

Spring 2017

## CrossSections, Spring 2017

University of Northern Iowa. Department of Physics.

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# CROSSSECTIONS

SPRING 2017

## A MESSAGE FROM THE DEPARTMENT HEAD, DR. PAUL SHAND

Dear UNI Physics alumni and friends,

As you have probably heard, UNI has a new president, Mark A. Nook, who started his duties as the institution's 11th president on February 1, 2017. Before arriving at UNI, Dr. Nook served as chancellor of Montana State University Billings, (2014-16) and senior vice president for Academic and Student Affairs for the University of Wisconsin system (2011-14). These are challenging times for most public universities but public comprehensives such as UNI are particularly vulnerable. Dr. Nook must deal with a reduction in funding from the Iowa legislature in the next fiscal year. The Iowa Board of Regents is considering an increase in tuition that will partially offset the budget cut if approved. Whatever happens, already tight belts will be additionally strained. It is also noteworthy that a new collective bargaining law has stripped UNI's faculty union, United Faculty, of its power to bargain for anything but base wages and "other matters mutually agreed upon." A new Faculty Handbook that sets forth faculty rights and responsibilities has been developed to replace the master agreement between United Faculty and the Regents.

Despite the ongoing financial strictures and legislative changes, UNI and the Physics Department continue to press forward. The over \$30-million renovation of Schindler Education Center is complete, which will give a boost to UNI's already formidable presence in the K-12 education sphere. UNI also received the Student Success and College Completion Award from the American Association of State Colleges and Universities for its successful efforts to increase retention of first-year students.

The UNI Physics Department continues its efforts to improve recruitment and retention of physics majors. We have re-introduced the B.A. in Physics degree program, which will officially be available to students at the beginning of the Fall 2017 semester. However, by the magic of university bureaucracy, Enrique Tovar became the first student to graduate with the reconstituted B.A. in Physics degree this past spring. The B.A. offers the opportunity for students who have a primary major in another area to also major in physics and thereby acquire deeper knowledge of analytical and computational problem-solving techniques than

afforded by a physics minor. In an era where interdisciplinarity and multiple skills sets are increasingly prized for technology-intensive jobs, we believe it is an opportune time to resurrect the B.A. degree.

You may recall that a year and a half ago, UNI signed a formal agreement with Iowa State University to officially establish the "3+2" physics/engineering dual-degree program. This fall, five UNI physics majors will be starting their engineering studies at ISU. This is the largest number of 3+2 students ever to transfer to ISU in a given academic year. The University of Iowa has also approached us about formalizing a 3+2 agreement with them. This agreement is currently being developed. At the same time, we have to ensure that the 4-year B.S. in physics degree remains an attractive option for students. These are the students who populate upper-level courses (required and elective) and are the long-term undergraduate research participants. Indeed, these students have represented the Physics Department and UNI well at national conferences over the past year.

Contingents of physics students presented at the Undergraduate Women in Physics Conference in Lincoln, Nebraska last October, the Society of Physics Students national conference (“PhysCon”) at Silicon Valley in November; and the Council on Undergraduate Research National Conference in Memphis, Tennessee in April.

Finally, faculty member Dale Olson will retire at the end of June. Dale has served the Physics Department and UNI for 49 years and has had an indelible impact on the lives of our students. We will certainly miss Dale. We are all the better because of his generosity of spirit and irrepressible love of physics. Thank you to everyone who donated to the Physics Department last year. The scholarships and research stipends funded by your generous gifts have supported deserving students and made a positive difference in their lives. I encourage each of you to make a donation this year, however small (see back page).

As always, you are welcome to stop by for a visit. Colloquia given by alumni are especially appreciated by our students. I hope to see some of you at the upcoming Physics Homecoming Picnic (October 7). Take care, and I wish you all the best.

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

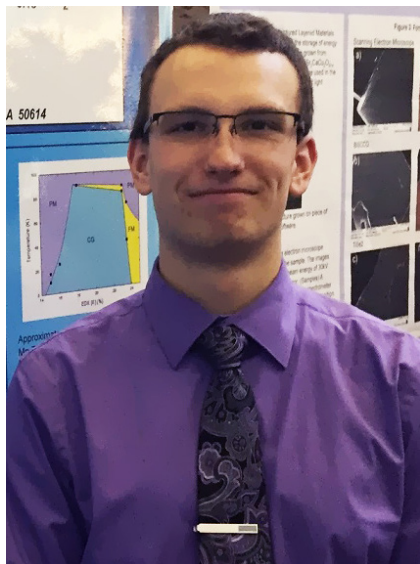


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# STUDENT PROFILE

## LUCAS BEVING



Lucas Beving is currently a senior student at the University of Northern Iowa majoring in physics and mathematics. Beving decided to attend UNI due to the size, cost, and the excellent experience he had when he visited an introductory physics class as a prospective student.

Throughout his time at UNI, Beving has participated in several undergraduate research projects. In 2015, during the summer after his sophomore year, Beving undertook his first undergraduate research project with Dr. Paul Shand. This project focused on experimental investigations of magnetic materials, namely, nanostructured tantalum disulfide intercalated with manganese (which provides the magnetic properties). One year later, Beving participated in a ten-week undergraduate research project at the Princeton Plasma Physics Laboratory. Under the supervision of a PPPL

staff researcher, he worked on a MAT-LAB finite-element simulation of the effects of voids in Nb<sub>3</sub>Sn wire, which is frequently used in superconducting magnets. (Superconducting magnets are a mainstay in plasma physics research.) The wire in a superconducting magnet is subjected to large stresses when immersed in the high magnetic fields produced by the magnet. The magnitude of the strain the wire undergoes is greatly dependent on the density and nature of the voids in the wire. Too much strain will cause structural damage to the wire. Beving described the research program as a great experience. “It was fun to work at an actual government lab and interact with the other students and with people who do research for a living,” he said.

Beving is involved in the UNI Physics Club and serves as the president. He has also served as a mentor to first-year physics majors. His favorite part of mentoring is building relationships with other students and preparing them for their upcoming classes. Beving is also enrolled in the University’s Honors program. In his free time, he enjoys playing video games, and outdoor activities such as hiking and climbing.

According to Beving, one of his favorite memories at UNI was living in Campbell Hall during his freshman and sophomore years, where he met many of his friends. Another lasting memory was attending the 2016 American Physical Society March Meeting in Baltimore,

where he presented his research findings and networked with other undergraduates from across the country.

Beving also provided some advice for students considering a physics major. “When you figure out what you want to do after graduating, whether go to grad school or work in industry, try to have a concrete plan for the electives you will take to complete your degree. The faculty do a good job of helping students with that. Also, take advantage of opportunities to participate in research and other projects. For example, if there’s a problem encountered in class that interests you, ask your professor if you could do a project on it,” he said.

Beving will graduate in May and plans to attend graduate school at the University of Iowa, where he will pursue a Ph.D. in physics, focusing on plasma physics. Upon completing his graduate studies, Beving hopes to become a physics professor at a university similar to UNI.

# FACULTY PROFILE: TIM KIDD



**Tim Kidd**  
Professor of Physics

Before coming to the University of Northern Iowa, Professor Tim Kidd studied at the University of Illinois Urbana-Champaign, where he received his bachelor's degree in physics. He obtained a Ph.D. in physics from the same institution in 2002. In 2006, after completing postdoctoral work at Brookhaven National Laboratory, he began teaching at the UNI Department of Physics. Since then, Kidd has taught everything from introductory physics classes for freshmen to programming classes for scientists and engineers. Currently, his primary instructional duties involve teaching electronics-related courses such as Introduction to Electronics and Physical Computing.

Kidd is also actively involved in research. He is currently working on three main projects: investigating the physical properties of nanocellulose, fabricating novel nanoscale structures, and finding new ways to make materials magnetic. Kidd explained that some of the research projects are a result of failure that led to discoveries. "I try to do one thing,

but I sometimes end up doing the complete opposite. I don't know if it'll work, but that's the nature of scientific research," he said. According to Kidd, research projects are a good way to link class activities to experience in doing real-world physics. "I get to see students come from no experience in the lab to seeing them run their own experiments and design their own equipment. This kind of experience is very valuable for graduate-school research and for work in industry," he says.

During his time at UNI, Kidd has been recognized for a number of achievements, including several grants from sponsors external to UNI. Some of the grants include: a \$400,000 grant from the Iowa Power Fund, three National Science Foundation grants to support undergraduate research, an \$85,000 Carver Initiative grant for education to purchase classroom equipment for the freshman level and advanced electronics labs, an Iowa Energy Center grant for \$70,000 and a \$200,000 Battelle grant to purchase scientific equipment. He has also been recognized with a departmental award for his work in protecting physics programs when several academic programs at UNI were cut five years ago.

In addition to teaching and research, Kidd has been deeply involved in faculty leadership activities. He is currently serving as the Chair of the Faculty. As the faculty chair, Kidd serves as a direct liaison between UNI administration and the faculty. One of his main responsibilities is to serve on committees. "I serve on every committee known to man," he joked. Kidd also explained that one of his most important duties since becoming the faculty chair was serving on the presidential search committee whose

work resulted in Dr. Mark Nook becoming the 11th president of the University of Northern Iowa a few months ago.

Now that the presidential search has ended, Kidd's attention has turned to other issues important to UNI's faculty. One of his priorities is strengthening and streamlining the university's academic programs. "If a class is required for graduation, it must be a meaningful one; we don't want to add more to busy students' schedules," he said. Kidd also wants to make it easier for students to be able to take the classes they need. Further, he wants to improve communication with the administration so that both faculty and the administration are as well informed as possible before decisions are made. He is currently involved in discussions with various departments on campus to find methods that better help the public to understand academic and budget priorities, and how those priorities impact both students and faculty.

Kidd described his favorite memories at UNI as, "The eureka moments when students get it. When they are working on projects for a class or in research and they see the light and it begins to work not for me, but for them. That and when my students graduate and start working somewhere that makes them happy." In upcoming years, Kidd wants to see more students as well as more diversity in the physics program. "I hope to see good students in the Physics Department and to make sure to keep concentrating on giving them the skills and opportunities to do well in the real world," he concluded.

# DEPARTMENT HAPPENINGS

## Alumni Homecoming Picnic

The Alumni Homecoming Picnic was held on Saturday, October 1, 2016 at Seerley Park in Cedar Falls. The picnic followed the UNI Homecoming parade, in which the Physics Club and Women in Physics Club participated for the first time with a physics-themed float. As usual, the food and fellowship were enjoyed by all, on a glorious fall day.



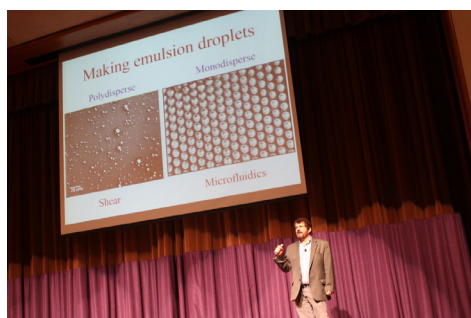
*Physics alum Jeff Wallace and wife Amanda dig in at the Homecoming Picnic. The food ranged from quintessential American to authentic Indian.*



*Physics majors Michael Martin and Jessica Thatcher walk behind the Einstein-themed Homecoming Physics float.*



*Physics alumni Kurt Drilling (left) and Randy Holmes, along with Randy's wife Julie, chat at the Homecoming Picnic.*



*2017 Begeman Lecturer David Weitz delivering his lecture in Lang Hall Auditorium.*

## Begeman Lecture

The 2017 Begeman Lecture was delivered by Dr. David Weitz, Mallinckrodt Professor of Physics and Applied Physics at Harvard University, on March 29. The topic of the lecture was “Dripping, Jetting, Drops and Wetting: The Magic of Microfluidics.” The large audience, which included many biology students and faculty, was fascinated by the exquisite control exercised by Dr. Weitz and his research group in manipulating tiny amounts of fluid.

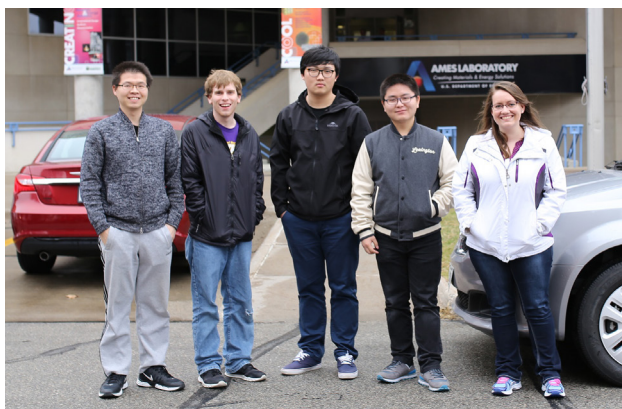
# DEPARTMENT HAPPENINGS

## Student Research

Each year, the students who receive a summer research fellowship give oral presentations on their work as a part of the Physics Department's Colloquium series. The talks are only 10 minutes long; thus, the students must effectively condense project-related information into a coherent oral summary. The colloquium has served as a good warm-up exercise for those students who have presented their research at national conferences.



*Physics major Michael Martin talks about his computational project on random walks on self-similar structures.*



*Physics Club and Women in Physics Club members visit Ames Laboratory on the campus of Iowa State University to learn about research efforts at a national laboratory.*



*Physics major Cai He delivers her research report, which involved Raman spectroscopy of two-dimensional materials.*



*At the end of the fall semester, students and faculty relax and have fun at the "Holiday Colloquium." In this picture, Dr. Dale Olson, magically extracts previously unseen test tubes from a beaker containing cooking oil, to the amazement of two future physics majors.*



Students are also exposed to external speakers such as Dr. Christian Binek of the University of Nebraska-Lincoln. Dr. Binek discussed his latest research on spin-based electronics.

## Alumnus in Residence

In April of each year, alumni are invited back to UNI to re-engage with their departments and the university. Alumni are selected and invited by individual departments. On-campus activities include breakfast with the president, lunch with the dean, and meetings with departmental faculty and students. The 2017 Alumnus in Residence for the Physics Department is Noah Podolefsky ('00).



2017 Alumnus in Residence Noah Podolefsky talks to physics majors about his current job and how his experiences as a UNI physics major helped him succeed after UNI.

## Physics Banquet

At the annual Physics Banquet, the Physics Department celebrates the academic excellence of its majors by giving awards in various categories. Outstanding student service and graduating students are also recognized and honored. Everyone present gets to enjoy a wonderful feast prepared by the UNI Department of Residence.



Group photo of Physics Banquet attendees. And a very good-looking group it is!



Physics Teaching major Jacob Weber enjoys a pre-dinner drink as he chats with his guest, Brittany.

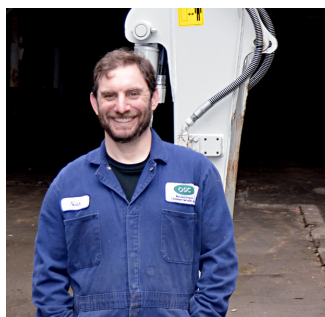
## Academic Decathlon

For the past two years, UNI has hosted Academic Decathlon Study Day, which is a series of activities to help high-school students prepare for the Academic Decathlon. The theme for this academic year is World War II and the Physics Department was asked to facilitate a session on radioactivity and nuclear fission and fusion. Faculty member Jeff Morgan served in this role and conducted the study session involving over 100 students.



# ALUMNI FEATURE

## NOAH PODOLEFSKY



Alumnus Noah Podolefsky graduated from the University of Northern Iowa in 2000 with an undergraduate degree in Physics and a minor in mathematics. Podolefsky continued his education at University of Colorado, Boulder where he pursued his Ph.D. degree in physics, graduating in 2008. Currently, Podolefsky serves as the chief technical officer of a start-up company, Green Machine Equipment (GME).

Headquartered in Buffalo, New York, GME was co-founded by Podolefsky and Jon M. Williams. Williams had an idea to produce electric, emissions-free construction equipment that would be as powerful as those that run on petroleum. Once the two joined forces, the company began to focus on producing lithium-ion powered drive systems.

It was Podolefsky's hobby of building motorcycles that led to his position at GME. As he built an electric motorcycle in his garage, he taught himself about batteries and motors. It's this love for disassembling and reassembling equipment that makes Podolefsky excited about working for GME. "Ever since I was a little kid, I liked taking things apart and building things. That's basically what I get to do now," he says. The CTO position requires him to design and assemble working machines. His work at GME allows Podolefsky to utilize his physics knowledge to build green

technology that can compete with and eventually replace their fossil fuel-based counterparts. Podolefsky continues to live in Boulder, Colorado and commutes about once a month. Much of his design, testing and prototyping work on batteries and drive systems is done in the laboratory he set up in his basement. He joked that his favorite part about his job is working in his pajamas.

Podolefsky's experience at UNI in pursuing a physics degree has been essential both in academia and in industry. "Learning physics here taught me a way of thinking that has been invaluable in everything else I've ever done," he said, adding that the UNI Physics Department taught him problem-solving skills and gave him laboratory experiences that helped him succeed.

During his time at UNI, Podolefsky's favorite project was writing code to operate a soda machine on the Internet. The project occurred in 1998, a time in which the Internet didn't have many websites, and required a dial up modem. To connect the soda machine that delivered on the Internet, the students had to build circuit boards, program, and write interface codes. "It was a lot of fun, something we did for no reason at all, except [that] it was fun," he said, added that the project was successful, and delivered soda to the students.

Podolefsky was involved in the Society of Physics Students, as well as the American Physical Society while at UNI. As an undergraduate, he also worked as an instructional lab assistant and a research assistant in three different research labs. As graduate student at CU, Podolefsky also worked as a research assistant and as a teaching assistant. Then he also had the opportunity to work with the Physics Education Technology (PhET) group

with 2001 Nobel Prize in Physics winner Carl Wieman. After his Ph.D., he continued his work on physics education research as a research associate before landing his current position at GME.

The best advice Podolefsky has for current students is to not be afraid to try new things. Podolefsky's college experience began at the University of Iowa, where he found himself lost in the crowd in large classes of 300-400 students. "I just couldn't thrive there," he explained. He decided to transfer to UNI.

Podolefsky also added that he tried several different paths throughout his journey in college. He pursued four different majors before deciding to pursue a degree in physics. "It took 7 years to graduate. I left school halfway through. I had lots of figuring out to do, then I went back and made something out of it," he said. According to Podolefsky, he also had to follow his own advice after the opportunity for GME came along. "I was 100 percent on the academic track. On my way to go from grad school to postdoc to tenure-track professor and this opportunity for this company came along. I thought if I don't do this now, there won't be any more chances," he said. Podolefsky explained that although it was a hard decision, he is glad he did it.

In terms of the future, Podolefsky says that he hopes the company succeeds and grows. "We are in what is called the "death valley" of startups, so it either takes off or will fall apart," he stated. When GME slows down, Podolefsky hopes to return to academia to teach at the University of Colorado, where he can interact with students and aid in research.

# SCIENCE EDUCATION

The Physics Department takes pride in providing quality research experiences for undergraduates completing our programs. In an attempt to further develop experimental skills and increase engagement for our first-year students, the department began using the Workshop Physics curriculum for the Physics for Science and Engineering introductory courses in the Fall of 2010. Three years later, the department introduced a new First Year Projects in Physics course designed to give the same students early exposure to experiments outside of the realm of basic mechanics, which is often the primary focus of a high school physics course.

Workshop Physics was developed by Priscilla Laws and colleagues at Dickinson College over the course of many years, and commercially distributed beginning in 2004. The curriculum is one of several based on the findings of Physics Education Research, which suggests traditional modes of instruction (often centered in large lectures) are at times ineffective at optimizing student understanding of physics concepts. In the 1990s, faculty from the UNI Physics Department attended a summer workshop at Dickinson for training in the approach; this experience informed revision of the format of our algebra-based introductory General Physics courses that survives to this day. The Workshop Physics curriculum eliminates large-class lectures, replacing them with guided small-group experimentation, derivation, and discussion. (At UNI, lectures accompanying each Workshop Physics unit are recorded online and students may watch them at their convenience, likely in the few days before each exam!)

Regular homework assignments blend traditional back-of-the-chapter type problems with problems involving further analysis of data collected or models developed in class. Exam questions resemble those from more traditionally taught courses, but always include a laboratory-based question that requires students to demonstrate data collection and analysis skills.

Jeff Morgan, Associate Professor of Physics and Science Education, has been teaching this course since the new format began in 2010. The department also hires a learning assistant who serves as a co-facilitator; priority is given to interested Physics Teaching majors. Morgan and the student assistant circulate throughout the room during the two-hour studio sessions, checking on student progress, assisting with derivations, data collection, or experimental setup, and asking students probing questions designed to deepen their understanding of the material.

The department has been testing students at the conclusion of each semester using questions from a calculus-based AP exam; this practice began one year before implementing Workshop Physics. While students in the revised course have rarely produced results better than the 2009-10 traditionally-taught group, the averages from the two groups are consistently close, leading us to conclude that at minimum we “do no harm” with the Workshop Physics approach. Additionally, students develop significant skills in data collection and analysis (chiefly via spreadsheets) that were less emphasized in the past. With seven years of data, our next steps are to examine the results of these exams in topic groups to help us deduce which topics are well taught with the workshop materials and which may require revisions or supplements to the existing curriculum.



*Students in the Physics I for Science and Engineering course explore the concept of kinetic friction. Workshop Physics active-learning pedagogy is used to teach this course.*

# Dale Olson's Retirement Letter

*This reflection on Dale's time at UNI is taken from retirement messages written by Roger Hanson (Emeritus) and Becky Adams (Secretary). Roger arrived at UNI one year after Dale, and Becky has worked with Dale for 27 years. Imagine Roger and Becky reminiscing with Dale, who is too choked up to speak.*

**Roger:** Dale, I remember communicating with you in early 1968 about a faculty position open in Physics at Grinnell College. Probably I interviewed you at an AAPT/APS annual meeting which, at that time, was the main setting for employers and prospective employees to interact. At the time, I did not realize that we would become long-term colleagues at UNI. Now you are about to retire from UNI — the years go by in a hurry, don't they?

**Becky:** In late 1990's and early 2000's, the Department was involved in a Russian exchange program with faculty and students from the Russian State Pedagogical University in St. Petersburg. As I remember, you embraced this opportunity by engaging some of the Russian students with your research involving holographic interferometry, studying the Russian language, and traveling to St. Petersburg in May 1999.

**Roger:** For you, the period beginning as a Physics Faculty member at UNI in 1968 and continuing until 2017 is just one year shy of 50 years. According to the best information I have, your 49 years sets a new record for faculty at the institution, which has had names

ranging from Iowa State Normal School to University of Northern Iowa. Louis Begeman served for 36 years, (1899-1935 — might have taught occasionally in the late 1930's); Willard Poppy 26 years (1949-1975); and Verner Jensen 35 years (1956-91).

**Becky:** Fast forward to Spring 2006 and the first "UNI Mini-Sumo Robotics Challenge" was held in the Great Reading Room in Seerley Hall. In April of this year, the 12th Annual UNI Mini-Sumo Smackdown was held and broadcast live from the Hemisphere Lounge of Maucker Union. The development and continuation of this educational and fun event is in large part due to your tireless work in making it happen.

**Roger:** Your research and pedagogical interests varied and overlapped through the years, which in turn enriched the program of the Physics Department. When I first arrived at UNI in 1969 you were winding up your Ph.D. work in solid-state physics at the University of Rochester, and beginning some EPR (electron paramagnetic resonance) research at UNI. Then several years later, you had a leave of absence at Rochester where you became involved in optics, which was becoming a forefront area, with lasers and holography leading the way.

**Becky:** There is one more area I want to mention which was vividly clear to me as I looked through photographs of you over the years and it is that you love doing outreach. There were so many times in each academic year where you were in a lab with a group of students—Black Hawk Elementary School, Upward Bound, Physics Olympics, undergraduate research students, and robotics campers and mini-sumo builders. The groups I have named are only a sampling of the diverse groups you have served with outreach activities.

**Roger:** Best wishes, Dale, in your retirement.

**Becky:** I wish you good health, peace, and happiness in your retirement.

*Dale, we all wish you the very best in this new phase of your life. Knowing you, you will revel in it.*



*Dale Olson cuts one of his two cakes at the retirement party held in his honor by the 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:

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\$ \_\_\_\_\_ **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).

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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](mailto:physics@uni.edu) or return this form to:

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

First Name \_\_\_\_\_ Last Name (maiden) \_\_\_\_\_

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