CrossSections, Spring 2016

University of Northern Iowa. Department of Physics.
It has been an eventful year for the department and the university. Come to think of it, it has been an eventful year for the country. I will, however, confine my comments to happenings at UNI. At the departmental level, there were several items of note. First, faculty member Rui He received a $518,000 Faculty Early Career (CAREER) grant to pursue experimental investigations of the optical, electronic and vibrational properties of nanoscale structures composed of a few atomic layers of graphene and similar materials. Dr. He is a Raman spectroscopist of high repute who maintains collaborations with top research groups working on two-dimensional materials in the USA and China. She is the subject of the faculty profile in this issue of Cross Sections.

Second, many of you are aware that the UNI Physics Department has had an informal “3+2” Physics/Engineering dual-degree arrangement with Iowa State University for a number of years. Under this program, a student spends three years at UNI taking physics and Liberal Arts Core (General Education) courses and two years at ISU taking engineering courses, at the end of which the student is awarded a B.S. in physics and a B.S. in engineering, having met all the requirements of both degrees. Last fall, a formal articulation agreement was drawn up by Gary Mirka of ISU and me. After several iterations, it was signed by the presidents of ISU and UNI (provosts and deans also signed) on February 25, 2016. Quite a few requests for information about the 3+2 and other UNI physics programs were generated from the media publicity associated with the signing. We hope these requests translate into actual students enrolling in our physics programs! Speaking of programs, we are planning to resurrect the B.A. degree, which was terminated four years ago during the 2012 program cuts. We believe the B.A. will be attractive as a second major, especially for other science majors such as chemistry and computer science.

In last year’s issue of Cross Sections, I indicated that we had expanded our recruitment reach to China, successfully enrolling several students in our physics programs. I am pleased to announce that the first Chinese student that we recruited, Chao (“Louis”) Ji, will be graduating this summer. Louis arrived with very good English skills and so he will be able to graduate in four years plus one summer. You can learn more about Louis later in this issue. We continue to recruit students from China though the stream of students has slowed, likely because of competition from much bigger and better-known U.S. universities.

At the university level, a new provost, Jim Wohlpart, arrived in May 2015. He has moved rapidly to meet with campus constituencies, absorb the ethos of the institution, and make changes to the organizational structure of the Academic Affairs division. Wohlpart has led the effort to develop an Academic Master Plan (AMP), which is a high-priority initiative of President Bill Ruud. (There is also a Facilities Master Plan under development.) The AMP will be a “living” document that guides
the long-term operation and evolution of the university. The AMP is to be distinguished from the UNI Strategic Plan (currently also being developed), which is generated every five years. By the way, the Iowa Board of Regents is also in the midst of its strategic planning process. I guess it has been a good year for plans. Other significant events are the renovation of Schindler Education Center, which houses the College of Education (COE). Along with the renovation, the COE is revamping its mission and vision statements and developing strategic initiatives in order to reinvigorate teacher education at UNI. (Another strategic plan.) A new dean has been hired and there will be a new associate vice president for teacher preparation.

I’ll devote my final words to thanking those of you who donated to the Physics Department during the past year. Your generosity keeps us on an upward arc in student learning and engagement in both the classroom and in research. Please continue (or start) your giving to keep UNI Physics strong.

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

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Listing and Solicitation
After a visit and discussion with then Physics Department Head Dr. Cliff Chancey, Kyle Spurgeon, from Bloomfield, IA, decided UNI was the right fit for him. Chancey’s passion for getting students involved pretty much sold Spurgeon. “The department here is incredibly willing to get all of their students involved in real research,” he says.

Spurgeon has devoted a significant amount of time to experimental research during his time at UNI. His research, supervised by Dr. Tim Kidd, has focused on the creation, observation and investigation of nanostructures on layered crystalline materials using an electron beam. He has become proficient in scanning electron microscopy and atomic force microscopy. “It is really interesting to use a variety of techniques to see something that you created that is much smaller than the diameter of a human hair.” Spurgeon’s work has led to his co-authorship of articles that have been published in peer-reviewed physics research journals.

Spurgeon is the president of the UNI Climbing Club and an active member of the UNI Physics Club. Involvement in club activities helped him to get acclimated to the campus when he first arrived to UNI. He says clubs offer great opportunities to form friendships with people who have common interests. In addition, Spurgeon says they are a good way to meet other students in a variety of majors and from different backgrounds. He also enjoys coding and electronics projects.

Spurgeon has some insight for prospective students joining the Department of Physics. “The faculty really work hard to make sure you get the education you need to excel in the field you wish to go into,” he says. “Whether you want to go into academia or engineering, the professors here will make it their personal goal to prepare you for that.”

Following his graduation, Spurgeon plans to attend graduate school at the University of Kansas to pursue a Ph.D. in physics in the area of high-energy particle physics. He got a taste for the field when he participated in a summer research program at Argonne National Laboratory and looks forward to being fully immersed in research at the forefront of high-energy physics.
Chao “Louis” Ji
Senior

Chao (“Louis”) Ji is a senior from Shashi district, Hubei province in the People’s Republic of China. Ji is pursuing studies leading to a B.S. in Physics.

He first decided to come to UNI because he had heard about UNI as a high-school student in China. Ji learned that “UNI pays a lot of attention to undergraduate students, and especially in the Physics Department, students are well treated, and they have plenty of chances to do research with professors.” Because of these attractive features, Ji enrolled at UNI as a physics major in Fall 2012.

When he came to UNI, Ji expected a busy campus in a big city, and was pleasantly surprised to find that Cedar Falls is a beautiful, peaceful town with great people. Thanks to his professors and classmates, Ji has enjoyed the campus whether the sun is shining in the brilliant Midwest sky or the snow is blanketing the countryside creating a wonderland of white.

Ji is involved with the Physics Club, as well as the International Student Association (ISA). He says ISA “helped with getting through the first few months when I first came here. ISA introduced us to the surroundings, helped us get to know places, organized trips to other towns around Cedar Falls, and helped us practice our English.” He enjoys the Physics Club weekly meetings where they gather to discuss courses, problems, projects and other things happening in their lives.

When asked how UNI was preparing him for the future, Ji mentioned a few professors. “I really have to thank all the physics faculty, especially Dr. Paul Shand and Dr. Rui He, as well as my academic advisor, Kathleen Peters. They always try to help me, not only in courses, but also in future plans, like writing essays and applying to graduate schools. They always give me great suggestions to help me prepare for my future.” His research with Dr. He resulted in a publication in the Physics Review B journal in 2013. He was also awarded merit scholarships in 2013 and 2015.

Ji says one of his most memorable experiences here at UNI was his recent participation in the National Conference on Undergraduate Research. Ji and a few fellow undergraduates traveled to Asheville, North Carolina for the conference where they had the opportunity to present their own research, learn about other students’ research, as well as explore North Carolina.

After graduation, Ji plans to attend graduate school at Arizona State University to continue his physics education. “It has been a great pleasure to study at UNI. Coming to UNI was one of my most important decisions, and it is really worth coming here for four years. UNI is a campus full of the greatest people, the most advanced facilities and beautiful surroundings,” Ji says. He also adds that UNI will always be one of the most memorable experiences of his life.
FACULTY PROFILE: DR. RUI HE

Dr. Rui He
Associate Professor of Physics

Dr. Rui He joined the UNI Physics Department as an assistant professor in 2011. Dr. He did her undergraduate work at Fudan University in Shanghai, China. She then moved to the U.S. to pursue a Ph.D. in applied physics from Columbia University in New York City, which she obtained in 2006. After her graduation from Columbia, she went back to China and joined the Hong Kong University of Science and Technology as a postdoc in the physics department and as a research assistant in the mathematics department. In 2009, she returned to Columbia University where she worked as a postdoctoral research scientist until she was hired by UNI.

Since coming to UNI, Dr. He has been very pleased with the staff and students. She says the Physics Department head Paul Shand and her other colleagues have been very helpful and encouraging in developing a high-quality research program that is at the forefront of condensed-matter physics while simultaneously involving undergraduates in her work in significant ways.

In February of this year, Dr. He received a $518,000 CAREER grant from the National Science Foundation. The CAREER Grant is awarded to junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their institutions. She is the first UNI faculty member in any department to receive a CAREER grant. With the support of this grant, Dr. He is studying the interactions between atomic layers of two-dimensional materials. Her research examines how atomic layers interact when they are stacked vertically and the impact that these interactions have on the electronic and optical properties of the materials. She says the materials are promising for future electronic and optoelectronic applications.

In her time at UNI, Dr. He conceived and spearheaded the formation of the UNI Women in Physics Club, a group that meets regularly for social events and to create a supportive environment for women in physics. Recently, the group has been involved in visiting labs on campus, scheduling activities for the upcoming academic year, and trying to invite more women to speak to the club. “Being the faculty advisor provides me with the opportunity to interact with female students, and recruit more of them to be involved in research,” she added.

Dr. He has also been the leader in the Physics Department’s effort to recruit undergraduate students from China. She has used her personal connections in China to reach out to Chinese students and their parents. She will again travel to China this year to meet with contacts and to highlight the advantages of pursuing a bachelors degree in physics at UNI.
Begeman Lecture

On March 29, the 2016 Begeman Lecture was delivered by Dr. Jason Tumlinson, who is an astronomer at the Space Telescope Science Institute in Baltimore. The title of the lecture was “The Astronomical Search for Life and Its Cosmic Origins.” Dr. Tumlinson described how future space telescopes and new instrumentation will enable direct searches for life on planets orbiting stars other than the Sun and unveil the deepest origins of life in the cosmos. This lecture series is made possible through the generosity of the Jourdan family. Richard Jourdan and Mary Frances Jourdan are the grandchildren of Louis Begeman, the first head of the UNI Physics Department. Begeman, under the supervision of Nobel Prize winner Robert Millikan, carried out the first accurate measurement of the charge of the electron using water droplets.

Jason Tumlinson

Tumlinson illustrating the small blue planet that is our home in the cosmos during the Begeman Lecture
Alumni Picnic

The third annual Physics Alumni Picnic was held on Saturday, October 17, 2015. The picnic is scheduled to coincide with Homecoming. The picnic is preceded by the Homecoming Parade, which drew large crowds along the streets of Cedar Falls. Physics alumni and friends gathered at Seerley Park to eat, drink and converse on a sunny but chilly day. We all had a good time. The picnic was followed by a tour of Begeman Hall (Physics Building). Please make plans to join us at the fourth annual Alumni Picnic on Saturday, October 1, 2016.

A lovely day for a picnic! From left: Kelly Morgan, Pavel Lukashev, Dale Olson, Kurt Drilling, Ben Buhrow, Fred Behroozi, Mary Behroozi and Paul Shand

Fall foliage and food! From left: Elena Escalada, Jennifer Stollenwerk, Ariana Stollenwerk, Kelly Morgan, and Larry Escalada
Physics Major addresses Regents

Physics major Darian Everding, a senior, was one of eight UNI students selected to address the Education and Student Affairs Committee of the Iowa Board of Regents on September 9, 2015 on the topic of “Showcasing UNI Student Success.” Darian’s presentation highlighted the activities of the Physics Club, the Women in Physics Club and undergraduate research in the Physics Department. All the students gave outstanding presentations, which had the regents marveling at the poise and eloquence of Darian and the other students. Darian was ably assisted by senior physics and chemistry major Cassara Higgins in putting together the presentation.

Physics visits Theatre

Last fall, the First-year Projects in Physics class visited the Theatre Department, which was in the midst of a production of the play “Rent.” The lighting and costumes for the play required quite sophisticated electronics and programming, which was of great interest to the physics students. The First-year Projects course is taken by freshman physics majors. In this course, the students learn basic electronics and coding, which are then used to complete a significant project.

Physics Banquet

The annual Physics Awards Banquet was held on April 15. It was an evening of fun and pride. As usual, the UNI Department of Residence set the stage with a marvelous meal. Alumnus Eric Reiners then gave an interesting and topical presentation on cybersecurity. Next, students and faculty entertained the audience with a game that rather closely resembled “Pictionary.” The finale was highlight of the night – the announcement of student awards for the 2015-16 academic year.
Student Research Presentations

UNI Physics students gave presentations on their undergraduate research projects at several regional and national conferences over the past year. Three of these conferences will be mentioned here. First, Physics/Math major Lucas Beving (junior), Physics/Earth Science major Keith Doore (junior), and Physics/Chemistry major Byron Fritch (sophomore) presented their work at the March Meeting of the American Physical Society in Baltimore, Maryland, March 13–17, 2016. Lucas's faculty advisor is Paul Shand, Keith's advisor is Andy Stollenwerk, and Byron's advisor is Tim Kidd. The March Meeting is the largest physics meeting in the world, with approximately 10,000 attendees. There were several sessions dedicated to undergraduate research and special activities for the undergraduate students. Financial support to enable students to attend the March Meeting is an important benefit of successful pursuit of research grants by UNI Physics faculty members. Second, Chao (“Louis”) Ji, a senior physics major, and Brad Staten, a senior biomedical major, presented at the National Conference on Undergraduate Research (NCUR) in Asheville, North Carolina, April 7–9, 2016. Louis's faculty adviser was Rui He and Brad's advisor was Pavel Lukashev. Louis and Brad were among 13 UNI students who presented their work at NCUR. Funding was provided by the UNI College of Humanities, Arts and Sciences (CHAS).

Finally, senior biology major Derek Bradley was among 60 students selected from more than 300 from all across the country to present his research at the annual “Posters on the Hill” event sponsored by the Council on Undergraduate Research (CUR). Derek's faculty advisor was Tim Kidd. The selected students present their work on Capitol Hill in Washington, DC to an audience of U.S. senators, representatives and staffers. The students and their research advisors also meet with the legislators from their state. This is a wonderful opportunity for students to share their research work and undergraduate experiences with federal legislators and aides.

Many other physics majors gave presentations at special Physics Colloquia for undergraduate researchers held in the UNI Physics Building during the fall semester.
State Physics Competition & Department Tour

Approximately 40 high-school students who participated in the State of Iowa Physics Competition at the McLeod Center on April 12 visited the Physics Department after the competition. The schools represented were Cedar Falls High School, Ottumwa High School and Perry High School (near Des Moines). The students toured some of the research labs and did some activities with Mini-Sumo robots. Afterwards, they were also treated to lunch and provided with information about UNI Physics degree programs.
Integrating Crosscutting Concepts in Iowa Science Classrooms (ICCISC) was funded by the Iowa Department of Education as a Title II Mathematics and Science Partnership Program in 2014. The Principal Investigator (PI) is Physics and Science Education faculty member Dr. Larry Escalada, with co-PIs from Physics and other science departments. The ICCISC is a three-year professional development program to help Iowa’s secondary science teachers develop standards-aligned curricula that engages, excites, and educates students in science and other STEM-related fields using research-based teaching methods. ICCISC initially targeted 24 current secondary science teachers who are working to align their curricula to meet the essential concepts and skills of the Iowa Core and/or the Next Generation Science Standards. Participating teachers learn how crosscutting concepts are used in different domains of science, how the crosscutting concepts can be used to create coherence across secondary science curricula to improve student learning, and how to design curricula to address the crosscutting concepts in their courses.

The ICCISC program includes intense two-week summer institutes (Summer 2014, Summer 2015, and Summer 2016) on the UNI campus followed with academic year professional development and support (Academic Years 2014-15, 15-16, and 16-17). Participating teachers are required to participate in a minimum of one full year (summer institute and academic year). Teachers are strongly encouraged to participate for all three years. Our cohort grew from 24 teachers in Year one to over 40 teachers in Year two. Participants are required to implement the instructional units they create during the professional development in their classrooms, and are encouraged to use materials created by others in the program. Benefits for teachers include UNI graduate credit in both science content and science education at a reduced cost, stipends, summer housing and meals, substitute reimbursement for their schools and paid registrations to attend conferences, instructional materials, instructional support, and access to a curriculum sharing website.
Since graduating from UNI in 2005 with a BS in Physics, Cary Pint has found success both in research and teaching pursuits. He attributes his passion for these activities to his experience in the physics and computer science departments at UNI. Pint says the UNI Physics Program “opens an oasis for an undergraduate student that, if they choose to get involved, can put them way ahead of their peers at other institutions.”

After his time at UNI came to an end, Pint continued developing his research interests at Rice University, where he received a doctorate in physics. “After graduating from UNI, I spent a semester working with ion beams at Lawrence Berkeley National Laboratory and then joined the graduate program in applied physics at Rice University, with research focused on carbon nano-materials.

After receiving my doctorate degree from Rice, I spent about a year as a postdoctoral researcher at University of California, Berkeley focused on developing solar energy conversion systems, and then spent about a year and a half working as a research scientist at Intel Labs in Santa Clara, CA, focused on developing integrated energy systems.”

After gaining this important experience in an industrial setting, Pint decided to continue the pursuit of his research interests in academia. He is currently an Assistant Professor of Mechanical Engineering at Vanderbilt University. His research group is working on the next generation of energy technology, which Pint believes “will involve portable sources of energy and remotely powered systems.”

Pint also teaches and mentors undergraduate students (and a few high school students) in mechanical engineering – an area that has significant overlap with his background in applied physics. Teaching and mentoring have been very rewarding for Pint. “I really enjoy the interaction with students at all levels and having the capability to do research that is world-changing in such a dynamic academic environment.”

Pint’s impactful research has led to recognition from many prominent sources. In 2012, he was named by Forbes Magazine as one of the top 30 under 30 disruptors in the area of science and innovation for his work on energy storage. In 2013, he received the Ralph E. Powe junior faculty award from the Oak Ridge Associated Universities. Pint also received the high honor of being named as a Kavli Fellow of the National Academy of Sciences. Most recently, he was listed as one of the top 20 under 40 talents in Academia by the American Society of Engineering Education.

The research that Pint and his colleagues are conducting is blazing a trail in the areas of energy storage and sustainability. Pint says, “I hope to change the world! The area that I work in energy systems is the infrastructure of nearly all modern innovation. The ability to develop systems that can minimize or eliminate our dependence on fossil fuels generates a roadmap to a world that is free of many of the looming global problems we will face – ranging from water shortage to war.”
Brian Raue graduated from UNI in 1985 with B.A. degrees in physics and mathematics. Brian received M.S. and Ph.D. degrees from Indiana University. His Ph.D. research was in the area of experimental nuclear physics. Brian subsequently did postdoctoral research at Old Dominion University where he also taught as an adjunct professor. Brian was hired as an assistant professor at Florida International University in Miami, Florida in 1996. He has risen through the ranks at FIU and is currently professor of physics and director of the Physics Department's graduate program. Brian was honored by the UNI Physics Department as the 2016 Alumnus in Residence. He spent April 7 (Alumni in Residence Day at UNI) on campus interacting with faculty, staff and students. Brian gave a talk on his nuclear physics research, after which he spent time conversing with current UNI physics students about graduate school opportunities and his undergraduate years at UNI. Brian and his wife Dionne live in Miami.

Eric Reiners graduated from UNI in 1994 with a B.S. degree in applied physics. After leaving UNI, he spent some time traveling in the Orient on a shoestring budget. After this period of personal growth, Eric returned to the United States and landed a job in sales at Tandy Corporation. From there, Eric moved to Serena Software as a software developer. He subsequently moved to Rapid7, which specializes in computer and network security. Eric is currently Vice President of Products at Rapid7. He was the guest speaker at the annual Physics Department Awards Banquet on April 15. Eric lives in California with his wife Kerri (also a UNI graduate) and family.

Adam Wilson graduated from UNI in 2012 with a B.S. degree in physics. While at UNI, Adam did research on magnetic properties of intercalated transitional-metal dichalcogenides with Dr. Paul Shand. Adam also worked in logistics, inventory and manufacturing engineering at John Deere throughout his undergraduate career. After leaving UNI, Adam went to Rensselaer Polytechnic Institute in New York to pursue a Ph.D. in engineering physics. Adam's research focused on the development of technologies for solid-state solar thermal energy conversion and micro- and nano-scale thermal management systems. Adam will defend his Ph.D. dissertation later this year and has in fact already started experimental work in a new position at the Army Research Laboratory in Maryland, which will officially become a postdoctoral appointment after his defense.
UNI Emeritus Professor H. Kent Macomber passed away on January 4, 2016 at a hospital in Santa Fe, New Mexico. He and his wife, Carol, had lived in Las Vegas, New Mexico since 2006.

Dr. Macomber joined the UNI Physics Faculty in 1976, and was active as a teacher and scholar until his retirement in 2000. He participated in research activity in the Physics Department for several years after that. Dr. Macomber set high standards for his students and was highly respected by them as an excellent teacher who was skilled at making very clear and logical explanations. Those of us on the Physics faculty whose research was mostly experimental appreciated his helpfulness in investigating theoretical aspects related to our research. His fine mind and very careful and thorough way of thinking about physics and other subjects was instructive to many of us. Students and faculty alike have been inspired by a great teacher and scholar.
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