The Dilated Times

The newsletter of the Drew University Society of Physics Students

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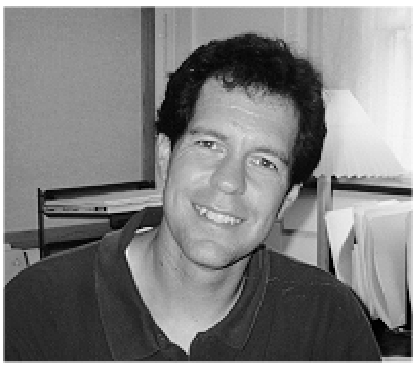
Dr. McGee Returns



My 2001-2002 sabbatical was spent at two relatively large research institutions: the Naval Research Laboratory in Washington, DC and Bell Labs (part of Lucent Technologies) in Murray Hill, NJ.

From May through August 2001 I worked as part of a summer faculty fellowship program at the Naval Research Lab (NRL). NRL is on the banks of the Potomac River, and, as the name implies, was originally built to serve the ordinance and ship needs of the US Navy. Over the past thirty or so years, however, the lab has evolved into a much broader role, and now performs research ranging from astrophysics to nanotechnology. I worked in the Photonics Technology group as part of a 7 person team of engineers and physicists. The group was building what are called "microelectromechanical devices" otherwise known as "MEMs". Our MEMs functioned as optical microcavities. These are essentially two partially reflective mirrors separated by a micrometer-sized gap. Electrically altering the mirror separation can be used to tune the cavity into and out of resonance with various frequencies of light. The ability to discriminate among multiple light frequencies makes these devices attractive for applications in optical communications systems. One of my jobs was to build a computer-controlled spectrometer to probe the cavities at various frequencies and measure their response. As you might imagine, LabVIEW played a big part in this work!

From October 2001 till now I have been working in the Materials Research group at Bell Labs. Bell Labs has an amazing history, basically starting the digital revolution with the invention of the transistor and starting the photonic revolution with fundamental work in lasers and fiber optics. My work here involves the fabrication and testing of polymer waveguides. These are essentially "pipes" of plastic, about 5 microns square and several centimeters

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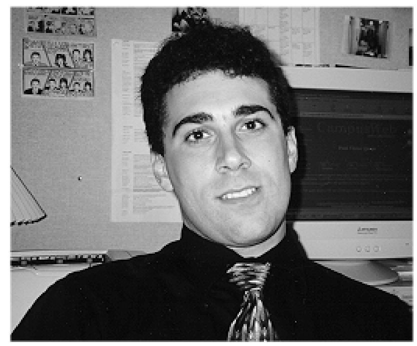
A Farewell to Dr. Quinn



Dr. Paul Quinn has finished his temporary one year position at Drew and is moving on with his career. Dr. Quinn graduated from Drew with degrees in Math and Physics in 1996 and returned last September to fill in for Dr. McGee who was on sabbatical for the 2001-2002 academic year. Dr. Quinn has accepted a position as a full time professor at Kutztown University, a state school in Pennsylvania. Dr. Quinn is excited about his position at Kutztown, particularly because the school has an active plan to expand their science program.

At Drew Dr. Quinn taught Physics 1 and 2, and Astronomy 1. He especially enjoyed teaching Astronomy because the subject matter causes students to think differently than they are used to and this results in very pointed and challenging questions. Also

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Notes From the Outside

John LaMarr, CLA 1994

Hello, my name is John LaMarr and I graduated from Drew University in 1994 with a double major in Physics and Applied Mathematics. This note may give you some idea of what I've been up to since leaving Drew, and tell you a bit about what I'm doing now.

After I graduated from Drew, I went directly into the graduate program at the Optical Sciences Center (OSC) of the University of Arizona. At the OSC most of the students are given a research assistantship, rather than a teaching assistantship. So rather than being assigned to an undergraduate class or lab to grade papers or lecture, I had to find a faculty member who had funding and work for a new student. I ended up joining the Remote Sensing Group (RSG), doing satellite calibration.

The RSG works mostly with the vicarious calibration of earth-viewing satellite sensors. We are using vicarious in the sense of "through another's eyes", though I know that doesn't really explain it very well. In fact, the original head of the group had a standing offer of $20 to anyone who could come up with a better word than "vicarious" to describe our work. We would take our equipment out to one of our sites and measure the reflectance of the ground and several atmospheric properties while the sensor flew over. A standard reflectance collection covered an 4 x 16 pixels area of the satellite image, which for the Landsat Thematic Mapper satellite translated to reflectance of a ground area measuring 120 m x 480 m. These data, along with the atmospheric measurements, were used as the inputs for a radiative transfer computer code which modeled the atmosphere and yielded as its output the radiance (watts m^{-2} sr^{-1}) at the sensor. The average of the signal from our site is divided by the at-sensor radiance to calculate the calibration coefficient.

The reflectance data are calculated by comparing the upwelling radiance from the site to the upwelling radiance of a reference panel with a known reflectance. The reflectance that is needed for the radiative transfer code is the specific reflectance which corresponds to the light incident from the sun and reflected towards the satellite. My dissertation topic was to develop a method to remove the effects of diffuse sky light on our reflectance measurements. Since our sites are generally very homogenous and diffuse, this effect only amounts to about 1% or 2% at 400 nm, and quickly decreases with increasing wavelength. While this small a contribution would be in the noise for most applications, the RSG is working towards achieving an overall accuracy of 2% for the calibrations, so the effect couldn't be ignored.

I finished my dissertation about a year and a half after I began working for Telic Optics in Massachusetts, and graduated in December 2001. On a side note, I would strongly encourage any of you who are going to graduate school to finish your degree work first and then get a job. Working a full time job, and then coming home and having to put in another few hours at the computer analyzing data or writing is not a fun way to spend 18 months. Getting back to my current job, it has almost nothing at all in common with the work I did for my dissertation. Telic Optics, Inc. is a small company which designs and manufactures custom infrared optical systems. I really enjoy working for a small company (we only have about 30 employees) because it means that I have the opportunity to do a lot of different things. I will spend a few days trying to design a lens for a scene projector, then I'll be down in the testing lab working on the interferometer trying to verify the performance of a zoom lens for the next couple of days. In addition, I like computers, so I have designed a database for keeping track of our null lens inventory, and have designed the company webpage. For more information about us, check out www.telic.com (shameless plug).

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Finally I might say that about the only unifying theme of my career so far has been that each phase has had little or nothing to do with the preceding one (often a hallmark of physics training - Ed.). That being said, I've enjoyed it all, and I love my job.

- John H. LaMarr
thelamarrs@att.net

The Mysterious Universe

I have a problem. My five-year-old nephew Laszlo wants to be a scientist. In fact, he believes he is a scientist. Recently I showed him our RISE microbiology lab. He looked at cultures in Petri dishes and peered through a microscope. On his way out of the Hall of Sciences he ran into Professor Timmons. He introduced himself: "I'm a scientist. You can call me 'professor'."

His father, who is crazy about him, frequently takes him to the Museum of Natural History in New York, where he seems to absorb everything he sees. After one such visit I (who am also crazy about him) asked him, "What is the difference between sunlight and laser light?" He immediately replied, "Well, it's like this [this is the way he talks]: when you put sunlight through a prism, you get lots of colors. When you put laser light through a prism, that doesn't happen." He said this with great conviction, shaking his head from side to side.

So what's my problem? It's that he calls me on the phone to ask questions, such as "Uncle Ash, what's electricity?" When I mention batteries and wires, he asks, "What's in a battery?" Later his questions become even more difficult to answer: "Does electricity go through water?"

My answers were not very satisfying to him. So I tried a different approach, inspired by Steven Weinberg's marvelous chapter "On a Piece of Chalk" in his book *Dreams of a Final Theory*. We talked about chalk and chalk dust in the blackboard tray and how everything is made up of very small, invisible particles – molecules and atoms and electrons. When electrons move through a wire, there's a current. That was a little better but the concept of charge was hard to get across.

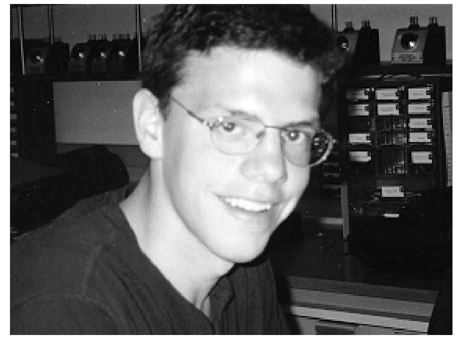
I have come away from this with two thoughts: (1) The world really is pretty mysterious; and (2), it's very important that childrens' questions about the world be answered in some way that satisfies them, at least temporarily. And that isn't easy.

At the January meeting in Philadelphia of the American Association of Physics Teachers, Congressman Rush Holt, who is a physicist, talked about introducing physics to students in grade school. That sounds like a great idea, but who are the teachers who can teach physics to young kids, and what will they teach?

Here's a wonderful challenge and opportunity. Write a book about physics aimed at 6 to 10-year olds and their teachers. I'm serious. Go to Barnes and Noble and you'll see how great the need is. *Sam and Suzy Meet the Weatherman* just doesn't fill the bill. Who knows? Your book might become a best seller. And you would be breaking down the barriers to science literacy. You might even be encouraging someone like Laszlo to become the scientist he thinks he already is.

- Dr. Carter

Justin Graduates!



One might suppose that after four years of physics classes, a graduating senior would have a solid background in using logic to solve problems. After all, I've had a lot of practice. Drew offers enough physics activities to keep any majoring student busy. I think of all the evenings tutoring, afternoons at TA jobs, nights in the observatory, and independent studying that I have enjoyed. Then there was the Governor's School in the Sciences and the research experience at Penn State, not to mention every intermediate and upper-level physics class in the catalogue. Through it all, I have learned a lot. For instance, when Joe Kinast and I set up the Gamma-ray source for the Compton effect, we realized too late that it probably was not a good idea to have the source pointed right in front of the monitor where we sat taking data. Some things have been tedious, like trying to align all the mirrors and gratings of a pulsed dye laser in A-lab. Other things have been stranger, such as Dr. Carter's description of the "here" and "there" vectors in Quantum Mechanics.

Equipped with this problem-solving background, I embarked on the quest to find the right graduate school. I researched different programs, toured several schools, and asked many questions. However, despite all these efforts, I could not easily reach a decision after I was accepted at a few institutions. It seemed that all the logic and reflection did not provide the answer. Perhaps some choices involve more than weighing pros and cons. So I went with my gut feeling and chose Boston University. I am very excited about studying physics at BU and getting a change of pace from life in Madison. The BU physics department is small to mid-size with 36 full-time faculty and about 85 grad students. I am leaning towards studying condensed matter physics, but my future plans are by no means certain. I do encourage all Drew's physics students to take advantage of the opportunities Drew offers and to trust their instincts about grad school.

- Justin Hotchkiss (02)

New Web Page on Dual Degree Programs in Engineering and Applied Science

As many of you may know, Drew has dual degree or combined plan program affiliations with Columbia University and Washington University in St. Louis. If you think you may have interest, please check out our new web page devoted to a full description of these programs at:
http://www.depts.drew.edu/phys/DualDegree/DualDegree.html
These programs lead to an undergraduate liberal arts (B.A.) degree from Drew and an undergraduate engineering (B.S.) degree from the affiliated engineering school. Participants commonly follow a "3-2" or "4-2" scheduling, entering the engineering school after their junior or senior year at Drew respectively. Possibilities also exist for earning a graduate engineering degree (M.S.) in six total years.

The Dual Degree program is another attractive alternative to traditional engineering curricula which are often highly structured and can require longer than four years to complete. Program graduates are "liberally educated engineers" possessing strong communications and problem solving skills, and a broad background in the humanities and social sciences as well as a high-quality technical education. They are well prepared to advance in technical management and to play major roles in solving increasingly complex societal problems.

Other advantages of Dual Degree study include: the possibility of postponing irreversible career decisions while exploring and confirming long-term goals; the ability to complete degrees in two diverse areas under predictable conditions; gaining time for the pursuit of other academic, athletic, or extra-curricular interests; and the opportunity to use the supportive, personal environment of Drew to develop the skills and confidence for success in engineering.

- Dr. Fenstermacher

Career Corner

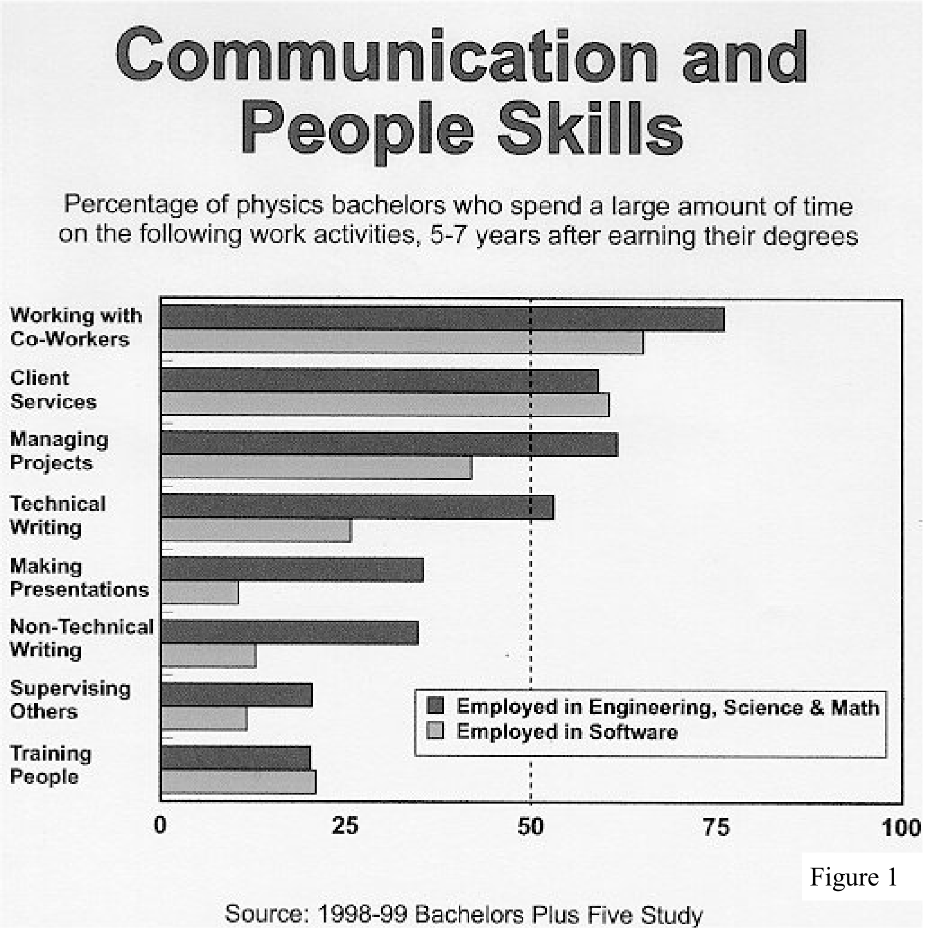
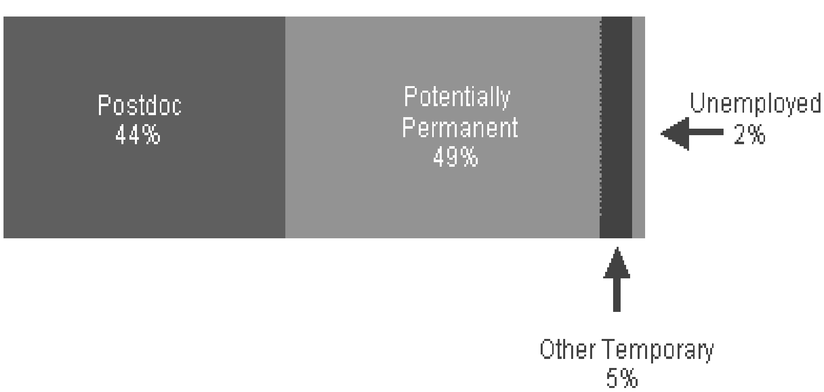


Figure 1

US Employment Status of Physics PhD's, Class of '99 and '00
Figure 2



AIP Statistical Research Center, Initial Employment Report.

This issue's Career Corner presents more data collected from the American Institute of Physics Statistic Division. Two items might be of particular interest for our students. The first reveals the communication and people skills required in the employment of physics bachelors 5-7 years into their jobs. I would speculate that these data are essentially valid for PhD's and Master's people as well. In the college world of study, it's sometimes easy to forget the balance of skills required for most jobs in the real world. Notice, for example, the large fraction of employees spending significant amounts of time on managing projects and technical writing. A liberal arts training for physics majors seems particularly relevant to these needs. (Figure 1)

For those who are concerned about the state of jobs for physics PhD's, there is good news. The unemployment rate is one of several indicators that shows the dramatic improvement in the job market for new physics PhD's during the 1990s. For the classes of 1997 through 2000, the unemployment rate was a steady 2%, a significant decline from the 6% unemployment rate that haunted the classes of 1993 and 1994. Another indicator of an improved job market is the length of time spent jobseeking. The class of 1992 faced an average 3.9 months of jobseeking. The classes of 1999 and 2000 searched for an average of 3.3 months. (Figure 2)

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And finally, for those with dollar signs in their eyes, first year salaries appear as shown in figure 3. The median annual salary for a new physics PhD differs greatly by type of position and employment sector. The Federally Funded Research & Development Centers (FFR&DCs) and the industrial sectors continue to offer starting salaries substantially higher than those offered by academic institutions for both postdoc and potentially permanent positions. For much more data and trends, visit www.aip.org/statistics.

- Dr. Fenstermacher

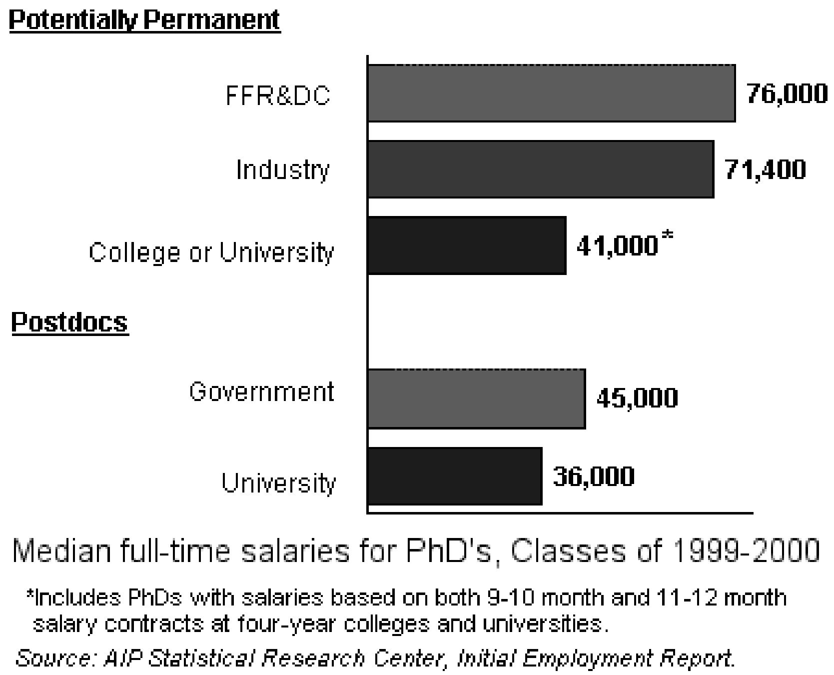

Figure 3

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while at Drew, Dr. Quinn kept up work on his specialty – simulating 3-D granular systems. Senior Justin Hotchkiss completed an independent study helping Dr. Quinn in this area. The pair also attended an APS conference in Indianapolis last month.

Dr. Quinn is quite sad to be leaving Drew and will miss his alma mater, especially the students and activities like Drew's concerts. He will continue his position at the Governor's School at Drew since his summers at Kutztown are free.

Dr. Quinn found it a great experience to become colleagues with his undergraduate mentors and would like very much to someday return to Drew to teach a permanent position, however until he receives tenure at Kutztown, he'll be there, and in the meantime he won't miss the commute.

- Brett Becker (03)

Copenhagen at Drew!

On April 2 students in Dr. Ashley Carter's History of Physics in the 20th Century class, among others, were treated to Drew's own production of *Copenhagen* in HS-244. The play, recipient of the 2000 Tony Award for Best Play, was written in 1998 by British playwright Michael Frayn. It is about the mysterious visit the German physicist Werner Heisenberg made to his mentor, the Danish physicist Niels Bohr in 1941 occupied Denmark. This visit has puzzled and continues to puzzle historians.

Questions arise regarding the intent of Heisenberg with his visit. Frayn attempts to answer these questions by creating several different scenarios where Heisenberg, Bohr, and Bohr's wife Margrethe (speaking without concerns, after death) attempt to remember the visit to explain to themselves, as well as to the audience, what happened and , more important, what was said that day.

The part of Heisenberg was played by senior Theater Arts major Bradley Wrenn . Bradley has performed in several productions for the theater Department as well as being involved in the New Jersey Shakespeare Festival. Alice Saltzman, Adjunct Lecturer of Theatre Arts and professional actress, played the role of Margrethe. And, finally Joseph Patenaude, Associate Professor and Acting Chair of Theatre Arts, played the part of Bohr. The three dazzled the audience with their emotional interpretations of the intense conversations among the three characters.

Spectators were at the edge of their seats thanks to the dramatic interplay between the characters—and a great history lesson came along for free.

- Arlene Ovalle (03)

SPS Zone Meeting in Baltimore

The national Society of Physics Students is broken up into regional zones, with each zone sponsoring a conference every year. Unfortunately, Drew's zone did not hold such a conference during the 2001-2002 school year. What's a physics student to do?
On April 6th, the solution was found, when eight Drew physics majors/minors traveled to Baltimore to attend a zone meeting at Johns Hopkins University in Baltimore. Although this conference was intended for SPS chapters in a different zone, the Drew chapter attended for lack of an annual Zone 3 meeting.

These meetings generally consist of a panel of both student and faculty presenters, who give short talks detailing different aspects of physics, ranging from independent research to overviews of current debates. The Baltimore conference included three student presenters. The first to present was a student from Lycoming College who discussed his research on different types of pion flow. His talk was followed by a PowerPoint presentation describing a Virginia Military Institute student's construction of a pulsed dye laser. This was of special interest to the Drew chapter because similar equipment can be found in our optics lab. The final student presentation gave a detailed overview of a JHU independent astrophysics research project.

Other presentations at the zone meeting were given by JHU faculty. These talks skillfully covered the topics of particle physics and astrophysics; with both lectures aimed at presenting information to help undergraduates decide whether to pursue entering the field after graduation. Along with the professors' lectures, another JHU faculty member, Dr. Ravi Sankritt, spoke on the Far Ultraviolet Spectroscopic Explorer (FUSE) satellite being controlled from the physics building at Johns Hopkins. This satellite, launched in 1999, is being operated to collect data on the outer reaches of the Milky Way Galaxy, with special attention on distant gas clouds. Sankritt also explained a troubleshooting procedure used after launch; engineers working with the satellite utilized magnetic forces to stabilize satellite control, an example of basic physics principles being used to combat mechanical difficulties. The presentation culminated with a tour of a FUSE model, as well as the satellite control room.

In addition to the standard zone conference presentations, the Baltimore conference boasted a visit from Dr. Gary White, the national director of SPS. He gave a presentation entitled, "The Secret Lives of Physicists: from Spandex to Spintronics," which mainly included data collected on the prospective futures of physics B.S.'s and Ph.D.'s. This presentation was highly interactive, and offered valuable information to the many physics students that attended this conference.
The conference closed with an opportunity to speak with the SPS members and JHU faculty, and a video of the installation of the Hopkins' advanced camera for surveys in the Hubble Telescope was displayed. The Drew students and Dr. Fenstermacher then returned to campus, having been able to participate in an annual SPS zone meeting.

- Emily Hamilton (04)

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long. The polymer is mixed with an organic dye molecule, making the entire mixture electro-optic. That is, a voltage applied to the polymer-dye composite causes a change in its index of refraction, which then changes the speed of light through the material. The goal here is to use a digital bit stream as the voltage, which is then "coded" onto the light beam. Making these micron-sized pipes is quite a challenge: I spend a lot of time in a clean-room, wearing white coveralls and constantly on the lookout for microscopic dirt particles that could contaminate the polymer. The results are worth the patience, however- a working polymer lightguide lights up fantastically when lit by a properly aimed laser beam.

In May I'll be back in my lab at Drew, getting ready to continue the work begun at NRL and Bell Labs. Danielle Bousquet, a chemistry student, will be working at Bell Labs over the summer on synthesis of organic dyes for the polymer waveguide project. Tom Zielinski, a physics student, will also be working on the project. Tom will be setting up new fiber optics experiments and looking at ways to couple laser light into the polymer waveguides and measure their transmission characteristics. There will be lots of new and exciting laser experiments set up in HS 207, so as always, be sure to stop by and say hello.

- Dr. McGee

Upcoming SPS Events. . .

Saturday, April 20
Spring Saturday
SPS students greet prospective students with physics demos and liquid nitrogen gourmet delights at the annual activities fair.

Monday, April 22
SPS/Physics Annual Awards Banquet
The department and SPS celebrates the end of the year with an induction ceremony for the physics honor society, Sigma Pi Sigma, and awarding of departmental endowed prizes. A good time is had by all!

Sunday, April 28
*Advance Lab Field Trip to **QED***
A special field trip to Lincoln Center to see Alan Alda portraying the genius physicist and Nobel Prize winner, Richard Feynman in the play *QED* by Peter Parnell.

Sunday, May 5
Annual Physics/SPS Spring Picnic
An end of classes party with all manner of picnic food and games - a time for relaxing before finals.

Alumni Business Card Project

Many thanks to all of you who have already sent one of your business cards for our Physics Alumni Outcome Board. To date we have received about 20 cards and it's an impressive collection. But we would certainly like to have a fuller representation. If you haven't already done so, please send along one of your cards to add to the group. Just put your graduation date on the back and put it in an envelope addressed to Bob Fenstermacher, Department of Physics. Thanks in advance from all of us.

The Dilated Times

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Address Correction Requested

Inside… Dr. McGee returns, Farewell Dr. Quinn, The Mysterious Universe, *Copenhagen* at Drew, Justin Graduates, and more!

Contributors: Dr. Fenstermacher, Dr. Carter, Dr. McGee, Justin Hotchkiss, John H. LaMarr , Emily Hamilton, Arlene Ovalle, Brett Becker