Physics Teacher and Robotics Team Coach at Cedar Falls High School in 1997. He held this position until 2016. At Cedar Falls High School, Swartley taught multiple levels of physics classes, from introductory to advanced classes. "In all the classes, I always tried to include many everyday applications of the physics other than just textbook learning," he says. "This included many activities and labs I learned of in my various courses and workshops at UNI." As more advanced courses were added, Swartley helped to establish a dual credit (with Hawkeye Community College) College Physics course and more recently, the AP Physics C: Mechanics course. In 1998, he started the FIRST Robotics Competition team at Cedar Falls High School. "This provided great opportunities for students to learn various aspects of a real-world engineering project, including both technical and non-technical skills," Swartley notes. The "Swartdogs," as the team is known, has been quite successful in the annual FIRST competitions.

In 2016, Swartley became Community Partner / STEM Facilitator for the Cedar Falls Community School District. In this role, he works with all grade levels in promoting STEM events and opportunities, both in school and the wider community. This includes such things as working with FIRST teams in the district, helping to organize the Cedar Valley STEM Festival and the Cedar Falls High School STEM Night, and working with individual teachers on STEM classroom activities. "I also have helped to get new computer science courses started in the district at both the junior high and high school levels," Swartley says. "Part of my job also involves writing various STEM related grant applications for various teachers, groups or projects within the district." Swartley was recently named "Outstanding Educator" for 2019 by the Cedar Falls Lions Club.

> "I always tried to include many everyday applications of the physics other than just textbook learning."

When he is not working to promote STEM, Swartley enjoys spending time with his family, playing board games, running, and fixing things around his house. He lives in Cedar Falls with his wife Emily and their four kids.

IN MEMORIAM



Dale Olson

Dr. Dale Olson died on Tuesday, May 7, 2019. He was 77 years old. Dale had a long and distinguished career in the UNI Physics Department. He retired in 2017, after 49 years as a faculty member at UNI. Dale was also a strong advocate for clean energy and sustainability, and a fierce defender of action to mitigate the effects of climate change. He was the owner of a sleek, red Tesla sedan, which he enjoyed talking about almost as much as he enjoyed driving. Here are some reflections from three faculty members on the occasion of Dale's retirement. These reflections capture Dale's essence: sociable, enthusiastic, dynamic, relentless.

"It has been a great pleasure to know you for the past three years. I am not sure if you remember but we had lunch together during my very first visit to Cedar Falls, in the spring of 2014. You took me to the Masala Grill (a local Pakistani restaurant) for buffet, and although I don't remember all the details of our conversation, I do remember that we discussed physics, politics, "ethnic" food, and literature. So, in fact you are one of the very first people I met at UNI. Then later that day, you showed me your robots and told me about their stories. It was very entertaining and interesting, as I was exposed for the first time to the inside story of the legendary Mini-Sumo robotics competition (which I ended up judging two years later). It was a truly memorable day."

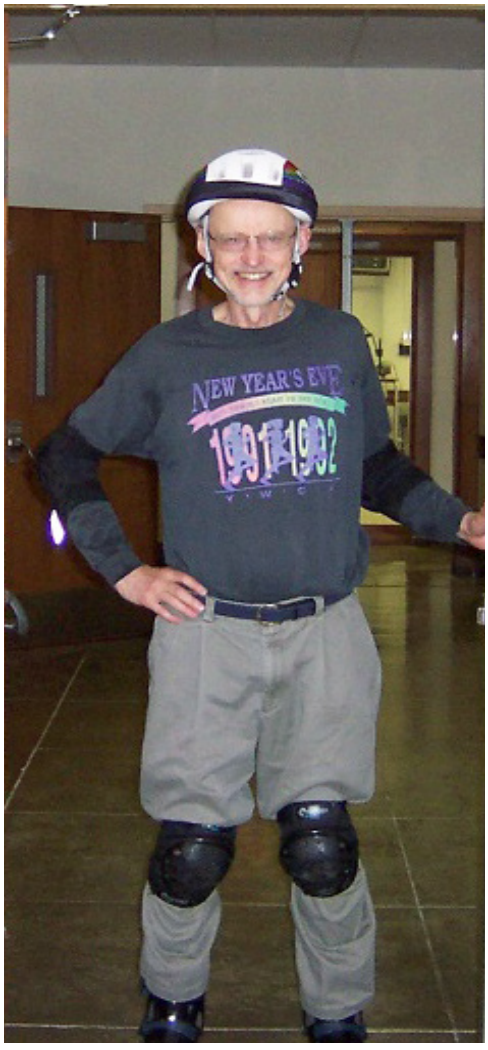
"You have been an irrepressible agent for effective physics teaching. You have never stopped searching for and implementing more effective ways to improve students' understanding of physics concepts at all levels of the curriculum. Indeed, you have been quite a risk-taker in the classroom, not afraid to forgo the comfort of known and traditional methods in order to actualize the promise of new and lesser known techniques. You have also been an ardent advocate for the involvement of undergraduate students in meaningful research. I have always admired the enthusiasm and gusto with which you pursued the engagement of students in your research and pedagogical projects. When I was a fresh, young assistant professor, you were an excellent role model for molding students into practicing scientists. Dale, you have also been

unfailingly dependable in helping the department to execute its outreach and recruitment responsibilities. You have done countless optics and holography demonstrations and workshops for visiting students and families. You have also generously given your time, skill,and intellect to educate and entertain prospective students and their parents with Mini-Sumo robots."

"Your enthusiasm for taking on new challenges, both academic and athletic, is inspirational to all of us. I enjoyed collaborating with you on the optical imaging project several years back, as well as assisting with the Mini-Sumo competition before a change to my teaching schedule made that impossible.

When I teach methods courses for the science teaching candidates I make mention of the fact that instructor enthusiasm can play a role in student learning. I often use you as an example of one who, from my view, seeks to model a love for learning science with the best of intentions for influencing student success. Thank you, too, for your advocacy of science and facts in an era where some seem to find both of dubious value. I hope that all of us who are committed to science education are able to demonstrate the utility and vitality of our field to the students we're fortunate to work with."

Dale is survived by his wife Ann, daughters Sara and Joan, sons Jeff, Derek, Dustin and Daniel, sister Carmen, grandchildren and many other relatives. Dale was a teacher, scholar, and a fine human being. He will be sorely missed.



> You have never stopped searching for and implementing more effective ways to improve students' understanding of physics concepts at all levels of the curriculum.

IN MEMORIAM

Frances Jourdan
A Life Well Lived

Mary Frances Jourdan was a grandchild of Louis Begeman, the first head of the Physics Department at what was then Iowa State Normal School. Frances was a regular and very generous donor to the Louis Begeman Memorial Scholarship Fund and the Louis Begeman Fund for Excellence in Physics. The former provides funds for substantial merit scholarships for junior physics majors and chemistry or biochemistry majors; the latter is a discretionary fund that supports physics programs.

Mary Frances Jourdan was born on May 26, 1927 to Ralph Louis Jourdan and Florence Begeman Jourdan in Salt Lake City. Ralph procured ore for smelting and refining; Florence taught high-school math. A few years later, Ralph received a promotion and the family moved to New Jersey. Frances graduated from Ridgewood High School in 1945. She attended Indiana University, where she indulged her interest in drama.

After graduation, Frances traveled to Germany where she organized plays and other entertainment for American soldiers after World War II under the auspices of the Special Services. During this period, she witnessed the coronation of Queen Elizabeth II in London and skied the Alps during her free time. Frances later returned to the United States to pursue an advanced degree at the University of Washington. After completing her degree, she secured employment in the oil industry, which took her to the jungles of Venezuela, among other places.

Frances returned to the States and in 1966, embarked on a long career as a teacher in California, mainly at the fourth-grade level. Her career was extremely rewarding for her because she could give her students the benefit of her firsthand experiences from her travels abroad. She received many thank-you notes from students during her teaching career. During the summers, Frances traveled extensively, including trips to Yugoslavia, Nepal, Iran, the Trans-Siberian Railroad, New Zealand, Fiji, Australia, the China Silk Route, a safari in Africa, Costa Rica, Patagonia, Vietnam and Bhutan. Her students learned about these far-flung places through the many slides she made capturing her adventures. She also traveled widely within the United States.

Frances was also active in philanthropy. Following in the footsteps of her mother, she became a member of P.E.O., a philanthropic organization of women celebrating the advancement of women. (P.E.O. was founded in Iowa and is headquartered in Des Moines.) In the 1990s, Frances joined the charities set up by her mother Florence Begeman and Uncle Myron Begeman to support a foundation celebrating their father Dr. Louis Begeman who was instrumental in developing the sciences at the University of Northern Iowa. She contributed annually to the two Begeman funds mentioned above, which are administered by the UNI Foundation. During her long residence in California, she had a sincere wish to preserve the environment. In pursuing this goal, she generously supported the Nature Conservancy Organization.

Frances died on Sept 12, 2018 in her beloved California. She is survived by her brother Richard, who is also a great friend of the UNI Physics Department.

SUPPORT THE PHYSICS DEPARTMENT

Would you like to support the Department of Physics? If so, please fill out the form below and return it to:

UNI Foundation Financial Services
121 Commons, Cedar Falls, IA 50614-0239

_____

Name

_____

Address City, State, Zip

_____

E-mail Preferred Phone ☐ home ☐ cell ☐ business

Please check if new address, phone or e-mail.

I/we would like to support the following fund(s).

$_____ **Physics Student Research/Awards Quasi-Endowed Fund** provides support for scholarships and undergraduate research in physics (220193-20)

$_____ **Louis Begeman Fund for Excellence in Physics** is a discretionary fund to support UNI Physics Programs (222181-21)

$_____ **Grossman-Perrine Endowed Scholarship Fund** supports an annual scholarship to a current physics major, with preference for a woman and minorities (211778-30)

Online: If you prefer, you may give via our website: https://www.uni.edu/physics. Use the "Donate to Physics" button on the left side. Please enter your donation amount in the boxes, or click "Take me directly to the giving page" to contribute to any other project (enter the project name or gift intention in the area marked "Please specify designation" in the "Other" category).

$_____directed to _____

My (or my spouse's) company, _____ (name), will match my gift.

(Please contact your HR office for details and matching gift form to be submitted with payment.)

Type of Payment:

Check: enclosed, payable to the UNI Foundation

☐ **Credit Card:** please charge my card
$ _____ beginning (mo/yr) ____/____
Please complete card information below.

Signature (required) _____ Date _____

Credit card information will not be kept on file 100509

Charge my: ☐ VISA ☐ MasterCard ☐ Discover ☐ American Express *(please check one)*
Card Number: _____
Expiration Date: _____

University of Northern Iowa

Department of Physics
215 Begeman Hall
Cedar Falls, Iowa 50614-0150

ALUMNI INFO REQUEST

LET'S HEAR FROM YOU!

Let us know what you have been up to. You can email us at physics@uni.edu or return this form to:

Department of Physics
University of Northern Iowa
215 Begeman Hall
Cedar Falls, IA 50614-0150

First Name _____ Last Name (maiden)_____
Address _____
City _____ State_____
Email:_____

Please share any news about you or your family to be included in the next Physics Newsletter.