The Dilated Times

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There and Back Again: A Physicist's Tale (in Two Parts)

By Michael Jokubaitis '10

Recently, I was privileged to undertake a journey: a journey of many miles and many revelations; a journey outward and a journey inward; a journey through what might become the past, and what may be the future. This adventure started last spring, when Dr. Fenstermacher suggested that I run for office as the Society of Physics Students Associate Zone Councilor for Zone 3. I was interested and so I applied. Much to my surprise and elation, I was elected: to my surprise because I did not expect anything to come of my application and to my elation because as a member of the SPS National Council, I would attend the annual Council meeting.

A meeting may not sound like a reason for excitement, but this year's meeting was special – very special. The meeting would be held in conjunction with the 2008 ΣΠΣ Quadrennial Congress on November 6-8. Physicists, physics teachers, and physics students from all over the country would gather together at one of the most magnificent sites in all of physics: The Fermi National Accelerator Laboratory ‑ Fermilab. It promised to be a remarkable experience.

Well, this aspiring physicist sojourned to Fermilab and has returned to tell the tale. Here follow two retrospectives: one on the journey and the experience; the other on the topic of the Congress itself – Scientific Citizenship: Connecting Physics and Society – and what the future may hold for this field of human endeavor.

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Drew Science Scholars Symposium

By Michael Jokubaitis '10

On September 18, 2008, the first Drew Science Scholars Symposium, sponsored by RISE and organized by Dr. Barbara Petrack, was held in honor of Dr. Ashley H. Carter: beloved teacher, mentor, friend, and true Renaissance man. The symposium was to feature four Drew science graduates – Dr. Jonathan Spanier ('90), Dr. Paul Quinn ('96), Dr. Carmen Drahl ('02), and Laura Barclay ('07) – but unfortunately due to illness, Dr. Quinn was unable to attend.

Dr. Ashley Carter

Drew University President Dr. Robert Weisbuch presented opening remarks, and a moment of silence was held in remembrance of Dr. Carter. The first speaker was Dr. Spanier. His talk, entitled "Nanomaterial Surfaces: Is Beauty Only Skin Deep?" focused on the research he and his group at Drexel University are conducting on novel hybrid nanostructures and ferroelectric materials. Dr. Spanier received the prestigious Presidential Early Career Award for Scientists and Engineers (PECASE) and was featured in last spring's *Dilated Times*.

Next, Dr. Carmen Drahl, an Associate Editor at *Chemical & Engineering News*, spoke about "Pathways: Journeys at the Interfaces of Science." She discussed how, as a chemistry major at Drew and as a graduate student at Princeton, she realized that she didn't want to do long-term research and so began to look for other careers. She found her niche as an editor at *C & E News,* where she combines her passion for science and need for new challenges by researching and writing articles about the latest discoveries in chemistry and chemical engineering.

Finally, Laura Barclay took the podium. A graduate student in physics at the University of Delaware, Laura spoke about her senior project: "Einstein and His Son Hans Albert: a Fresh Look at Their Relationship." This talk was of particular poignancy since it was the last senior project on which Dr. Carter worked. Through her studies and her writing, Laura developed a close friendship with Dr. Carter. Her appreciation for his tutelage was expressed in an article she wrote for last spring's *Dilated Times* and which was reprinted in last fall's special issue.

Each of the speakers expressed the gratitude they felt for Dr. Carter and for his contributions to their lives. At the end, all agreed that the symposium was a rousing success and one which, it is hoped, would meet with Dr. Carter's approval.

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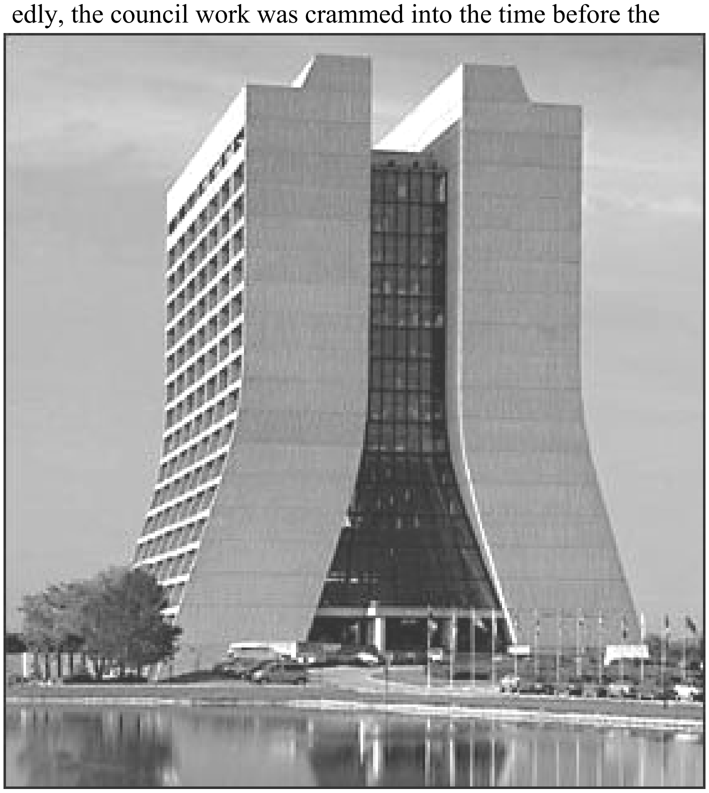
Part I: 5 Days, 1562 Miles, 27 Hours, A Once in A Lifetime Event

Early on the morning of Wednesday November 5, I got up, tossed my bags into my car, turned the key in the ignition, stepped on the gas, and sailed up my driveway. I was going to the 2008 ΣΠΣ Quadrennial Congress. There may be some of you who are thinking, "Where could he be heading? To the airport? The train station? Surely, he didn't intend to…" In a word, yes. I intended to drive 781 miles to the Holiday Inn Select, Naperville, Illinois. How bad could it be, I thought. Just take 206 to I-80. Then it's just a straight shot out to Illinois. Just… It's funny how a trip never seems too long on paper. I found that out the hard way. Thirteen-and-a-half bleary-eyed and nerve-racking hours after leaving home, I arrived at the hotel. After prying my fingers loose from the grooves they had dug in the steering wheel, I went inside to find there was a meet-and-greet in progress amongst the members of the council. In a few minutes I had met fellow physics students from Florida, Connecticut, Tennessee, Wisconsin, Colorado, California, and Washington. This would be the norm for the next four days. Never have I met so many people in such a short time.

At 8:00 the next morning, the council convened in the hotel ballroom for our first session. After the preliminaries and introductions, we turned to business. Our responsibilities during the Congress were twofold: first to act as hosts for the nearly 675 registrants (a figure exceeding all expectations by well over 200) and as intermediaries between Fermilab and the attendees; second, to conduct the regular affairs of the council. Not unexpectedly, the council work was crammed into the time before the Congress officially convened that evening, and on Sunday after the Congress recessed. There was more than enough in between for us to do. More happened in those four days than I can possibly relate in this one article, so here are just a few of the highlights.

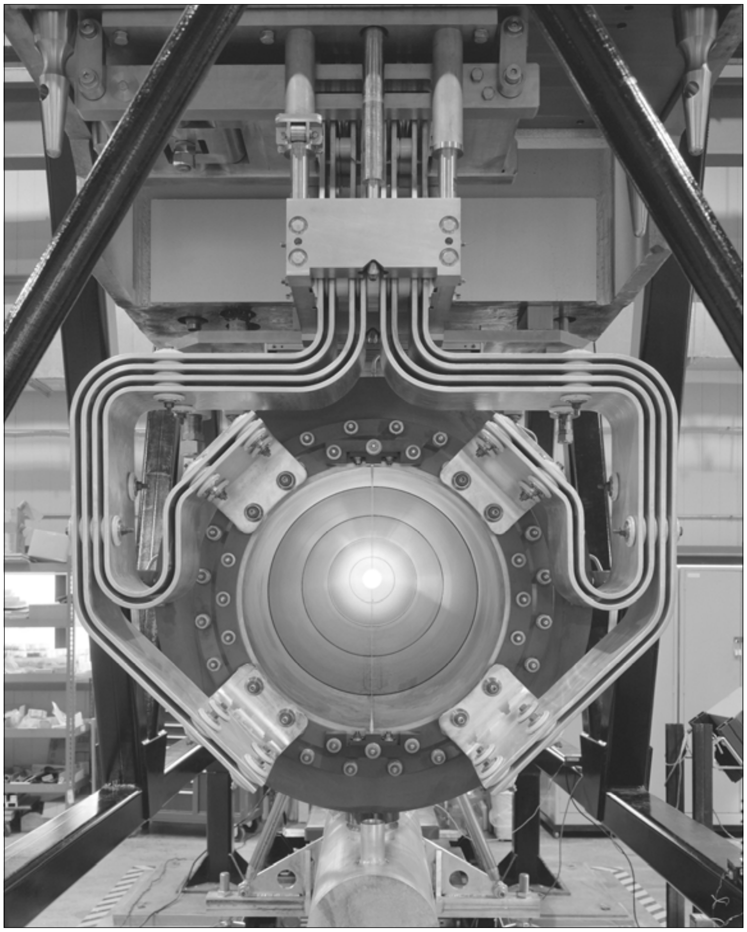


Robert Rathbun Wilson Hall (Photo Courtesy of Fermi National Accelerator Laboratory)

On Thursday afternoon, the council traveled to Fermilab to set up and to orient ourselves. For those of you who have been to Fermilab, you might remember traveling along the prairie, past the resident bison herd, and first seeing Wilson Hall rising out over the tops of the trees. In pictures, it seems incongruous: a sixteen-story office building surrounded by flat grasslands, marshes, and tree groves. In person, however, the inspiration of Dr. Robert Rathbun Wilson, Fermilab's first director and chief designer, is evident. Wilson Hall seems to flow seamlessly from the land around it. On its east side a small berm stretches off into the distance: thirty feet below it is the main ring – the Tevatron – the instrument that helped find both the bottom and the top quark. As we walked inside Wilson Hall, the sheer scope and scale of the building and the realization of where I was hit me. For what seemed like minutes but must just have been a few seconds, I stood and stared. I finally came out of it when I saw my reflection in the glass doors and the ridiculous "kid-in-a-candy-store" grin on my face. It was fantastic.

Things only got better. For Friday morning I'd signed up for "Breakfast with the Scientists" in Wilson Hall. This meant getting up at 5:45 A.M. to board the buses at 6:30 A.M. after standing outside in the near-freezing (33 F) cold and wind for half-an-hour. A little frostbite was worth it, however, because of one unexpected and surreal experience. While sitting at a table with several other students, a Dr. Garbincius came over and asked if he could join us. He proceeded to regale us with tales of the lab, Dr. Wilson, and Dr. Lederman, and very openly answered our questions about what it's really like to be a "working" physicist. After a few minutes, another scientist came over and was introduced by Dr. Garbincius as Dr. William Bardeen. That name might be familiar to you. Dr. Bardeen is the son of Dr. John Bardeen, one of the creators of the first solid-state transistor and the complete microscopic theory of superconductivity. Dr. Bardeen received a Nobel Prize for each of these accomplishments so just talking to his son was an honor. But then he said to us "Would you guys like to see some nice hardware," and from his pocket he pulled a small blue cloth wrapped around something. He unwrapped the objects and put them on the table. "Pass them around," he said, and as his father's two Nobel prizes stared up at me from my hands, I felt that uncontrollable grin coming back. Then, he handed us one more treat. In a small round pasteboard container labeled "Bell Labs –Murray Hill, NJ," he showed us one of the first solid state transistors ever made: a spare for the two that went into the first transistor radio.

The schedule for the rest of Friday featured several plenary speakers including Dr. Richard Garwin, former chairman of the Department of State's Arms Control and Nonproliferation Advisory Board, and Dr. Young-Kee Kim, Deputy Director of



Main Injector Neutrino Oscillation Search (MINOS) Primary Lensing Horn (Photo Courtesy of Fermi National Accelerator Laboratory)

Fermilab and professor at the University of Chicago. Tours of the lab were also on the itinerary and, aside from breakfast, these were arguably the best part of the day. I was fortunate enough to visit MINOS and LINAC. MINOS is the Main Injector Neutrino Oscillation Search, where a beam of protons is taken from the third stage accelerator (the Main Injector), "smashes" into a graphite target producing kaons and pions which decay rapidly into muon neutrinos that collide with the near detector at Fermilab, then travel 785 kilometers underground to the Soudan Mine in Minnesota where they collide with the far detector. The purpose of this experiment is to determine whether or not neutrinos "change flavor," which would indicate that they have mass. Unfortunately, the elevator was broken and we couldn't see the actual detector chamber, but we had a remarkable presentation about the experiment and were, with a large dose of vertigo, able to look down the 165-ft access shaft.

The mercurial weather had gone from cold and dry to snow by the time we left and headed to LINAC ‐ the Linear Accelerator. LINAC is where the protons used in all subsequent stages of the accelerator are produced. For me it is utterly amazing that the technology used to generate the protons – the Cockcroft-Walton – was designed in the early 1930s and is so effective that it is still used today. The modern world seems to believe that the latest technology is always the best. I prefer the attitude shared by Fermilab and Drew's Physics Department: "if it ain't broke, don't fix it." The last part of the tour was the main control room, vaguely reminiscent of NASA or, perhaps more accurately, a railroad switch house where technicians hover over dozens of monitors checking and double-checking each aspect of the proton and anti-proton trains' transits about the ring.

The final highlight I will mention may seem tame in comparison to those that have preceded it, but out of all of them, it left the most indelible impression on me. The final speaker of the conference was Dr. Leon Lederman, former Director of Fermilab and a Nobel Laureate. While he spoke on a range of subjects, one in particular shall remain in my mind: his perspectives on the simple wonder and joy that comes from doing physics. All-too-often, particularly for the student, physics can become a chore; day after day, problem set after problem set, with the only goal of making it through the next exam. The tedium drives from our minds the realization of what we are really doing and why we chose to do it. Dr. Lederman reminded the audience that there is great beauty in physics when we take the time to step back and see it. He also admonished us not to fall into the stereotypical trap society perpetuates of segregating science from humanities. Science is a very human endeavor but somehow over time it has been de-humanized. The fervor, the passion, the love, and the care with which physicists and scientists pursue their art and their craft is just as vital and important to them as such things are to those who pursue other fields. Dr. Lederman shared with us a story of working late at night in the lab, poring over data. Slowly, very slowly, a light of revelation began to glow in his mind, and suddenly he had it. He jumped up and hurried out into the hallway. Like a child who had found a marvelous secret that no one has seen or heard before, he couldn't control himself ‐ he had to share it. There was no one around except the janitor, whom he grabbed by the shoulder and pushed into the lab, where he proceeded to explain everything almost faster than he could form the words to express his sheer delight and elation. As I stood there listening, I wondered if I would ever be fortunate enough to have such an experience. I did know one thing, though ‐ the grin was back.

By Sunday morning, while I was exhausted and ready to leave, I was sad to see it end. As I climbed into my icebox of a car, and prayed that it would turn over, my mind sifted through the events of the previous four days. What had I learned from all this? Thirteen-and-a-half hours later, when I arrived at my driveway at 2:30 Monday morning, I think I had my answer. As physicists, we have a responsibility to directly share with the rest of humanity our work and revelations. And why wouldn't we want to? It certainly isn't easy, but if that were a legitimate excuse then physics would be a sorry field indeed. There are such mysteries to explore and beauties to reveal, that like the great art that it is, physics deserves to be appreciated, at least at some level, by everyone.

For more, please see Part II on Page 5

NOTES FROM THE OUTSIDE

By Joe Kinast '01

Shake hands and take names...

There's an old adage that states, "It's not what you know, it's who you know." Of course, this is wrong. It should really be "It's not what you know, it's *whom* you know." Grammar, people. Grammar. While it's tempting to dismiss this advice as the lunatic ravings of people whose arrival on the planet predates cell phones, mp3 players, and in some cases, the Civil War, I believe there's merit in this particular saying. Particularly when it comes to searching for a job.

Before discussing the importance of having an extensive professional network, I think it's worthwhile to review the gritty details of a typical job search. If you've recently hunted for a job, or if you have managed to not repress all memories associated with your last job hunt, you will likely recall that the process goes something like this:

1. Spend a day or two polishing your resume or CV and assigning phrases like "supervised simplification of massive code base" to tasks that are more accurately described as "told a dude to comment out a couple lines of code and recompile that hideous mess."
2. Monitor an online job search aggregator and try not to be overcome by self-doubt and feelings of inadequacy. I guarantee that you'll see at least one job listing per day along these lines: "Qualified candidates will be flawlessly fluent in ALL of the following: Perl, Python, C#, C, C++, Java, Chinese, Korean, Ruby, Lisp, LabVIEW, Latin, SAS, R, SPSS, Portuguese, MATLAB, Mathematica, ZEMAX, Code V, Oslo, VB, Esperanto, and HTML. Expert knowledge of quantum field theory, stochastic calculus, bioinformatics, fixed equity models, and veterinary handling procedures is required (NO EXCEPTIONS!!!). Excellent people skills and the ability to juggle rabid and/or flaming emus will set you apart from other candidates." Though it's tempting, you'll want to steer clear of emailing these people with encouragement like, "I hope you can convince a deity to leave his/her current job for your entry-level quality assurance position, but I suspect it's more likely that I'll bump into a salsa-dancing, three-headed unicorn who vomits gold from the two outer heads and platinum from the middle one."
3. Send a message to all of your geek contacts that begins with "Just wanted to let you know that I'm looking for a job..." and ends with "Please don't tell anyone about the three fires I accidentally caused in Advanced Lab."
4. Desperately send resumes and CVs to promising job leads and hope for a reply, even if it's an automated email from HR informing you that they're ecstatic that you've funneled your resume into the electronic abyss, never to be seen again by a living human.
5. Smile pleasantly as friends and family tell you that "everything will work out for the best" while you ponder how much your life presently resembles the final moments of The Hindenburg.
6. Engage in a couple phone interviews in which you're asked to describe your feelings about the best pitch counts on which to hit and run. What this has to do with an R&D position for a biomedical company is anyone's guess. Just answer the question.
7. Go for an on-site interview and nimbly field requests like, "Please perform an interpretive dance inspired by our company's mission statement." Additionally, if you're a pacifist who's interviewing with a non-profit research organization (by the way, "non-profit research organization" is code for "we mainly do Department of Defense research"), try not to vomit when the interviewer says something like, "Well, even if you have problems with killing people, occasionally you'll have to sit in meetings with people who -- in addition to not having qualms about killing people -- have actually done so." (I swear to you, this was actually said to me.)
8. Write follow-up emails to the 572 people who interviewed you during your on-site visit. Of course, by the end of the day, your prospective employers were pulling random people off the street (some of them homeless) to interview you. Finding their email addresses will be difficult, but do the best you can.
9. Wait a couple days before calling the hiring manager, at which point she'll inform you that a very impressive deity was deemed a better fit for the position.

Depressing, no? And, for as unpleasant as steps 6 through 8 can be, you'll likely discover that you can most easily reach those steps if you have a contact inside the hiring organization. That's not to say that blindly sending resumes and CVs is a dead end. It's not. It's just a lower percentage play. So, what's a dork to do? The best solution is often years in the making, and if any undergrads or grad students are still reading this, I recommend that you pay close attention. *It's not what you know, it's whom you know.*

If you're an undergraduate, try to score internships. When you're at these internships, meet as many people as you can. If you're invited to lunch or happy hour, go. If you're interested in research, get as much research experience as you can. Get to know the people in your lab and the people working in adjacent labs. If you think a career in investment banking sounds interesting, try to get in contact with someone in the profession and ask if you can shadow them for a day or if they'd be willing to do an informational interview with you. (While we're here, you might want to think very hard about pursuing investment banking. As of the time of this writing (late September 2008), it appears that we'll be returning to an agricultural society and the bartering system by 2011, at the latest.)

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If you're in graduate school, go to conferences and shake as many hands as you can. If you think you want to continue in academia, make sure you talk to people in subfields you find interesting. Get to know other people in your own subfield. You might be asking them for jobs or recommendation letters someday. If you want a job in industry, attend trade shows and talk to vendors who are doing interesting work. Get business cards from other people and try to circulate your own.

While following the above advice will not guarantee that your job search will go smoothly, I do think it has its merits. Ultimately, the real world doesn't mimic the meritocracy fostered by academic environments. Don't misunderstand me: what you know is important. But whom you know is important as well.

I confess that I'm often quick to dismiss the wisdom of our fathers. After all, they handed us a collapsing financial system, a political environment that features more name-calling and finger-pointing than your average kindergarten class, and a world populated by people who generally loathe Americans. And, sure, when I told my dad that I could fit his entire music collection onto an electronic device the size of a matchbook, he looked at me like I had just claimed that I could coax 183 squirrels to swan dive into a running chipper shredder with nary a peep of protest. But, some advice is timeless, and the man knows the importance of having a network of contacts when searching for a job. And, you should, too.

Joe Kinast is presently a freelance writer based in Pittsburgh who occasionally declines a job offer to design a portable, long-range, infrared, night-vision, facial-recognition system for Uncle Sam because if Special Ops show up in your backyard at 3:17 AM, they're not there to toilet paper your trees. When meeting women, he claims to be "retired." It sounds more intriguing than "unemployed."

More seriously, Joe Kinast graduated from Drew in 2001 and immediately entered graduate school in physics at Duke University. There, he studied ultracold quantum gases under John Thomas and earned his Ph.D. in 2006. He recently completed a postdoctoral appointment (studying novel sensor design and development) at the University of Arizona's Electrical and Computer Engineering Department.

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Part II: Bridging a Great Divide: Scientists and Society

As we near the end of the first decade of the 21st century, science, but physics in particular, is facing a potential crisis on multiple fronts. Decreased funding, an uncertain political landscape, and a seeming lack of understanding and general apathy by the rest of society all threaten the stability and place of physics and physics research not only in the United States but also around the world. How can physics avoid this gathering storm? How can physicists reconnect with non-scientists and convince them of the field's importance and relevance? How can we, as physicists, become better citizens in our communities and around the world? These were the questions posed at the 2008 ΣΠΣ Quadrennial Congress on "Scientific Citizenship: Connecting Physics and Society."

While these questions may have no one answer, if any is ever to be reached, it will undoubtedly depend on a comprehensive understanding of the genesis of these questions. How did we come to this point? At the Congress, this issue was addressed primarily by Dr. Neal Lane, formerly Assistant to the President for Science and Technology, Director of the White House Office of Science and Technology Policy under the Clinton administration, and Director of the National Science Foundation. Dr. Lane's talk was entitled the "Civic Scientist Era," and focused on the evolving role of science and scientists in the United States during the 20th century and into the 21st.

According to Dr. Lane, the twentieth century witnessed two great events that brought science, and physics in particular, into the public consciousness and helped to establish it in the national psyche: World War II and the Cold War. With the Manhattan Project of World War II, physics gained a prominent place in the minds of Americans. While ultimately destructive in its intent and riddled with ethical and moral issues, the Manhattan Project was nevertheless a model for scientific and governmental cooperation and in the process of seeking the "ultimate weapon" generated numerous benefits, not the least of which were the national laboratories that sustained and provided a home for much of the scientific research conducted in the United States during the latter half of the twentieth century. Why did this project, after it was revealed, receive so much attention and often approbation from the public? In large part it was because the public viewed the project as being compatible with their goals: the end of the war and establishment of the ever-elusive feeling of national security. It was this desire for security that fueled America's entry into the Cold War race with the former Soviet Union for scientific and technological superiority. In a bid to win, the government founded and supported programs intended to develop a new generation of leaders in science, engineering, and mathematics, while at the same time investing enormous sums of money into complicated projects, perhaps the most iconic of which was the Apollo Program. These projects captivated the national imagination in a way not seen before or since.

However, as Dr. Lane explained, the unqualified success of the Apollo Program was its own downfall. Because it succeeded, the public considered it "mission accomplished" and began to lose interest and the government reduced support. Other programs continued, though, including the building and development of Fermilab, but overall activity declined as the Cold War drew to a stalemate during the late 1970s and through the 1980s. Pure scientific research in the United States also suffered due to the Justice Department's divestiture of AT&T in 1984, which ultimately hampered and curtailed the basic research projects conducted by America's premier, non-government research institution, Bell Labs. In an interesting twist of fate, overall pure research may have been reduced, and research conducted for military purposes increased, particularly

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during the "Star Wars" period of the Reagan administration. This brought forth several technological advancements that have immeasurably influenced the modern world, including LCD screens, giant magneto resistance (GMR), and the lithium-ion battery – "in short, the iPod," said Dr. Lane.

Many were hopeful that with the end of the Cold War, a new age of collaboration would begin and that the American government and people would again realize the importance of science and research. While such a new age did ensue, as evidenced by the level of cooperation present in such projects as the Large Hadron Collider (LHC) and the International Space Station (ISS), the end of the Cold War removed, in the public's mind, one of the primary reasons to fund and pursue scientific research – the need to show American supremacy. As with the Apollo program, we had "won;" nothing was left to be done and money could be devoted to pursuits with more tangible results. This consumer-minded focus on instant-gratification contributed to the death of the Superconducting Super Collider (SSC) in 1993 - after an investment of over two billion dollars.

Finally, and perhaps unexpectedly, the tragedy of September 11, 2001 further hindered physics research in the United States. After the terrorist attacks, the proportion of the federal budget allocated for defense spending increased significantly. Already facing a deficit, money had to be reallocated from other programs and Washington deemed non-military, and non-health-related scientific research one of those areas. This shift was concisely displayed in the most startling graphic shown by Dr. Lane, which depicted the relative proportions of the federal budget allocated to defense and non-defense spending and broke down the non-defense spending into its constituent fields.

Because of the ΣΠΣ Congress's location, the portion of the non-defense budget allocated to energy research was of particular interest since not only Fermi but also Brookhaven, Thomas Jefferson, Argonne, and the Stanford Linear Accelerator (SLAC) National Laboratories are operated under the auspices of the DOE and are directly involved in high-energy physics (HEP) research. For example, the total funds dedicated to HEP in the DOE 2008 FY budget was $689 million, compared to $752 million in 2007. To put this amount in perspective, this is roughly equivalent to the government's expenditure for 42.6 hours of the global war on terror (including funding for Iraq and Afghanistan).

When this drastic funding cut was announced on December 17, 2007, it was hailed as "Black Monday." Ultimately, Fermilab was forced to lay off 200 employees and the future of the U.S. high-energy physics program was put in jeopardy. Planned support for the International Linear Collider (ILC) and the NOvA project at Fermilab essentially disappeared and research on the BaBar experiment at SLAC was stopped for 2008 entirely. While the ILC will go on, such a lack of funding makes it unlikely that it will be located in the U.S.. For years, America has been the leader in HEP and home to most of the world's largest accelerators. Only KEK in Japan and now CERN exist outside the U.S.. The decline of HEP in the U.S. has resulted in astonished outcries from the rest of the world. According to Natalie Angier, the *New York Times* science writer, "Most of the other developed nations are looking at the U.S. as if we're in some kind of seizure of insanity, because they've always looked to the U.S. as being a leader." Lastly, consider that Fermilab is in a race with CERN to find the Higgs Boson, the so-called "God Particle," that would provide a concrete understanding of the nature of matter and mass in the universe. Aside from the obvious experimental and theoretical challenges, the scientists at Fermilab are racing the clock to find it before 2010 when planned funding for the lab will cease.

Where does this leave the question of scientific citizenship? What did the ΣΠΣ Congress decide? How can we as individuals help to bolster the position of physics in the U.S.? Unfortunately, the answers to these questions are not entirely clear. The Congress did generate, through a series of breakout discussion group sessions, a list of roughly fifteen recommendations for ΣΠΣ and SPS to consider and implement. These were designed to improve communication and understanding between the physics community and non-scientists. But, due to difficulties with the vote-collecting apparatus, no consensus was achieved. However voting was moved to an online forum where further discussion could take place. As of the writing of this article, no definite action has yet been taken on these motions. It also must be admitted that while an important influence in the lives of many physics students, ΣΠΣ and SPS have relatively little real power to enact change in the U.S. physics community as a whole.

You may now be wondering, "So… what was the point of all of this? We know that there is a potential problem facing the future of physics in the U.S. If ΣΠΣ and SPS haven't been able to do anything about it, what could I possibly do?" Speaking for myself, prior to attending the ΣΠΣ Congress I didn't even know that there was such a problem. This, is the first step: awareness. If we want to fix this issue, we first need to recognize that it exists. While it may be daunting and while there is no easy solution, there is a second step each of us – students, teachers, and researchers alike – can take. Physicists, and scientists in general, readily talk amongst themselves in the languages of their respective fields, yet when it comes to speaking with the general public, we seem to have great difficulty. Because our work is so specialized, we typically choose, out of necessity or mere convenience, to speak only with others in our own fields. This, unfortunately, all too often isolates us, limiting those with whom we communicate. Science, perhaps more than any other endeavor, relies on communication. Regardless of the particular area of inquiry, we are fundamentally trying to expand the depths of *human* understanding. We, therefore, have an obligation to share what we know and what we learn with scientists and non-scientists alike.

For more information on the Congress and the motions please see the ΣΠΣ and SPS websites at
http://www.sigmapisigma.org/ *and*
http://www.sigmapisigma.org/congress/2008/reports/index.htm

For more on the race to find the Higgs Boson and the issues facing HEP in the United States, see the Independent Lens feature, "The Atom Smashers," *and the companion website*
http://www.pbs.org/independentlens/atomsmashers/

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IT'S NOT AS EASY AS IT LOOKS ON MYTHBUSTERS!

By Brian Kelly '09

This summer, I had the good fortune to continue my work with Dr. McGee in his lab on the Drew campus. I worked for two months, first under the direction of recent alumnus Varun Makhija ('08) and then independently. Our research this summer focused on Second Harmonic Generation of polymers, taking signal strength data as a function of both time and angle. Our goal was to find a polymer that was both efficient at generating a Second Harmonic signal, and that relaxed slowly after poling. Our colleagues at the University of Wisconsin-Madison, joined by our own Dr. McGee and Kimy Yeung ('09), manufactured the polymers we tested. We looked at modifications of a polymer that we had already determined to be electro-optic, trying to increase relaxation time of the system.

We ran into several snags. What began as a good opportunity to study some nonlinear optics and advanced lab techniques turned into a troubleshooting experience unlike any I'd ever tackled. Everything that could break did, from a flooded Photomultiplier (Solution: Changing the PMT tube, which I discovered must be done by touch in complete darkness) to a burnt out laser head (Solution: Disassembling the casing of a laser that costs more than I'd like to think about, to change an extremely fragile glass tube). We even had a cooling system for our laser spring a leak, and Mac and I turned into plumbers for a few days trying to fix it. I bet the employees of Jaeger Lumber remembered the clueless kids that came in looking for a gasket for a while! The net result was a summer that felt less like a research project about optical properties of polymers and more like a class on fixing optics equipment, which, believe me, is a lot more fun before you realize the price tags if you mess up. This isn't to say that I was dissatisfied with the summer: I greatly enjoyed learning more about how these "black boxes" I previously took for granted actually work, and fortunately we were able to take enough usable data for Dr. McGee and his partners to present findings. The summer did, however, serve as an eye-opening experience for me; an introduction to all the little things that go into maintaining a productive experiment, and all the sources of problems I never thought about before. I gained immense appreciation for a well put-together experiment, and a small glimpse of life as an experimenter in the world of physics. I am grateful to Dr. McGee and his research group for giving me this opportunity to gain more experience in working in a lab, and anticipate it being a very useful experience to call upon in my future work.

Jimmy John's and Planetary Nebulae

By Melissa "Missy" Louie '10

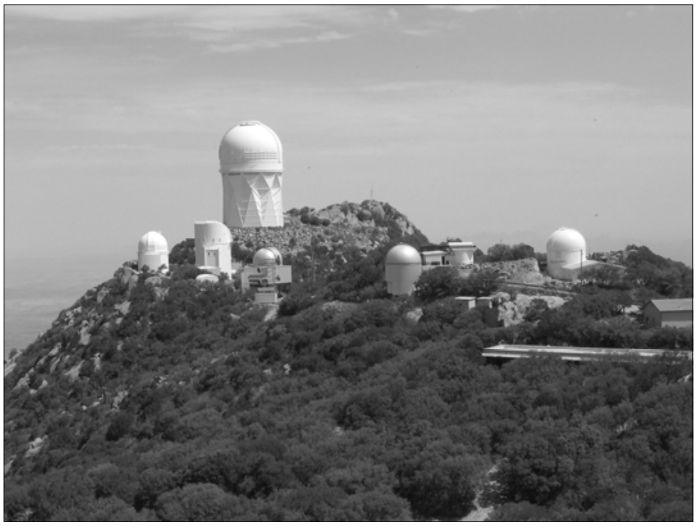
This summer I ate a lot of Jimmy John's sandwiches, went to bed at five o'clock in the morning, sang Jimmy Buffet and traveled to Florida and Arizona. It may seem like I didn't do anything productive, but on the contrary, my summer internship for the Southeastern Association for Research in Astronomy (SARA) kept me busier then I ever realized.

I was selected as a summer research intern for the SARA, and was one of ten student interns working all around the Eastern United States. My research was conducted under my mentor, Dr. Todd Hillwig, associate professor at Valparaiso University, in Valparaiso, IN. I observed two Planetary Nebulae (PNe) that are believed to have binary central stars. My job was to collect and analyze light curves on the two objects, then confirm or deny the true binary nature of the systems. In order to collect data on my objects , I used the 0.9 m SARA Telescope located at the Kitt Peak National Observatory (KPNO) remotely, and the 32" telescope on campus at Valparaiso. I also had the experience of traveling out to KPNO for a four night observing run and taking data onsite.

I learned much about data reduction and data analysis. At the end of the summer I presented my work to all of the other research interns at a meeting at Florida Institute of Technology, and learned about the results of their research projects as well. In January 2009, I will be traveling to the 213th American Astronomical Society meeting in Long Beach, CA to present a poster of my research.

Besides doing my own research, I learned about some of the newest charge-coupled device (CCD) technology by assisting in the installation and characterization of a new CCD camera for the Valparaiso University Observatory (VUO). Also at Valparaiso, I worked at the VUO with three of their students collecting data on an ongoing list of PPNe and PNe that members of the Physics and Astronomy Department there are researching.

Participating in the SARA REU program was an amazing experience. I created many bonds with students and faculty members all over the country who share a similar passion for astronomy. I had the ability to travel all around the country and see and work with state of the art astronomical research equipment. Being a SARA intern is something that I will always remember and be proud of for the rest of my life.



Kitt Peak National Observatory (Photo Courtesy of KPNO)

Continued from Page 7...

Variable Stargazing...

By Kyle Nugent '09

The beauty and elegance of the stars has mystified the human race for as long as there has been history. Anyone can appreciate the vast scale of the night sky, which impresses upon anyone just how very small he or she is. I have long marveled at the idea of light traveling for millions of years from a distant galaxy only to be captured quietly by my eye. Naturally, when I was given the chance to work in such a fascinating science, I leaped at the opportunity. This summer I was fortunate to do research in the Drew University Observatory where I took data on cataclysmic variable stars as a part of the Drew Summer Science Institute (DSSI), and the experience is one I will always remember.

The Drew Summer Science Institute allows students the chance to conduct research with a professor. Dr. Murawski was my advisor, and he was there to help develop my project and advise me at every step of the way. During the course of the summer, I researched cataclysmic variable stars, as well as every aspect involved in the process of taking data with Drew's telescope. I used the Drew University 16" Cassegrain reflecting telescope and a CCD (Charged Coupled Device) camera to take nightly data of my target stars for the project.

Earlier in the summer Dr. Murawski and I decided that, as a test for our method, we would start taking data from Delta Cepheid, a classic variable star with a rich research history dating back to 1784. A variable star with such a long record of observation provided the perfect foundation for us to start taking data on the lesser known cataclysmic variables. After our trial run, Dr. Murawski and I set our sights on the cataclysmic variable star AB Draco. Over the few weeks during which the weather was nice enough to work in the observatory, the data I collected and analyzed was uploaded to and shared with the American Association of Variable Star Observers (AAVSO) archives.

Having never used the observatory's CCD camera or the software to analyze images and produce a light curve, I had plenty to do—from updating programs, installing a new computer in the observatory dome, and figuring out how to reduce the noise in the signal, to checking that my data were accurate. Every day presented me with a new puzzle to solve and each solution was its own reward. I hope that the steps I took last summer will make it easier for others in the future to do more in the same amount of time.

When I set out this summer to work in the Drew Observatory, I was most excited to do something that furthered our knowledge of the cosmos — even if only a little. In that regard, I feel confident that I succeeded, and that my time in the Drew Observatory will make it easier for others to do the same. For that knowledge, and for all the different experiences I gained, I will never forget my time in the observatory.

The Dilated Times

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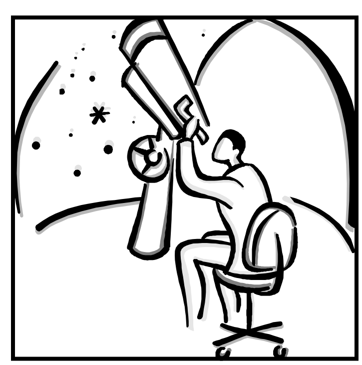
Department of Physics
Madison, NJ,
07940

Address Correction Requested

Inside...

Contributors…

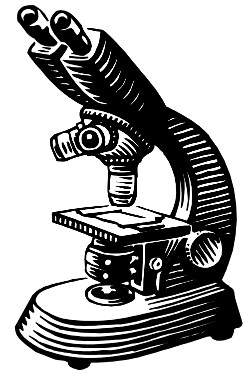
Joe Kinast, Michael Jokubaitis, Brian Kelly, Melissa "Missy" Louie, Kyle Nugent



GOT PRE-OWNED LAB EQUIPMENT/INSTRUMENTATION??

The department asks that alums remember us and our continuing need for laboratory instrumentation and equipment. If you have a particular item that is no longer useful to you and could find a new home at Drew, we would be very happy to hear from you at any time. While not limited to these, some current needs include:

General:



Flat panel Video Monitor (for hallway display of physics activities – student recruiting!)

General Lab Instrumentation
- Digital scopes
- Function/pulse generators
- Meters

Gas handling – regulators

Microscopes – general purpose stereo microscopes (for inspection of optoelectronic and solid state devices)

Optomechanics – translating stages with micrometer movement for optical experiments (e.g. Newport, Thorlabs, etc)

Power Supplies
- High voltage power supplies – 5 to 10 kV (e.g. Bertan)
- Low voltage, general-purpose

Vacuum pumps – general purpose roughing pumps and diaphragm/oil free pumps (for use with small vacuum ovens)

More specific research equipment:

Electronics – Stanford Research SR280 NIM bin, SR250 Integrator, SR645/535 digital delay

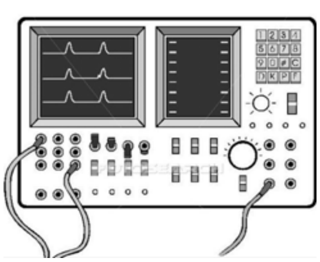
Fiber optic equipment – fiber cleaver, fiber optic switches

LASERS – NdYAG, Argon Ion, Diode-pumped solid state, fiber-coupled, HeNe

Microscope hot stage

Nonlinear crystals – e.g. $BaTiO_3$, $LiNbO_3$, BBO, etc

Thin film surface profiler – e.g. Dektak



If you have equipment you would like to donate, please contact:
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