Duke PHYSICS

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Annual Newsletter 2011

WHAT'S INSIDE

Editors: Haiyan Gao, Cristin Paul, Mary-Russell Roberson and Christopher Walter

Department Happenings


Photo: Cristin Paul

– by Daniel Gauthier

First, let me apologize for the "missing" print newsletter during summer 2010. Life in general was hectic and I fell behind on my obligations; thus, this "Happenings" summarizes information from Summer 2009 - Summer 2011.

Over the past two years, there have been numerous changes in department leadership and faculty ranks. In 2011, I stepped down as Chair of the department after six years and I am very excited that Prof. Haiyan Gao has agreed to step into this very important leadership role. See the article about her vision for the coming years. Also, Prof. Richard Palmer has stepped down after four years as Director of Graduate Studies and Prof. Shailesh Chandrasekharan will be taking over this important responsibility. In 2009, Prof. Stephen Teitsworth took over as Associate Chair for Teaching, succeeding Prof. Gao, and in 2010 Prof. Henry Greenside took over as Director of Undergraduate Studies, succeeding Prof. Seog Oh.

Comings and Goings

While our hiring has been limited by the economy, we were fortunate to attract Dr. Nicolas Buchler as an Assistant Professor of Physics and Biology in late summer 2009. His interests are in cellular biophysics, especially in investigating switch-like behavior in natural or synthesized regulatory networks.

Dr. Robert Brown, who has been teaching in the program for many years as a "Visiting Professor," was appointed Lecturer in 2010 and is playing a very active role in our teaching program, including teaching Introductory Physics at the Beaufort campus over the summers.

Faculty promotions include Drs. Ashutosh Kotwal (2010), Joshua Socolar (2011) and Roxanne Springer (2011) moving into the rank of Full Professor of Physics, while Dr. Chris Walter gained tenure and was promoted to Associate Professor of Physics in January 2011. Congratulations to all for these milestones!

We also added several secondary faculty in 2011: Professor Hubert Bray (Math), Associate Professor James Dobbins in (Radiology), Associate Professor Jungsang Kim (ECE), where I have listed their primary appointments in parentheses. In 2009, we appointed Professor David Beratan (Chemistry), Assistant Professor Patrick Charbonneau (Chemistry), and Associate Research Professor Bastiaan Driehuys (Radiology).

Also during this period, Profs. Moo-Young Han (2011), John Thomas (2011), Werner Tornow

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Vision for the Future


Photo: Wangzhi Zheng

– by Incoming Chair, Haiyan Gao

It will be an exciting and challenging way for me to start my 10th year at Duke as the Chair of the Physics department. I am honored and humbled by your trust and support. Duke has been the place where I have spent the longest, continuous time in my life including my birth city and hometown, Shanghai. To me, it is home and the department is my family. It is my good fortune to follow Dan Gauthier, whose leadership and service to the department have been exemplary, and my privilege to serve the department in my new capacity and I look forward to working with each one of you in the next three years.

Physics is a mature and evolving science discipline which had witnessed many breakthroughs in the 19th and 20th centuries. It is poised in the 21st century for more discoveries, breakthroughs and also for challenges. Interdisciplinary research and teaching has become ever important. Physics, as a discipline, has a long and successful tradition of conducting interdisciplinary research. Faculty, students, and researchers in our department are actively carrying out research in searching for the ultimate laws of nature, quantum physics of the 21st century, uncovering the mysteries of strongly coupled quantum systems, studying order and disorder in non-linear and complex systems, and characterizing and modeling biological phenomena. The search for the fundamental laws and explanations of natural phenomena often leads to technological breakthroughs of great benefit to society. Many of our colleagues are developing new physics-based techniques and technologies for communications, energy, medicine and security.

However, the facilities for our students and

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Department Happenings

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(2011) and Henry Weller (2010) have retired and moved into the emeritus rank. Profs. Han, Tornow, and Weller are still active on campus, while Prof. Thomas is continuing his research activities down the road at NC State University.

Finally, I am saddened to report that Professor Emeriti Henry Fairbank passed away in January 2011 and William Walker in April 2010. Their presence in our community will be greatly missed.

On the staff side, we welcome Ms. Elena Musty as Assistant to the Director of Undergraduate Studies, Ms. Cristin Paul as Assistant to the Chair, and Ms. Miriam Vines as Staff Assistant. Ms. Janet Patterson has departed the department, leaving her role as Instrument Maker in the Instrument Shop and Ms. Peggy Hall has departed her roles in the Store Room and Main Office.

Other Ramblings

Throughout this newsletter, you will read about other major developments in the department, including the renewal of our graduate curriculum, a new undergraduate major in Biophysics, the possibility of a new building for the physics department, etc. Also, our community has been very active on the research front, with many new grants, publications, honors and awards for our scholars, which are too numerous to list here. I encourage all of our alumni to keep up with our latest news on the departmental news site (http://news.phy.duke.edu/) and to sign up for our electronic newsletter (there is a window for signing up for a subscription on the lower right side of our news page). I also encourage everyone to submit a story about any interesting happenings. It is easy and our news team can work with you to polish your story. See: http://news.phy.duke.edu/submit-a-story/.

Vision for the Future

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faculty to carry out research are in dire need of improvements. The physics building is old and unattractive to students and visitors. The quality of our lab space in general is very poor and continues to deteriorate. This is detrimental to our ability to recruit those outstanding faculty members for whom state-of-the-art labs are essential for their research program. The poor lab situation also makes it difficult for us to attract outstanding graduate students in competition with our peers. It is absolutely important to have a new, state-of-the-art Physics building with 1st class laboratory space, open flow common area facilitating interactions among students and faculty. Under the leadership of Dan Gauthier and the support of the Arts and Sciences, the university is fully aware of the dire situation of our building and lab space. Preliminary discussions and exploration have started with the possibility of a new building possibly in a staged approach. I will continue together with colleagues in the department and friends of physics to voice our concern and need, to work with Arts & Sciences and the university until the plan for a new building becomes a reality.

The success of our graduate program can only be judged by the success of our students. How to attract top students in the country and in the world to our program? What is the unique strength of our program? The department is a welcoming, warm, friendly and nurturing place. But is this attractive enough for aspiring physicists? The recent graduate curriculum overhaul is one positive development towards this direction and the success of which can only be judged by our students over time. In the 2rd year of my term (2012-2013), which is the 3rd year since the implementation of the new curriculum, I plan to initiate a departmental self-study. The American Physical Society (APS) has documents that describe how to conduct a self-study of a graduate or undergraduate program and we will use them as guidelines in our study. The ongoing discussion and planning of reorganizing our department away from the traditional sub-divisional approach to fundamental, big questions in physics can potentially be very attractive to prospective graduate students. The strength of Duke being interdisciplinary-research-friendly and the physics faculty being a very important part of this big picture can certainly help our program. Under the leadership of Dan Gauthier, the news outreach to friends of the department, potential students, etc. has been improving steeply and such outreach and PR efforts are important to continue and enhance further.

While the department has been very supportive of our students particularly in providing opportunities outside of physics which may benefit students to pursue careers outside physics, we need to do more for those students who are interested and motivated to pursue careers in academia. We need to provide more opportunities for students to speak at conferences and workshops, and more opportunities for them to meet leading physicists outside of our department in their corresponding areas of research. Our faculty mentors need to be more proactive in nominating students for worthy awards and recognitions. In the end, the visibility of our program can only be enhanced by the success of more of our graduates both in and outside of academia. I look forward to working with Prof. Shailesh Chandrasekharan in his new role as the Director of Graduate Studies.

Overall, our undergraduate students are in general happy with our program, and more and more students have been very actively engaged in various research activities.

However, the number of physics majors is very small, smaller than our peers, smaller than the numbers of majors in other natural science departments at Duke. While we hope the number of physics majors will increase with the newly approved biophysics majors, we need to think of more ways to attract potential students and learn from the experiences of others who have successes in attracting majors.

Due to the small size of our department, we had not been able to offer a number of more advanced level courses introducing cutting-edge research topics. One possibility could be developing and offering mini-courses centered on big questions in physics that researchers in our department are actively engaging in. Students will have deeper understanding and more appreciation for cutting-edge research topics which in turn may help them and prepare them better for pursuing advanced degrees in physics and other disciplines in science, engineering, medicine, etc. For those students who do not plan on pursuing advanced degrees, it is important to prepare them well enough so that they can compete in the ever competitive job environment. I look forward to working with Prof. Henry Greenside in his role as the Director of Undergraduate Studies.

The next three years will be challenging for me, I am confident, however, that with your support and trust, I will be able to look back and feel good about my decision to serve and be proud of my service to the department.

Graduate News

- by Director of Graduate Studies, Richard Palmer


Photo: Michele Dubow

Each student must pass their Preliminary Exam as a candidate for the Ph.D. degree, usually in their 3rd year. From September 2009 to April 2011, Preliminary Exams were passed by: Kristine Callan, Ben Cerio, Abe Clark, Seth Cohen, Chris Coleman-Smith, Ethan Elliott, Somayeh Farhadi, Sam Gong, Hannah Guilbert, Min Huang, Georgios Laskaris, Baolei Li, Willie Ong, Joshua Powell, Jie Ren, Yu Song, Mengyang Sun, Shangying Wang, Taritree Wongjirad, Yang Yang, Qiujian Ye, Huaixiu Zheng, and Rena Zhu. Also Ravi Shekhar was awarded the M.S. degree in 2009.

Degrees and Exams

Student	Advisor	Student	Advisor
Wei Chen 1	Prof Haiyan Gao	Johannes Norrell 5, 6	Prof Joshua Socolar
Nasser Demir	Prof Steffen Bass	Brent Perdue 2	Prof Henry Weller
Seth Henshaw 2	Prof Henry Weller	Xin Qian 1	Prof Haiyan Gao
James Joseph 3, 4	Prof John Thomas	Adam Sokolow	Prof Glenn Edwards
Mary Kidd 2	Prof Werner Tornow	Changchun Sun 2	Prof Ying Wu
Nathan Kundtz	Prof Albert Chang	Phillip Wu 4	Prof Albert Chang
Peng Li	Prof Albert Chang	Huidong Xu	Prof Stephen Teitsworth
Bryon Neufeld	Prof Berndt Mueller	Xing Zong	Prof Haiyan Gao

1 Jefferson-Lab Fellowship 2 Newson Fellowship 3 John T. Chambers Fellowship 4 Fritz London Graduate Fellowship
5 James B. Duke Fellowship 6 Graduate Teaching Fellowship

New Curriculum

After much discussion, a new Graduate Curriculum was adopted by the faculty in October 2009. The new requirements were applied to students entering the PhD program in Fall 2010. The most important changes were: now only six core courses are required (and two electives), and the Qualifier Exams were eliminated. One advantage of this change is the first year students may only take 5 core classes their 1st year and just one core class their 2nd year, which among other benefits, the students were allowed earlier access to research. Also generally, the course syllabi have changed to a more modern presentation and a substantially revised schedule.

The Qualifier Exams will no longer be given. In place of the Qualifier, students will be evaluated on the basis of their grades in the core courses. These must be at the level of B or better for continuation at the end of first year. It is essential for all faculty teaching core courses to have rigorous grading, therefore these instructors are evaluating each student and meeting every month to discuss their findings. At the end of the first year, all students are evaluated by the full faculty, much as is done currently in the context of the Qualifier.

A new addition to the new curriculum are the Mini courses. These courses cover various topics and are becoming quite popular with the older students as the classes are only 4 or 5 weeks, leaving graduates much more time during the semester to work on their research projects. In the first year (2010-11) there were 4 mini-courses: Experimental Uncertainties; Nonlinear Wave Methods; Introduction to Quantum Communication; Networks. We are expecting to add more of these courses in the next year.


Photo: Henry Greenside

Graduate News *continued from page 3*

These students were given their Ph.D degrees between September 2009 to April 2011. Graphic courtesy of Jennifer Lane.

Admissions

The Graduate Admission Committee reviews the applicants, makes recommendations for offers (by the Dean), and some of these students will accept admission to Duke. After making the offers, we held Open Houses (twice in 2010) for the prospective students. They met with many faculty members and graduate students who showcase our Physics department and their ongoing research. Of course, some students could not attend at the time, therefore they visit at other times.

We had 194 applicants for admission in Fall 2010, and 209 in Fall 2011. We made 54 offers in 2010, and 47 in 2011. In the end, there were 16 students accepted to Duke in 2010, and 16 students in the Fall 2011. The incoming class hail from Armenia (1), China (3), Cyprus (1), Germany (1), Taiwan (1) and of course USA (9).

Also we will have two exchange students, one from France, and one from Germany. There will be 6 female students and 12 male students. In this Fall 2011, we should have 86 students, more than any year before.

It is interesting that in 2011 our acceptance rates were larger than expected for national students and smaller for international students, but in 2010 were the other way! We do not know why. Perhaps part of it, the Graduate Student Organization (GSO) were very involved this year and organized some special social events for the visiting prospective students. In any case, our acceptance rate is increasing when adding the international and national students.

Orientation

In a few weeks, the new incoming students will come to Duke University for a number of "orientations", which include the International Orientation, the Physics Orientation, and the Graduate School Orientation. The students will be exhausted, but at least there will be free food! The main Physics Orientation is mandatory. There are many responsibilities, including taking assessment exams, meeting one-to-one with the DGS (Director of Graduate Studies) and the ACT (Associate Chair of Teaching), training of the TAs, and much more. At the end, there will be the Annual Department Picnic, which will be hosted by our second year graduate students.

Change in Command

On June 30, 2011, I will step down as the DGS and Prof. Shailesh Chandrasekharan will be the new DGS. Over the last four years, I loved to try to help all of the graduate students, from their admission to their degree. I will miss them.

Undergraduate News

—by Director of Undergraduate Studies, Henry Greenside

Photo: Matt Staley

I would like to mention some highlights of achievements and events related to Duke's physics majors, to the graduating class of seniors, and to the physics major.

Several physics majors won prestigious awards in the 2010-2011 academic time frame. Junior Vivek Bhattacharya, who is majoring in economics and physics, was named a Barry M. Goldwater Scholar in Science, Mathematics, and Engineering for his undergraduate research in physics and economics. The Goldwater award is a highly competitive award that about 300 college sophomores and juniors receive nationwide each year (see the website http://www.act.org/goldwater/). This scholarship provides up to $7,500 per academic year toward college expenses. As an aside, about once every 2-3 years, a Duke physics major wins a Goldwater, which means that the Physics Department continues to attract some of the strongest science majors on campus

Junior physics major Farzan Beroz received an honorable mention by the Goldwater committee, which is an impressive acknowledgment of his academic and research achievements.

Senior Karthik Seetharam, who graduated as a double major in electrical engineering and physics, received an NSF Fellowship to study applied physics. He will begin graduate school this fall at Caltech and plans to combine a knowledge of theoretical physics with electrical engineering to improve the design and efficiency of photovoltaic devices for solar energy generation.

Senior Siyuan Sun was awarded the Daphne Chang award of the Physics Department for the best honors thesis. (See the website http://www.phy.duke.edu/about/DaphneChang/). Siyuan was unusual in beginning research as a freshmen and continuing with his research through his senior year. In collaboration with his advisor, Professor Ashutosh Kotwal, he did impressive original work in the area of experimental high energy physics, in which he devel-

oped and applied statistical tools to analyze data from the ATLAS detector at the Large Hadron Collider. The data analysis placed new constraints on the existence of a particle (a Z' boson), that will affect grand unification theories that predict the existence of the Z' boson. Siyuan will attend Harvard's physics graduate program this fall and plans to continue to do particle physics research.

Physics senior Michael Bern was nominated to Phi Beta Kappa for his earning a nearly 4.0 grade point average. Michael plans to spend a gap year doing biophysics-related research at the National Institute of Environmental Health Sciences in the Triangle Park and then apply to MD/PhD programs the following year.

Ten new students, a mix of juniors and seniors, were nominated by the Physics faculty for membership in the national Physics honors society Sigma Pi Sigma. (See the website http://www.sigmapisigma.org/.) These students were Michael Bern, Farzan Beroz, Alexander Beutel, Alejandro Cortese, Kevin Driscoll, Andrew Ferrante, Ashley Jones, Tanya Mitropoulos, Eugene Park, and Karthik Seetheram. These students were nominated for some combination of academic excellence in physics courses, excellence in physics research, involvement with physics outreach, and involvement with physics activities on the Duke Campus such as leadership in Duke's chapter of the Society of Physics Students. Duke's Physics Department has one of the oldest Sigma Pi Sigma chapters, dating back to the 1920s, shortly after Sigma Pi Sigma first came into existence.

This May, the graduating seniors included nine first physics majors, four second majors (students getting a BS or BA physics degree in addition to some other primary degree), and two students who were interdepartmental majors that took a substantial number of physics courses and who were involved with physics research. These numbers remain low compared to the number of physics majors at schools of comparable size and of similar academic excellence and the Physics Department has spent several years now exploring ways to increase the number of majors. (In the long term, we would like to double the number of primary majors to about twenty graduating per year.)

One change that was approved by the Physics faculty this spring was to increase the flexibility of the BS physics degree. In the past, numerous physics majors have commented on how the physics major had too many core requirements and this made it difficult to take electives that allowed one to explore various frontiers of physics, or to take a semester abroad because one would miss one or more of the core courses. The requirements for the Physics BS degree replaced two core courses (the second semester of quantum mechanics, Physics 212, and a second semester of experimental projects) with electives, which will be helpful. The Physics Department also slightly strengthened the math requirements for the BS degree by requiring majors to take a somewhat more formal course in linear algebra and a somewhat more advanced course in ordinary differential equations.

Another change that was proposed about a year ago by the previous DUS, Professor Seog Oh, and approved by the Physics faculty was the creation of a new major in Biophysics that lies within the Physics Department. This new major has attracted a total of eight majors so far (about four per academic year) and so already has succeeded in increasing the number of students who pass through our physics courses and who get involved with physics research. As expected, most of the biophysics majors are premeds who have a strong interest in or enjoyment of physics, but a few biophysics majors are interested in biophysics directly. The Department's first biophysics majors will graduate a year from now, in spring of 2012.

If any alumni of Duke's Physics Department, has some suggestions or experience in increasing the number of physics majors, the Physics faculty would be interested to get your input. You can send an email to the Physics DUS via the address dus@phy.duke.edu.

Photo submitted by Henry Greenside

Graduate Student Organization News

—by GSO President, Georgios Laskaris


Photo: Jimmy Dorff

Graduate Student Seminar
The Graduate Student Seminar is a weekly lunch event where graduate students present research talks to an audience of their peers. This seminar is a good venue to give practice talks before prelim exams and an excellent way to keep abreast of research performed in the department. There is an informal atmosphere where questions and discussions are encouraged. To meet the interest of most of the graduate student body, students working on a variety of fields were invited. These fields include high energy, nonlinear dynamics, neutrino physics, atomic physics, medium energy physics, condensed matter and optics. Half of the speakers were working on experimental projects and half on theoretical calculations. Special talks this year included Dr. Dan Pirjol, a particle physicist who now works at J.P. Morgam Chase Bank, discussing interest rate modeling for physicists. The ultimate goal of GSS is to provide a platform for students to practice their oral skills, inspire new ideas and prepare them for the challenges after graduate school. Huaixiu Zheng was the seminar Chair during the Fall semester and Sean Finch during the Spring semester. The schedule of GSS's is posted online: http://www.phy.duke.edu/graduate/studentseminar/.

GSO in GPSC
GSO representatives in Graduate and Professional Student Council (GPSC) bring the voice of physics graduate students to the council and keep physics students informed about the important decisions that are taken. GPS council has General Assembly (GA) meetings every other week to determine and solve various issues pertaining to graduate student life. These activities include basketball "campout", parking, student insurance, computer training from OIT and budget approval for various graduate student activities and communities on campus. GSO representatives have the right to vote for the executive board members and chairs of different programs of GPSC. GSO representatives and physics students played an important in GSPC during this academic year. Wangzhi Zheng and Qiujian Ye are the GSO representatives in GPSC.

Helping out the department!
GSO has numerous students who try to help the department in various aspects. Abe Clark who was the newsletter Chair acted as the intermediary between the department newsletter staff and the graduate students. He tried to get people to submit stories or information for publication as well as to promote the Facebook and Flickr pages for Duke Physics.

Who is an ombudsperson?
GSO decided to enforce the ombudsperson institution within the physics department. Three students were appointed at this position representing both genders and different cultures. An ombudsperson is someone to whom you can talk confidentially should you want advice on how to resolve a conflict within the Physics Department. He or she can help you consider what options you may have and help you evaluate those options. Although these volunteer ombudspeople have no formal training, they treat any conversations confidentially and do their best to assist students with resolving issues. The GSO hopes to continue to find volunteers to fill this important role in future years. The ombudspersons for this academic year were: Kristine Callan, Yingyi Zhang and Sukrit Sucharitakul.

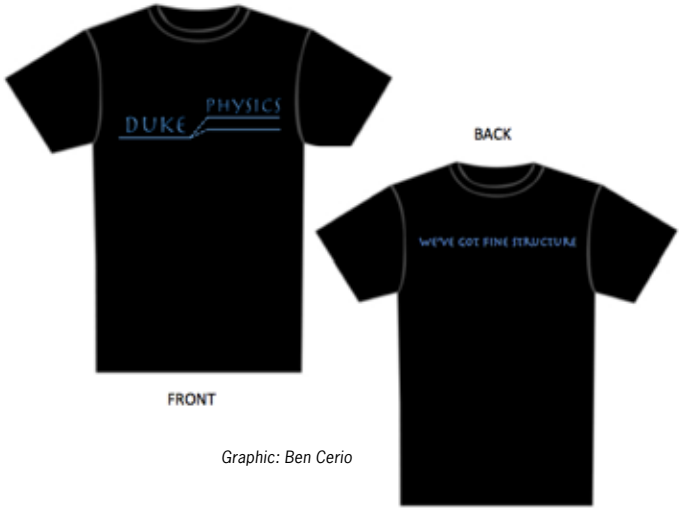
It's time to socialize!

New institutions in departmental life
During this academic year GSO introduced new institutions in departmental life. One of them is the departmental tea (usually Thursday afternoons at 3:30pm), which aims at bringing faculty, postdocs, graduate students and undergrads together for a relaxing time to socialize and talk to people in different groups while sharing good food, coffee and tea. This event has been well attended by graduate students and faculty.

Open House Week
Physics department and GSO organized the Open House Week. Many graduate students participated in the activities. A reception hosted by Professor Chris Walter and Professor Kate Scholberg and a house party hosted by Hannah Guilbert took place among numerous other social events. The recruitment rate was impressively high and the open house week turned out to be a huge success for physics department as well as for Duke University. GSO worked closely with the Associate Chair for Teaching (Professor S. Teitsworth) , the DGS (Professor R. Palmer) and the DGS assistant (Ms. Donna Ruger) in this effort. Hannah Guilbert is the Social Activities Chair.

New Department T-shirt!
The GSO and the undergraduate Society of Physics Students held a departmental wide competition for a new design of the Physics

Department T-shirt. Five designs were submitted and after an impressive participation the physics department members chose the T-shirt which brought the department to the world beyond the Physics Building. Ben Cerio was the winner of the competition. This design has travelled over the oceans to Asia, Europe, and beyond with a number of alumni requesting for their t-shirts!



Graphic: Ben Cerio

Mentoring Program

Each incoming graduate student was paired up with two upper class students. Before the new students arrived on campus, they were given the opportunity to communicate with their mentors and ask questions about Durham and Duke. Mentor-Mentee dinners were conducted twice per semester, with a group Thanksgiving dinner in the Fall. Yang Yang was the coordinator for the mentoring program this year.

Sports

A soccer team was recently formed in Physics Department in which faculty members, graduate students and REU-TUNL summer students participate. Although the soccer team is new, they managed to clinch third place in IMF summer league playing against other teams on campus. For those of you who are not big fans of soccer, numerous physics students officially participated in the "campout" last year, winning them season tickets for the Duke men's basketball games.

Graduate Student Survey

The annual Duke Physics Graduate Student Organization (GSO) survey was conducted from 5 Jun 2011 to 19 Jun 2011. In tandem with Duke University's transition to an improved, user-friendly interface, the GSO has adopted Qualtrix as its survey tool. As compared to the previous survey, this survey has witnessed increased participation. While the number of survey questions has been streamlined to avoid repetition, an open-ended option for comments at the end of every section has been provided to allow for additional student feedback. Student sentiment on recent changes such as the removal of qualifiers and the new academic curriculum has been solicited. The survey results were reported to the chair and will be presented in a faculty meeting. Willie Ong is the election commissioner and the organizer of the Graduate Student Survey.

The GSO Executive committee

The GSO executive committee was elected from the graduate student body. The Executive committee of the academic year of 2010-2011 includes Georgios Laskaris (President), Christopher Coleman-Smith (Vice-President), Taritree Wongjirad (Treasurer) and Class representatives, Joel Greenberg, Abhijit Mehta, Seth Cohen, Ben Cerio, Kevin Claytor and Yang Zhang. Board Executive committee meetings involving the appointed chairs of GSO were held monthly and records are kept during all meetings according to the laws described in the GSO constitution. The records are published by the technical Chair Junyao Tang on the Web page of the organization.

Alumni Profiles

Alum Uses Physics to Detect Nuclear Weapons Testing

— by Mary-Russell Roberson

Photo used with permission from Los Alamos National Laboratory

Roger Byrd, PhD 1978, has spent 25 years at national laboratories in New Mexico designing and refining satellite instruments that detect nuclear weapons testing. "You don't go to graduate school in nuclear test instrumentation," Byrd says. But his doctoral research at TUNL in neutron physics opened the door to a career where he uses his knowledge of the characteristics and behavior of neutrons, gamma rays, x-rays, and other signals to figure out ways to detect nuclear weapons tests.

After a short stint at Indiana University's Cyclotron Facility, Byrd went to Los Alamos National Laboratory, where he started out in basic nuclear physics but soon became involved in nuclear weapons testing.

"Once you're at Los Alamos you find out that there are interesting applications of basic physics," he says. "A lot of people gradually end up spending more time on applications than on what they learned in grad school."

Byrd's work is based on the need to verify whether other countries are adhering to treaties banning nuclear weapons testing. "The limited test ban treaty signed in the early 1960s is still the main treaty that applies to above-ground testing," he says. "Nowhere in space or in the atmosphere is anyone allowed to test a nuclear weapon. The satellites that verify those treaties are the ones I work on."

He says it's important to have more than one detection method in order to prove a treaty violation. "If it happens in the atmosphere, you will get an optical flash and a radio-frequency pulse, so you need RF and optical detectors," he says. "In space, we look for x-rays, gamma rays, and neutrons. We have all those instruments on the satellites," he says. "In the end we get almost everything there is to get. It's kind of hard to sneak past the treaty."

Detection of underground testing is taken care of by other instruments, but Byrd says he also has to be familiar with underground detection in case a test happens at or near the surface, where it might send out signals through both the atmosphere and the Earth.

In 2006, Byrd earned an MBA from the University of New Mexico. "At some point doing the technical work is not enough," he says. "Somebody has to worry about how this whole thing fits together, not just in space but also in the atmosphere and down in the ground, and what's going on in different labs. Those are not really technical questions." He then completed a three-year assignment in Washington, working as the technical advisor for the program office in DC that does nuclear treaty monitoring.

Today he is back in New Mexico, at Sandia National Laboratory, developing software to translate the outputs of the satellite instruments into usable information for the people who monitor them.

Alumn Leslie Molony Goes From Physics to Pharm

— by Mary-Russell Roberson

Photo submitted by Leslie Molony

Although the biophysics major is new at Duke for 2011, many physics alums over the years have melded physics and biology in their careers. Leslie Molony,'75, for example, has worked as a researcher and as an executive in the pharmaceutical industry. "I use my physics background just about every day of my life," she says.

"I use physics to figure out the science of pharmaceuticals and how chemicals interact with cells and with protein molecules," she says, "particularly the physical aspects of an interaction—size, forces, and the thermodynamics of the system."

After earning her BS in physics, Molony went to law school, as per her father's wishes, but left after a year. "I hated it," she says. "The whole idea of not having real scientific facts and making these judgments just blew my mind." She began working in a biophysics lab at Vanderbilt, where she became fascinated with the physical structure of cells and proteins. Her fascination led her back to Duke, where she earned a PhD in cell biology. She worked with Harold Erickson, studying the physical properties of proteins to figure out protein-protein interactions within cells.

Molony was a pharmaceutical researcher for about 10 years before making the transition to business development. She explains: "Pharmaceutical and biotech companies do not discover their own molecules; they often get them from academic labs or other companies that have too many and can't develop them all. My job was to know who had novel discoveries or compounds and then build a strategy to incorporate that research into the pipeline."

In 2007, Molony started a company called Transgeneron with two other scientists. The goal of the company was to develop a therapy for diabetes involving a protein molecule that reprograms stem cells in the pancreas to begin to produce insulin. In mice, the molecule was shown to reverse diabetes. But in the current economic environment, Molony and her colleagues couldn't raise enough

venture capital to support the company.

This month, she joined the Florida office of the Sanford-Burnham Medical Research Institute as the senior director of business development. Sanford-Burnham is a nonprofit organization that focuses on discovering molecular causes of disease and developing effective therapies. Molony will facilitate translation of the Institute's discoveries into commercial applications by fostering collaborations, spin-off companies, and licensing. In particular, she's interested in new methods of supporting promising therapeutic concepts in the early stages, which in the past was often funded through venture capital that's not so easy to come by today.

"Most every scientist here is essentially an entrepreneur—they have to fund their research," she says. "The entrepreneurial culture makes it a very interesting and exciting place because every day you never know what to expect. Within one day you'll have two scientists coming up with ideas for companies. The most exciting thing to me is that it presents a novel model for early-stage commercialization of biomedical discoveries."

Molony lives in Gainesville, Florida, where she enjoys riding her horses and watching her son play high-school baseball. She also tries to keep up with the astronomy research of Duke Physics '75 classmate Dr. Hal Weaver, in his work on the Hubble Telescope.

Alumn Scott Zoldi is Vice President of Analytic Science at FICO

—by Mary-Russell Roberson

Photo submitted by Scott Zoldi

After getting a PhD in physics at Duke in 1998 and earning a Director's Postdoctoral Fellowship at Los Alamos National Laboratory, Scott Zoldi is now Vice President of Analytic Science at FICO (Fair Isaac Corporation) in San Diego, California. "When I was at Duke this was not my first view of where I would end up," he says, "but it's actually a natural place for theoretical physicists."

What links all his work together is computational analytics. "Working with data and trying to understand complex systems and relationships in data has been a continual passion and interest to me," he says.

With Prof. Henry Greenside, Zoldi used computational science and computer simulation to study complex systems such as weak turbulence and chaos. He won a DOE computation science graduate fellowship that helped pay for his education at Duke and allowed him to do research in the summers at Los Alamos National Laboratory, where he later got a Postdoctoral Director's Fellowship. At Los Alamos, he used simulation and computation theory to advance computational methods with implications to numerical simulations of the behavior of the nuclear stockpile. In particular, he explored numerical shadowing theory, which relates to identifying the limits of computer simulation.

At FICO, he manages a team of more than 50 scientists, who analyze data with the goal of detecting and preventing credit card fraud and preventing breaches of financial networks. "I continue to hone and develop my analytic skills and continue to ask fundamental questions about physical laws of dynamical systems and those patterns in the data that would indicate whether or not a credit card is being used suspiciously," he says.

"We have a data consortium that comprises 65% of the world's credit and debit card transactions," he says. "We have all this data—so the question is how do we find the fundamental laws, behaviors, or features that would allow us to make predictions about which credit card might be going fraud? What are the anomalous behaviors we want to alert financial institutions to?"

He says that 17 of the world's 20 largest financial institutions use FICO's fraud analytics and models. "My team is responsible for a product that prevents hundreds of million dollars of fraud losses for banks across the world," he says.

As a vice president, he does less computer programming than he used to. He focuses on making sure the team is doing things correctly from an analytics perspective, with the help of three of his directors, two of whom are also physicists. "We have to ensure that the analytics are predictive and also robust and stable," he says. He also mentors the scientists on the team, and works closely with clients to get inspiration for the development of new analytic innovations. He's authored more than 30 patent applications for FICO.

Zoldi grew up in Maine and majored in engineering physics at the University of Maine. He was attracted to Duke, he says, because "I was impressed with the work that Henry and others were doing in the Center for Nonlinear and Complex Systems, and particularly Henry's focus on numerical simulation."

In his free time, he enjoys spending time with his family, which includes a 22-year-old stepdaughter and a two-year-old son. He's also a sports car enthusiast and likes to relax by taking his weekend car out for a spin and enjoying sunny Southern California.

Faculty Research

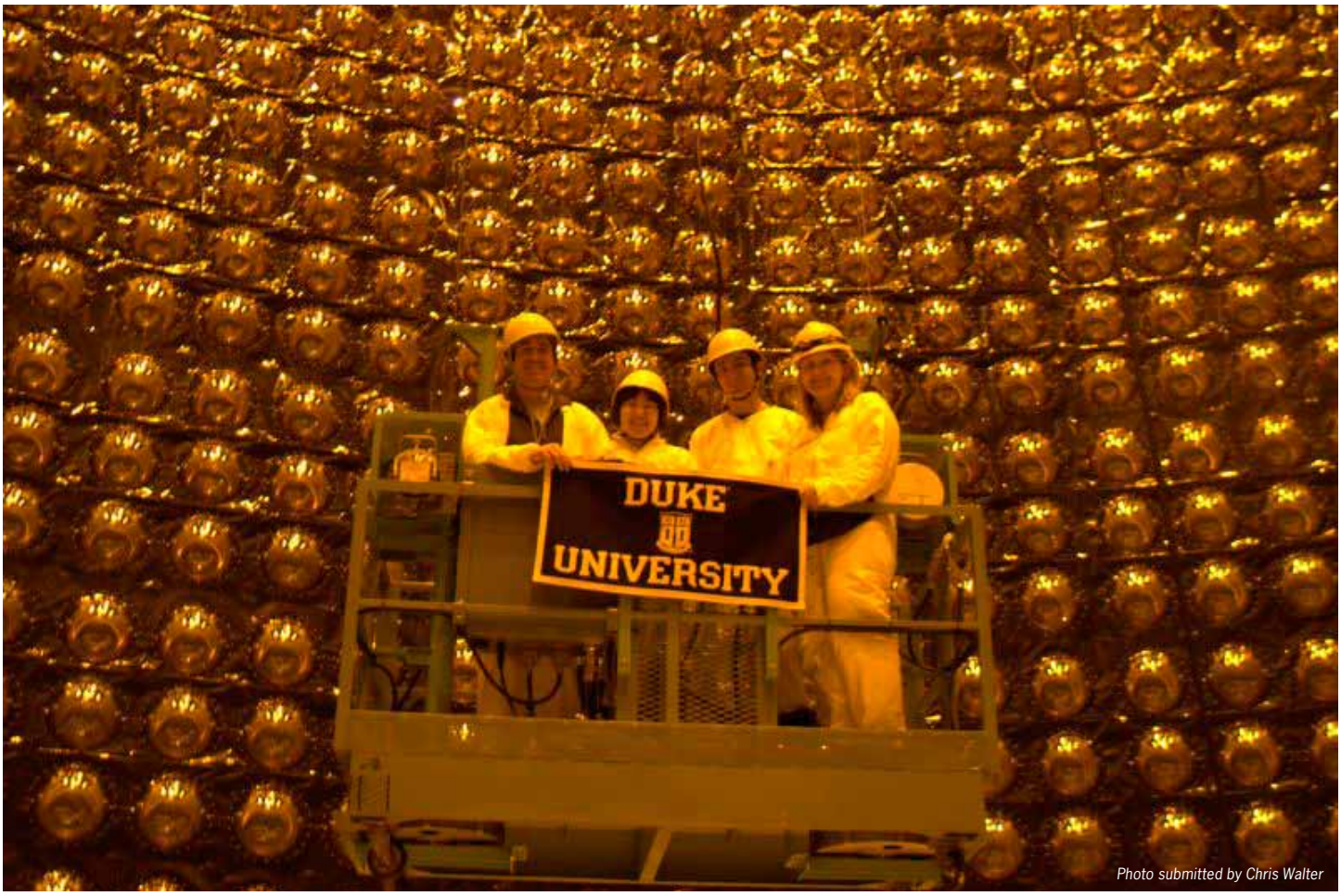


Photo submitted by Chris Walter

The Duke Neutrino Team Analyzes Exciting Results from the T2K Experiment

—by Associate Professor, Chris Walter

The T2K experiment in Japan announced indications that muon neutrinos are transforming into electron neutrinos. Using a powerful accelerator north of Tokyo, a neutrino beam was directed to the Super-Kamiokande detector 183 miles away under the Japanese Alps in western Japan. The neutrinos were measured near where they were born and then again at Super-K. An analysis shows that a tiny number of the neutrinos that started north of Tokyo as muon neutrinos transformed into electron neutrinos before being detected in Super-K. Eventually it is hoped that this research will lead to an understanding of why there is more matter than anti-matter in the universe. Read more on Prof. Chris Walter's website: http://www.phy.duke.edu/~cwalter/News/Neutrino_News_Releases/Oscillation_Result.

Full list of Duke T2K people:

Faculty:
Kate Scholberg
Chris Walter

Postdoc:
Roger Wendell

Grad Students:
Josh Albert
Taritree Wongjirad

New postdocs starting now:
Alex Himmel
Tarek Akiri

HIGS Attracts Worldwide Attention for its Gamma Rays

—by Mary-Russell Roberson

The recently upgraded HIGS facility on Duke's campus has become the world's most powerful Compton gamma-ray source. HIGS—the "high intensity gamma-ray source"—is part of the Triangle Universities Nuclear Laboratory (TUNL), which is located at Duke.
Physicists from around the world come to use the gamma-ray beam for a wide variety of measurements. For more information on one of these experiments, see "HIGS Plays Role in Nuclear Fusion Research." (http://news.phy.duke.edu/2010/10/higs-plays-role-in-nuclear-fusion-research/)

The machinery that produces the gamma rays was originally constructed in the early 1990s to generate free electron laser (FEL) beams, but now research involving high-energy gamma rays is attracting more funding. "The HIGS has become our primary operating capability," says Professor Ying Wu. "Typically, we provide the beam on target [for research groups] for 1,800-2,000 hours a year." Wu is associate professor and a TUNL associate director for accelerators and light sources at the FEL laboratory.

The facility still generates FEL beams, because they are a critical ingredient in making gamma rays. In a race-track storage ring that has a circumference of more than 100 meters, a stream of electrons moves close to the speed of light. On one side of the storage ring, two magnetic "wigglers" cause the electrons to emit a stream of photons. These photons are trapped inside a pair of high-reflectivity mirrors, forming the FEL beam. If the FEL beam collides head on with the stream of electrons, the collision creates gamma rays by a process known as Compton scattering.

"The first production of a gamma-ray beam at our lab can go back to 1996, but it was very low intensity," Wu says. "We got funding from the Department of Energy to upgrade the capability of the gamma-ray beam." In addition to the DOE funding, the three universities in the TUNL consortium—Duke, North Carolina State University, and the University of North Carolina at Chapel Hill—contributed substantially to the project. Those upgrades were completed in 2007, followed by further improvements to increase the intensity of the FEL beam and electron beam. In 2010, the lab reached two milestones.

Then, in the fall, HIGS scientists produced a gamma-ray beam with an energy of 100 MeV after producing an FEL beam with a wavelength of around 190 nanometers (in the vacuum ultraviolet range).

The new capabilities at HIGS open up new opportunities for basic research. The high-intensity, high-energy gamma rays make possible experiments aimed at providing new information about the structure of protons and neutrons. The high-intensity, low-energy gamma-ray beams can be used to help understand the nucleosynthesis of elements in the periodic table, the evolution of stellar burning processes, and the structure of the nucleus. There are practical applications as well, including using gamma rays as an imaging technology in industrial and medical diagnostics and for inspection of nuclear materials in closed cargo containers, and as a source to calibrate next-generation gamma-ray detectors including those used in satellite gamma-ray telescopes.

Wu has been involved with the FEL and HIGS for about 20 years. He came to Duke from China as a graduate student in 1988 and earned his PhD here in 1995. He spent two years at the Lawrence Berkeley National Lab as a staff scientist, and returned to Duke in 2001 as a faculty member. "This is the only dedicated Compton gamma-ray facility in the world," Wu says. "We're proud of our capabilities and intensities. We are producing intense, monochromatic, and polarized gamma-ray beams from 1 to 100 MeV." He and his colleagues are working hard to develop new capabilities at the facility to ensure that HIGS remains a worldwide leader in its field for years to come.


Photo : Cristin Paul

A portion of the "race track" storage ring in the Free Electron Laser Lab

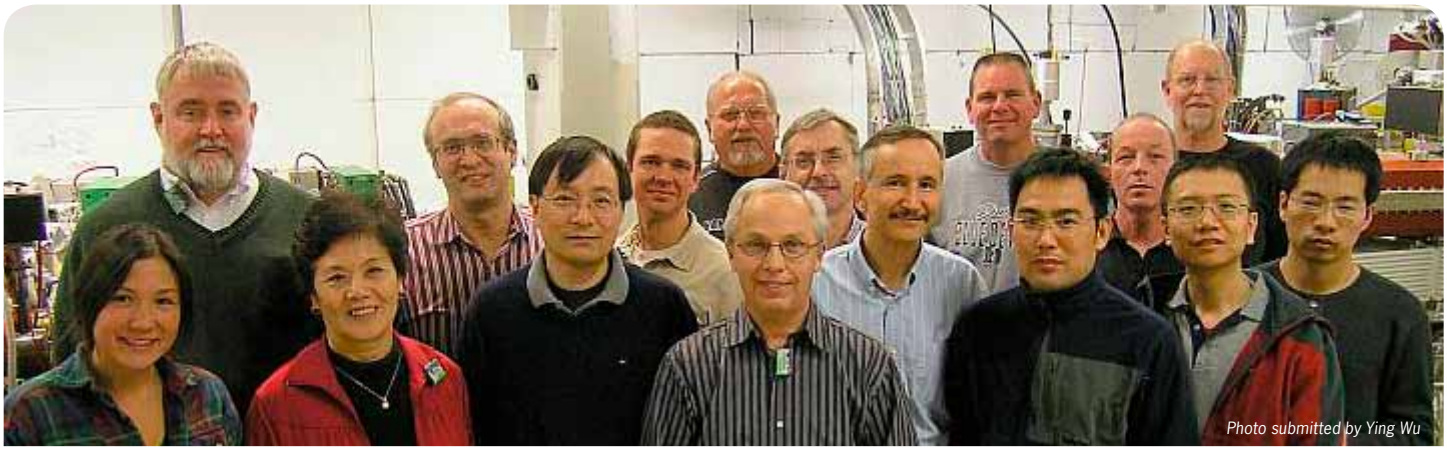


Photo submitted by Ying Wu

The researchers and developers of the Duke FEL and HIGS, including physicists, graduate students, engineers, technicians, and administrative staff. The group is inside the booster synchrotron, a full-energy injector into the storage ring. The synchrotron was the major addition to the accelerator facility constructed as part of the recent upgrade completed in 2007.

Duke at CERN: Updates from 2010-2011

—by Tracy Walker

Duke's community of faculty, graduate students, undergraduates and research scientists have long been active in the experiments at CERN in Geneva. This archive is by no means comprehensive, but offers a handful of highlights of recent updates from Duke physicists working on (or working with topics related to) the LHC or ATLAS experiments.

• Ashutosh Kotwal named co-leader of research group on ATLAS: Prof. Ashutosh Kotwal has been named co-leader of one of the international research groups on the ATLAS experiment at the Large Hadron Collider, along with Fabienne Ledroit of France.

• Prof. Goshaw's Group's First Measurement with ATLAS Experiment: Prof. Goshaw, Andrea Bocci, and Mia Liu have made a first measurement with the ATLAS experiment of W and Z boson produced with high energy photons.

• Prof. Kruse's Talk Featured by Duke Research: A public talk given on April 22nd by Professor Mark Kruse's on the origins of the universe and The Large Hadron Collider was recently featured by the Duke Research Blog.

• Prof Mueller Organizes Workshop in Paris: In this workshop, Prof. Berndt Mueller and colleagues discuss first results from the LHC.

• Quark-Gluon Plasma identified as the most perfect liquid of all: In an article just published in the Physical Review Letters, a group of theorists including Prof. Steffen A. Bass showed that the quark-gluon plasma (QGP) created in high energy heavy-ion collisions at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory and the Large Hadron Collider (LHC) at CERN forms the most perfect liquid ever studied in the laboratory.

• Alumni Update: Ariana Minot, NSF Graduate Fellow: After graduating from Duke in 2010 as a primary physics and secondary math major and completing a year of research on the ATLAS experiment through the Fulbright program, Ariana Minot is starting doctorate studies in applied mathematics at Harvard University as an NSF Graduate Fellow.

Photo: Heinz Pernegger

Duke Physicists and Biologists Collaborate on Plant Research


Photo submitted by Calvin Howell

– by Mary-Russell Roberson

Physics professor Calvin Howell and his students are working with Duke biologists on an interdisciplinary project to discover more about how plants absorb and use carbon dioxide—a question of particular relevance as levels of carbon dioxide in our atmosphere continue to climb. Howell and his colleagues use positron emission tomography (PET) to track molecules of carbon dioxide—tagged with radioisotopes—as they are absorbed by leaves.

Howell, director of the Triangle Universities Nuclear Laboratory (TUNL) which is housed at Duke, says, "Physics brings two types of perspectives to the project. One is the experimental techniques intrinsic to nuclear physics. The other thing I hope physics will bring is an analytical and quantitative approach for modeling plants," particularly biological processes involving the plant and the environment.

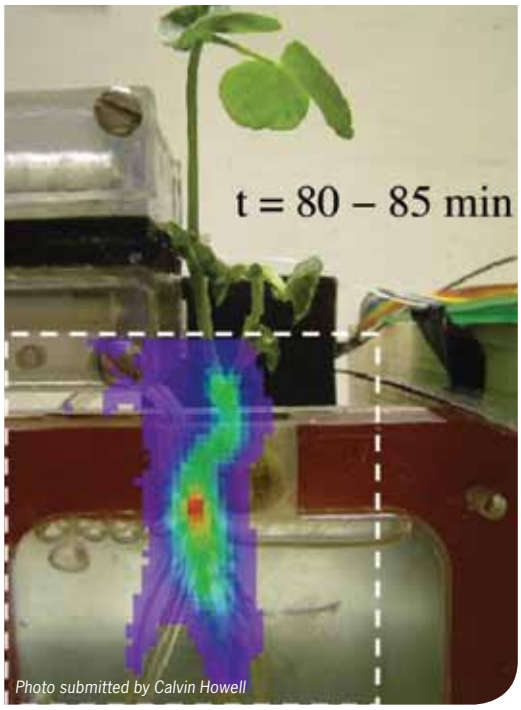


Photo submitted by Calvin Howell

PET has long been used in medicine, but its use with plants is relatively new. One of the advantages of PET is that it provides "movies" of biological processes rather than the "still" images of an X-ray or CAT scan that show mostly structural details.

Howell and graduate student Matt Kiser, PhD '08, worked closely with Duke biologist Chantal Reid to set up a system using the resources of TUNL and the Phytotron—a controlled-environment facility for plant research.

"You have to produce radioisotopes that can be traced in plants, and you have to make it in a compound that the plant can use," Howell says. In TUNL's tandem accelerator, the scientists bombard nitrogen-14 with a beam of protons to produce carbon dioxide molecules made with radioactive carbon-11. The process also produces carbon monoxide and nitrogen, which need to be removed from the gaseous mixture. With help from the chemistry department's Richard A. Palmer, Howell and Kiser designed a process to separate the gases by sending the mixture through copper tubing submerged in a nitrogen and ethanol bath. This "ethanol slushy" is cold enough to freeze the carbon dioxide but not the carbon monoxide or the nitrogen.

The radioactive carbon dioxide is pumped to the Phytotron via underground pipes, where it travels in a closed loop to a single leaf. "We have to be very careful we don't leak any radioactive gas out," Howell says. "The weak point is the seal around the leaf. As a physicist, I just wanted to put a rubber seal on the leaf and clamp down hard, but that would damage the plant." The biologists said Howell couldn't use vacuum grease either, because it would be toxic to the plant. The solution turned out to be a low-grade silicon that's the main component of silicon-based compounds used in medicines.

The team has begun to quantify rates at which carbon is taken up by a leaf, and how long it takes for the carbon to travel to the plant's stem and roots. Information about the timing of carbon allocation and transport processes will help the scientists connect observable physiological responses to the underlying cell biology, which in turn may illuminate how plants will respond to the ever-increasing amounts of carbon dioxide in the atmosphere.

Howell is working with a UNC student to refine the system so that it can be controlled remotely by computer. "We want to be able to point and click instead of having to adjust controls manually," Howell says. "It reduces our exposure to radiation and makes the system more user-friendly for the biologists." TUNL is also collaborating with the Jefferson National Lab on a project funded by the Department of Energy to develop techniques to improve the quality and resolution of PET images of plants.

In addition to learning more about how plants use carbon dioxide, Howell would like to investigate how, and how fast, plants respond when insects attack their leaves. "With the temporal component of PET, we can see how long it takes the plant to respond," Howell says, "and by using known fluid-flow analysis we can tell whether the response was active or passive, due to a concentration gradient."

Howell has enjoyed branching out into biology and chemistry for this project. "Whenever you try to do something that requires experience and knowledge that's not specific to your discipline, you have to not be shy and call up people and ask questions," he says. "Everyone I've talked to at Duke about this research has been enthusiastically helpful—this is a wonderful place for pursuing cross-disciplinary research."

Weblog Counts of Distinguished Physics Faculty

– by Fritz London Professor Emeritus, Horst Meyer

After preparing the webpages of the Duke Physics Distinguished faculty, starting with that of Fritz London (1900-1954), I recorded and tabulated their weblog counts. In addition of F. London, the webpages include those of Hertha Sponer (1895-1968), Lothar Nordheim (1899-1985), Walter M. Nielsen (1901-1981), Walter Gordy (1909-1985), Henry W. Newson (1909-1978), William M. Fairbank (1917-1989), Harold W. Lewis (1917-2000) and Lawrence C. Biedenharn (1922-1996). I was intrigued when following the pattern of these counts and comparing them. Here I wish to report briefly what I found.

Those four with the largest amount of "hits" and interesting features (London, Sponer, Fairbank and Lewis) are presented in the plot. To avoid overcrowding, the five plots which show counts with only random fluctuations are listed in the inset box with their average counts. I am much indebted to Henok Mebratu for producing the plots from the tabulations I had provided.

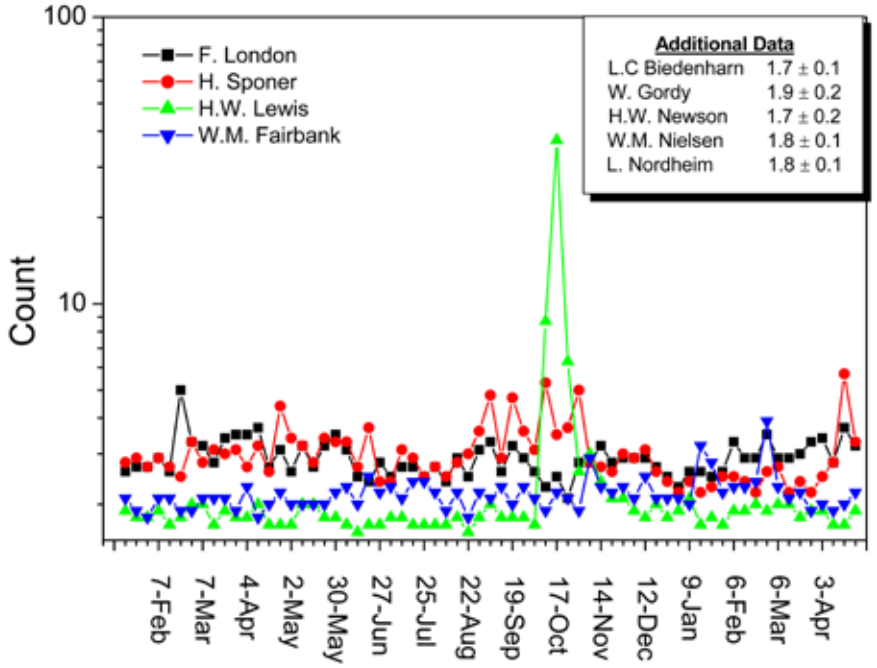
The weekly tallies indicate the number of "unique hosts", namely the different sources from which the "hits" originated. The total weekly size (in kB) from Monday to Sunday is a measure of the total number of "hits". As an example, a weekly tally of 3.3 kB for Sponer on April 24 corresponds to 57 "unique hosts" and a total number of 305 hits. The country of origin for some of them can be gathered from the codes. A number of hits originate from Duke, some can be traced to an American University, when they end with ".edu", some can be traced to a country abroad, mostly Germany , Russia, Sweden, UK. However most come from non-descript sources, like "1 b3091057.crawl.yahoo.net " , or pool-71-111-207-93.rlghnc.dsl-w.verizon.net.

It is interesting that Hertha Sponer, whose name is less well known than that of Fritz London attracts on the average a comparable number of weblog counts. The counts of Fairbank, who left for Stanford University in 1959, after having achieved an international reputation for his research at Duke, are on the average the third highest.

It is tempting to correlate a special activity in the number of hits with relevant events. For instance just before the Sponer lectures at Duke, there were peaks of activity in the Sponer weblog counts both on April 5, 2009 (not shown here) and April 9, 2011 (see plot). The German 2011 Hertha Sponer Prize, announced in November 2010, awarded to Prof. Martina Hentschel, a former postdoctoral fellow at Duke University working in Harold Baranger's group, could possibly be related with a special counting activity shown between late August and early November 2010.

The counts for Harold W. Lewis show him to become a rock star over a short period in Fall 2010, when his weekly count rose to the incredible peak of 38 kB (921 unique hosts), and to a total of more than 3000 unique hosts when summed over eight weeks. It is very likely that there was confusion with another Harold (Hal) W. Lewis, (Professor of Physics, Emeritus, U. of California, Santa Barbara) who attracted much attention in the fall of 2010 with his resignation from the American Physical Society in connection with a dispute on global warming. There it is stated that "Lewis's letter of resignation vaulted [him] to celebrity status among global warming skeptics". The surprising observation is, however, that most of these "unique hosts" accessed the webpage of "our" H.W. Lewis repeatedly, on the average about 6 times, hence a total of about 18,000 counts, even though it is immediately apparent from the first page that he had died in the year 2000.

Over the years since fall 2007 when the weblog counting started, the average number of weekly counts has been roughly constant, except for peaks and bumps such as those mentioned above, and some longer term undulations.



Plot of the weekly count (in kB) of the webpage "hits" for several distinguished Duke Physics Faculty as a function of time. Graphic: Horst Meyer

Prof. Nicolas Buchler Receives Funding from March of Dimes

—by Mary-Russell Roberson

Photo: Cristin Paul

Prof. Nicolas Buchler has received the Basil O'Connor Starter Scholar Research Award from the March of Dimes, which consists of $75,000 per year for two years. Buchler, who came to Duke in August 2009 with joint appointments in biology and physics, plans to use the grant to study the evolution of genes that oscillate autonomously in anticipation of periodic changes in environmental factors such as light, temperature, and availability of nutrients. Specifically, he'll be studying the evolution of circadian clocks in the genetic circuitry of yeast.

Circadian clocks have evolved independently in many different species, which suggests a significant advantage in being able to vary biological functions on a 24-hour schedule. "An ancient circadian clock was just a genetic circuit that could respond to light," Buchler says. "It seems to be the case that at some point it became advantageous to have an internal oscillator. What was the advantage of 'learning' to anticipate—of having an independent oscillator?"

Other researchers have recently shown that the dominant feature that favors development of an internal, autonomous oscillator is a "noisy signal"—for example, stormy days and full-moon nights that blur the basic pattern of dark night followed by bright day. "What was the feature of the noise that favored emergence of spontaneous oscillators?" Buchler asks. He hopes to be able to answer his question in his lab using fast-growing, well-understood, genetically modified yeast and a signal that's analogous to light, but easier to control—the availability of a nutrient called galactose.

Circadian clocks in yeast are just one example of the larger issue that fascinates Buchler, which is how single-cell organisms might have evolved to anticipate changes in their environment. In the long run, understanding this could provide insight into the workings of parasites and viruses. It has been shown that microbes are capable of associating changes in their environment, such as heat, with future conditions, such as lack of oxygen. Figuring out how fast they "learn" these correlations could lead to more effective treatments for illnesses caused by parasites and viruses.

"Alternatively," Buchler says, "if single-cell parasites and viruses are incapable of predicting certain signals, we could exploit this Achilles' heel to design more effective antibiotic or antiviral treatments."

As a biophysicist, Buchler says physics supplies the math and the intellectual framework for his approach. He thinks of the evolving yeast as a system that can be understood using nonlinear dynamics. "The scientific question driving this is biological, but we're thinking about things quantitatively and physically," he says.

Professors Ayana Arce and Mark Kruse Featured in Video Series

—by Mary-Russell Roberson


Photo: Cristin Paul

Professors Ayana Arce and Mark Kruse are featured in a new series of videos called "Physics for the 21st Century" produced by the Harvard-Smithsonian Center for Astrophysics and available online.

Kruse says the goal of the videos is to "share some of the excitement of what's going on in the frontier of physics right now to high school students and teachers, and interested undergrads as well." The videos, with accompanying transcripts and lesson plans, are available for free on the Annenberg Media website: http://news.phy.duke.edu/2010/12/professors-ayana-arce-and-mark-kruse-featured-in-video-series/www.learner.org/courses/physics.

Kruse says of the videos, "It's not just all glamour; they wanted to really show the audience how these questions are being answered." Kruse is featured in the first video (there are 11 in all), called "The Basic Building Blocks of Matter." In the 30-minute video, he explains the work that he and others are doing to look for the Higgs boson at Fermilab's Tevatron in Illinois.

Arce stars in the video accompanying the second unit, "The Fundamental Interactions." She talks about her work verifying data from the ATLAS experiment at the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) near Geneva, Switzerland. She uses Monte Carlo analysis and other statistical tools to analyze simulations of the ATLAS experiment; when compared to the actual data coming out of the ATLAS detector, the simulation analysis can give physicists a good idea of whether the detector is performing correctly.

In the videos, both Kruse and Arce are shown interacting with students and colleagues, as well as making some explanations directly to the camera. Some of the more complex ideas are illustrated with animation while they are talking.

"It was a fun experience," Kruse says. "The cameraman and director were very professional and good at putting everyone at ease. They give you a little bit of coaching beforehand about how to interact in front of the camera." He was filmed at Fermilab over the course of two days. He said the film crew collected perhaps 10 hours of footage from which they chose less than 15 minutes of film to use in the video.

Arce says, "It was the most intensive involvement with a camera crew I've ever had in my life." She says the camera crew followed her around for a couple of days (the footage was shot while she was still a post-doc at UC-Berkeley), filming her interactions with students and colleagues. Being filmed during candid conversations—and shooting second takes of these—was "a new experience," she says. "It was a lot of fun."

While she hasn't watched the entire video ("I have a problem watching myself on video," she says. "I watched as much as I could take."), what she saw was "really nicely done."

Hannah Petersen Joins Duke as Nuclear Theory Post-doc, Recently Named a Visiting Assistant Professor

—by Visiting Assistant Professor, Hannah Petersen


Photo: Cristin Paul

Dr. Hannah Petersen has recently been appointed to a Visiting Assistant Professor position in the QCD theory group. Her field of expertise is the dynamical description of heavy ion collisions using transport theory to study the properties of hot and dense nuclear matter and the quark gluon plasma. The development and application of a hybrid approach that combine microscopic transport and fluid dynamics constitutes one part of her research. The calculation of characteristic matter properties like the shear viscosity coefficient from a more fundamental approach, in this context the real-time lattice simulation of classical low momentum gluon fields coupled to the hard thermal modes in a so called colored-particle in cell (CPIC) simulation, is one of her new interests. The application of state-of-the-art visulization tools to facilitate new discoveries or highlight new findings complements her research.

After receiving her diploma and PhD degree at Goethe University in Frankfurt am Main, Germany, she joined the group of Profs. Mueller and Bass in January 2010 as a Feodor Lynen fellow, which is a postdoctoral appointment sponsored in part by the Alexander von Humboldt foundation. One major focus of her work has been on the influence of initial state fluctuations in heavy ion collisions on final observables. Her quantitative calculations of these effects in an event-by-event approach have lead to more than 10 invited talks at workshops, conferences and seminars nationally and internationally in the last year. Within the interdisciplinary MADAI (Model and Data Analysis Initiative) collaboration, a NSF supported Cyber-enabled Discovery and Innovation initiative, she has taken a leading role in working with visualization experts and statisticians on the application of modern technology to heavy ion research.

In her new position, Hannah Petersen gets more and more involved in the supervision of undergraduate and graduate students within the Duke QCD theory group. She is looking forward to the new responsibilties and challenges, such as the opportunity to teach in the fall 2011 semester, that come with the new position. Overall it is a great chance to expand her career experience and to contribute to the inspiring research environment at Duke.

Postdoc News

Attendees of the 3rd International Workshop on Nucleon Structure at Large Bjorken x. Photo submitted by Simona Malace.

Postdoc Simona Malace Receives JSA Fellowship Award

– by Postdoctoral Associate, Simona Malace

Simona Malace, a research scientist under Prof. Haiyan Gao stationed at Jefferson Lab, was the winner of the 2010 JSA Postdoctoral Research Fellowship Award. With this award she successfully organized the 3rd International Workshop on Nucleon Structure at Large Bjorken x.

The workshop Nucleon Structure at Large Bjorken x was held at the Thomas Jefferson National Accelerator Facility (Jefferson Lab) in Newport News, Virginia, during October 13-15, 2010. Funding for the workshop was provided by a generous grant from Jefferson Science Associates (JSA), awarded with the 2010 JSA Postdoctoral Prize to Simona Malace.

The workshop, attended by over 60 participants from 33 universities and research laboratories around the world, addressed the most recent experimental and theoretical advancements in our understanding of the nucleon structure at large Bjorken x. In particular, the central topic of the workshop was the description of nucleon structure in terms of parton distribution functions and transverse momentum distributions. This has become a very active area of research with the Jefferson Lab research program greatly contributing to a worldwide effort.

The meeting was successful with an enthusiastic attendance and a fruitful exchange of ideas. The proceedings of this workshop will be soon published by the American Institute of Physics. For more information please visit the HiX2010 webpage: http://www.jlab.org/conferences/HiX2010/

Undergraduate Studies Quantum Optics in the Lab

—by Mary-Russell Roberson

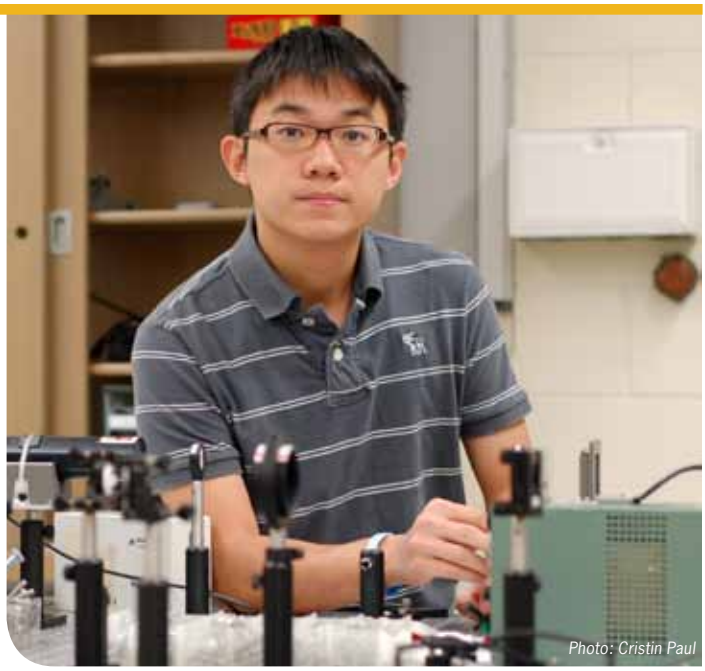


Photo: Cristin Paul

Yu-Po "Ken" Wong, a junior physics major from Taiwan, has spent the last two summers working in Prof. Dan Gauthier's optics lab. He's studying the spontaneous down conversion, which is when a photon going through a crystal is changed into two lower frequency photons. The research has implications for high-speed quantum communication.

"This kind of optics experiment is very fun to me. I'm learning a lot of stuff from a lot of areas of physics," Wong says.

"At the end of my freshman year, I thought it's time for me to learn to do some research so I emailed Dan and asked if there is an opportunity for me to do some research in his lab," Wong says. Dan said yes, and Wong received a Deans' Summer Research Fellowship to do so.

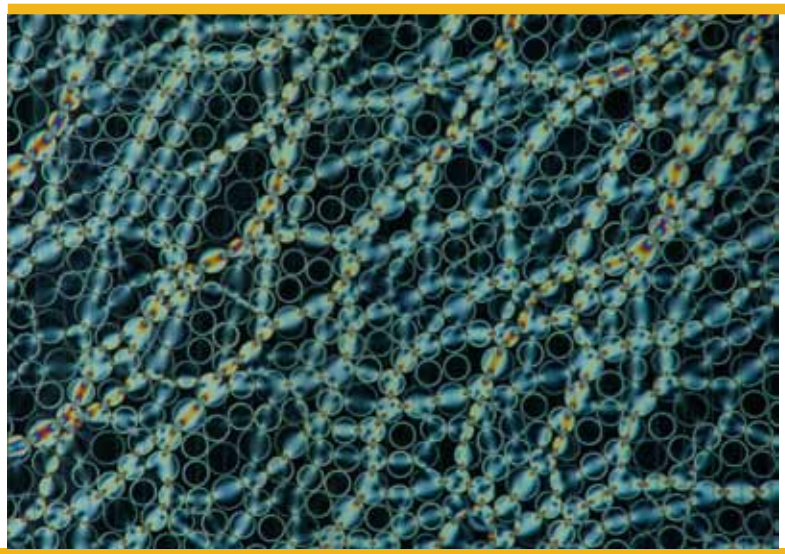
Wong first worked to duplicate an experiment done at another university. In setting up the lenses and lasers, every piece of equipment needs to be located precisely in relation to all the other pieces. Making sure every lens is in the correct position is a "very painful and long job," he says. "The alignment process takes about two days, and it takes me 30 minutes to align stuff if we modified something in the setup."

This past summer, Wong was joined in the lab by graduate student Hannah Guilbert. In the process of duplicating the original experiment, Wong, Guilbert and Gauthier discovered something interesting. The down conversion in this experimental setup is known to produce a circular ring of light, but they discovered the circle is actually an elliptical ring.

Wong is doing an independent study this semester working with Gauthier to understand the theory that explains the ellipse. He's also doing an experimental independent study using a turbulence cell, built by Bill Ebenstein, a research scientist in the department, to see what happens when the down conversion ring goes through turbulence.

The work has implications for the emerging field of quantum communication. Traditional electronic communication uses two states—zeros and ones. Quantum communication uses many more than two states, so there is a potential to transmit more information in a shorter period of time. Furthermore, quantum communication adds an extra element of security because the act of eavesdropping changes the quantum states in such a way that leaves a mark. The turbulence question is relevant because quantum communication traveling long distances would go through turbulence in the atmosphere.

In late October, Wong is going to the annual meeting of the Optical Society in Rochester, New York, to present last summer's work in a special session for undergraduates. Gauthier is also attending the conference and will be giving a talk titled, "Toward Single-Photon Nonlinear Optics via Self-Assembled Ultracold Atoms."



Duke Graduate Student Photo Selected "Picture of the Day" by NSF

On October 26, 2010, Jie Ren's photo of stress in a two-dimensional granular material was selected as the "Picture of the Day" by the National Science Foundation.

The work leading to the picture was conducted by Jie in Prof. Robert Behringer's laboratory. The photo also won first prize in the Mahato Memorial Scientific Visualization Contest.

From The Chair

• June 2011: Congratulations to Prof. Hubert Bray and wife Heidi on the birth of their fourth child Jonathan Jacob on Wednesday, June 8, 2011 at 1:18pm. Jonathan weighed in at 8 lbs, 5.5 ounces and was 20.5 inches long. Both Jonathan and Heidi are doing great.

• February 2011: Donna Ruger is pleased to announce that she has become a grandmother again. Shelby Helen Ruger was born on Feb. 10, 2011 to her son Jason and his wife Hassie.

• February 2011: Postdoc Hugo Cavalcante's wife Lucelia gave birth to their daughter Lua on Friday, February 18, 2011. Lua weighed 7 pounds and one ounce. Mother and Daughter are both doing well. Congratulations to Hugo and Lucelia!

• February 2011: Congratulations to DUS Assistant Elena Musty and husband Mike on the birth of their daughter Keira Irena! Keira was born on Thursday, February 17, 2011 around 5:15pm weighing 8lbs and measuring 19" long with a full head of dark hair. Mother and Baby are doing fine.

• February 2011: Assistant to the Director of Graduate Studies, Donna Ruger would like to share that she has become a grandmother again, this time with a grandson. Her daughter Jennifer and her husband John gave birth to Jackson Miller* on June 8, 2010 and then on February 10, 2011, her new granddaughter Shelby Helen* born to her son Jason and his wife Hassie. *Miller is Donna's maiden name and Helen is her husband's mother's name.

• February 2011: I am very pleased to pass on the news that the Provost has recommended that Prof. Roxanne Springer be promoted to Full Professor of Physics, effective Jul. 1, 2011. Please congratulate her when you see her next!

• February 2011: The Graduate Student Organization Tea Time is held each Thursday at 3:30pm in Physics 298.

• January 2011: The Physics Department staff threw a baby shower for Elena Musty, Assistant to the Director of Undergraduate Studies, on January 14th. Elena is from Russia so the staff ladies wanted to treat her to a full-blown American baby shower. There were balloons, pink cupcakes and lots of cute presents for Elena and her husband Mike's daughter due February 15th!

• January 2011: We are sad to announce that Professor Emeritus Henry Fairbank passed away this month. Henry was a recognized expert in low temperature physics and was chair of the department of physics from 1963-1973. The family's plans are not definite yet, but there will likely be a memorial service sometime this spring. I will pass on information as I hear about it. Please keep the Fairbank family in your thoughts.

• January 2011: The New York Times recently published an article about Randy Best's daughter, Madeline, and her dance performance. The piece, entitled "Selective Memory," ran during the COIL festival in New York city.

• January 2011: Senior Research Scientist Constance Kalbach Walker has just published her translation and editing of a monograph entitled "Jesus Tempted in the Wilderness" by Adolphe Monod, a famous 19th century French evangelical. This is the third work by Monod that Connie has translated and published. It is issued by Solid Ground Christian Books.

• December 2010: Graduate student Jie Ren and her husband, Hsiang-Kuo Yuan, welcomed their daughter into the world in December of 2010. Their daughter, Deanna Hope Yuan, was born on December 15, 6:39pm. The baby is 7lb 14oz, and is doing well.

• December 2010: I just received word from Dean Crumbliss that Prof. Chris Walter has been granted tenure! Starting January 1, 2011, his title will be Associate Professor of Physics. Please congratulate him on this important and richly deserved achievement.

• September 2010: Duke Physics faculty member, Prof. Mark Kruse, and his wife are proud to welcome twins into the world. Mother and babies are all doing fine.

• April 2010: We are sad to announce that Prof. Emeritus William Walker passed away from cancer on April 8, 2010. He built an experimental high-energy physics group, served two terms as chairman and was awarded a James B. Duke Chair.

• February 2010: Duke Physics staff member, Donna Elliott, is proud to announce that she became a grandmother at 11:30pm on Monday 2/1/10. She and her family welcomed a beautiful, bouncing boy.

• January 2010: Assistant to the Chair, Cristin Paul, is happy to announce the birth of her daughter Corinne Samantha born Tuesday, January 19. Corinne weighed a whopping 10 lbs, 5 oz and was 21" long. Both mother and daughter are doing very well.

• October 2009: Mrs Eugenia Ladd, Secretary to the Duke Physics Chair over many years and who retired sometime in the eighties, passed away on Oct. 22, 2009. Jene Ladd was to be ninety years old next year. She was a much loved person and some of you have known her and will still remember her.

• July 2009: Prof. Steffen Bass and his wife, Almasa, were very happy to announce the arrival of their son, Reiner Ismael Bass. He was born on 7/31/2009 and Mom and baby are doing fine.

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FEL Cavity Mirror courtesy of Gary Swift