The Dilated Times

The newsletter of the Drew University Society of Physics Students

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Editors: Adam Friedman, Emily Hamilton, Tina Aragona

Rolfe and Aragona Do Summer Physics Research at Drew

Tina and Katy

This summer we worked at Drew with Dr. David McGee and members of the chemistry department on a materials science project as part of the Drew Summer Science Institute (DSSI). We studied the optical properties of organic polymers made by Melissa Yang in the organic chemistry lab. The first week of our summer was spent reviewing basic optics and learning about photorefractive materials.

Photorefractive materials have the interesting property that their index of refraction changes when they are exposed to laser light. By crossing two laser beams within the material and setting up spatially variant bright and dark regions, we were able to set up a diffraction grating within the material.

We also spent time learning how to use LabView, which is a software computer program for controlling experimental apparatus and collecting and analyzing data. This program is used widely in corporate and university laboratories.

For several weeks, we focused on developing methods for getting the material into a format for study. We needed to create a 100-micron thick layer of it between two glass slides, across which we wished to put approximately 10,000 volts. In order to prevent arcing through the material, we had to be certain that there were no air bubbles or dust particles in the material. In order to facilitate this, we worked under a clean flow hood.

Finally, we set up the apparatus on the optical bench for taking measurements of the strength of the diffraction grating set up in the material.

This project was a valuable experience for both of us, as our first real research experience. Materials science is a particularly appealing area of study, as it encourages collaboration between the physics and chemistry departments.

Katy Rolfe Works at the Governor's School

After completing my research and going to the beach for a week, I worked as a counselor and teaching assistant for the New Jersey Governor's School in the Sciences at Drew. This is a unique program for rising high school seniors from New Jersey. The students come to Drew for a month to study a variety of topics in the sciences that they generally would not learn about in high school. The students are academically superior and were excellent to work, live, and socialize with. In addition to classes, the students attend field trips, lectures, and a variety of social activities, including dances, and sports events. As a counselor, I helped the students with their homework, planned activities, and generally hung out with them.

It was interesting for me to spend time at Drew over the summer. The atmosphere is very different from during the school year. It is much more relaxed, and I feel like I got to know members of the faculty on a much more personal basis, particularly during Governor's School.

Tina Aragona Continues DSSI Work

While Katy was beginning her job as a counselor Governor's School, I spent two more weeks working on our project. During those weeks, I steadily worked toward testing the properties of the films we had spent the summer preparing. I had a chance to alter a program in LabView and write a second one in order to control the experiment. During my final week of research, everything was finally ready to begin testing our cells. Using the programs I

(Continued on page 3)

Check out the Physics Department Web Page
at
http://www.depts.drew.edu/phys/
NEW: *Dilated Times* available as pdf files!!!!

Physics GRE Makes Jack Go Crazy

By my estimation, mankind, in its long history of tyranny and masochism, has devised three particularly awful tests with which to torture its educated. First, we have the Emperor's Exam, which was administered in ancient China as a way to separate those who deserved education from those who were to plow the fields. It has been said that if a person failed the exam, which lasted for days, he would have to kill himself for the shame of dishonoring his family. Second, we have the Putnam exam, the world-renowned, intense mathematics examination offered in December that has sparked many a Dr. Supplee comment about being fearless in the face of mathematical equations. Finally, we have the Physics GRE.

Now, for those of you who have taken, or will soon take the Physics GRE (as I will), you will no doubt understand the seemingly bizarre comparison to the Emperor's Exam. And, for those of you who have yet to witness, or stand in the shadow of , the torture that is the Physics GRE, oooohhh, you'll find out soon enough!

I shall now present to you the top ten reasons, in no particular order, as to why the Physics GRE, and preparing for said test, is so terrible:

1. You have 100 questions and 170 minutes, which means you must answer at a rate of one question every 1.7 minutes to get them all, or one question every 3.4 minutes to get half of them, and the questions are similar to those given on normal physics tests at Drew, of which we get about 5 or 6 to do in an hour.
2. Failing the test, i.e. getting a score in the 50^{th} percentile (most of the time anywhere from 20-30 or so questions right, which is a score of 20-30 percent) is considered respectable, so you are expected to fail.
3. No calculators or mechanical pencils allowed.
4. No one can ever seem to give you a straight answer as to how much the test actually counts when a grad school looks at your application, but they do tell you it is very important in an unimportant way.
5. You will be competing with the two top students in a town of a million from China who even got to go to college in the first place, plus have been endlessly drilling themselves so that they can get, and will get, perfect scores on this test.
6. The test requires "a mastery of undergraduate physics," which translates to, "know absolutely every single equation and formula from every class you may or may not have had the opportunity to take because we will not give you an equation sheet nor will you have time to derive anything."
7. It is literally not feasible to memorize everything. I am reminded of all of those little equations giving various types of velocities from Thermo.
8. It costs $130, like paying to be strung up on the rack.
9. and 10. AAAHHHHHH!!!!!!!!!

So, as I and the rest of the seniors at Drew get closer and closer to Doomsday (Last year, actually, I think Colin McLaughlin said he felt like he was walking to his death), and begin to study and worry more obsessively, have pity on us, as we are battling one of mankind's most horrid inventions to torture himself with. And, if you have already finished this battle, and are reading this, and it has re-aggravated that nervous ulcer, then take some Pepto, relax, and I will soon, for better or worse, join you on the other side!

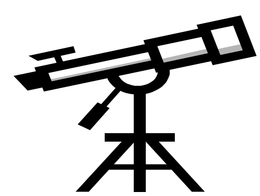
Adam Friedman, '04

An Update from the Drew Observatory

With Mars making a spectacular appearance, the Drew Observatory opened this fall to a full house. Members of the Drew Community, as well as some Madison locals enjoyed seeing the red planet just past its closest and brightest point in almost 60,000 years. Although Mars is now moving away from us, it will remain very big and very bright for much of the fall semester. Mars rises earlier each night, so plan a trip any Friday (7pm-10pm) as soon as you can. Later in the semester, Saturn and Jupiter will rise towards the end of the night, so night owls will get quite a show.

In other news, a brand new roof and paved observing deck was installed on the Hall of Sciences which is not only beautiful, but helps dampen vibrations to provide for better observing. Finally, the Observatory is in need of Assistants for the Spring Semester. Any interested physics students should contact Dr. Fenstermacher.

Karen Mooney, '04



Physics Quotations

"And if you were up too late, doing drugs or something, then maybe you would try this solution out of desperation" Dr. Supplee, Mechanics

"Ooh! Have they gotten to the rectal warmer yet? That one is my favorite!" Dr F., in the h-bar

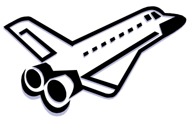
Summer Physics Research

(Continued from page 1)

had written and altered, I collected data from several of the samples we had created. After the eight weeks of work we had spent preparing the materials for testing, viewing some of the data, gathered with a program which I had tailored for that purpose, was an exciting and gratifying experience. My research this summer gave me a better perspective of the experimental aspect of science: research projects take a long time to develop, but the results are worth the effort.

SUMMER RESEARCH EXPERIENCE

NASANASANASANASA



This summer I was accepted to the Physics REU Program at the College of William and Mary in Williamsburg, VA. The program lasted 10 weeks, from Memorial Day to the beginning of August. I was allowed to select my mentor, and I chose to work with Dr. Russell Wincheski at NASA Langley Research Center. My project was the study of RCC (Reinforced Carbon Carbon) using Eddy Current Analysis. This means I used induction from a coil of wire to get a voltage "picture" of an RCC sample. Any defect like a crack in the sample would appear as a change in voltage. During the summer, I had to find the best frequency range for RCC and classify different types of defects like cracks, holes, and coating corrosion.

I had a fantastic experience at my REU. My work was challenging and interesting. The project will be completed this fall and presented to NASA as a method of finding defects in shuttle tiles. Outside of the lab, I met a great group of other physics students, and attended a metal shop class where I built a working (mini) cannon! I also learned a lot about grad school from some of the older students I met. After attending this program, I am confident that I want to attend graduate school and pursue physics further.

Karen Mooney, '04

PRINCETONPRINCETON-PRINCETONPRINCETON

This summer I participated in a Department of Energy fellowship at the Princeton Plasma Physics Lab in Plainsboro, NJ. I had spent the previous January at the lab working on background research for a biophysics project, which I then used to get a head start during the summer. The project focused on the development of a mathematical correlation between ion transport properties across cell membrane with ion transport across a physical plasma structure called a double layer. This structure consists of a separation of charges that by physical necessity has similar electrostatic properties to a cell membrane. Although much theoretical work has been done on this topic for the past few decades, an experimental basis for the theory has not been attempted, to my knowledge. I spent most of January brushing up on the mathematics that models the similarity, and reviewing double layer plasma experiments for clues on how to best construct an experiment to fit my needs.

I began my summer at PPPL with a one-week crash course on plasma physics, which was both informative, and overkill, as the interns were scheduled to sit through forty hours of lecture. We were assigned homework every night, which we were to complete by the next morning's lecture. Princeton grad students were available for the inevitable stream of questions we all had, but regardless, much of the evening was devoted to homework sessions.

After the first week, many of the interns dispersed to other national laboratories, while about seven stayed at PPPL. At this point, I spent a few weeks doing some final research, and began construction of the experiment.

I spent the majority of the summer 'under construction,' but quickly came to the realization that this is a necessary part of lab work. Unfortunately, at around mid-summer, a string of accidents led to a government (Department of Energy, don't get too excited) investigation of my very own lab. I managed to procure a vacuum pump that immediately blew up upon turning it on, and another group had an implosion in their vacuum chamber, sending the shards of a glass window nearly fifty feet across the room. As exciting as this sounds, all that resulted was ten lost days of lab time and a lot of paperwork to fill out. It was interesting, however, to really get to see the Princeton University/Government agency interaction, despite the lost time.

I was fortunate enough to have the opportunity to work on a project that was entirely new, and even my advisor knew little past the plasma physics. Because of this, I was free to design an experiment based entirely on my own research, which was extremely challenging, but ended up being quite rewarding. I met a lot of people throughout the lab, and most of these people were very interesting, coming from very different backgrounds and working on a lot of different projects, usually larger than life and even more complex. As a result of this project, I am very heavily considering a graduate program in biophysics, and hope to aide in the development of the PPPL biophysics project in future experimental work.

Emily Hamilton, '04

Physics Quotations

"I want to have Albert Einstein's baby" Karen, Spring Saturday

"Hah, Hah! Biochem and Physics...cute...you know... Biochemophys" Katy, Mechanics

On the Origin of Scientific Theories

Thomas Kuhn's famous work, *The Structure of Scientific Revolutions*, has had enormous influence on the thinking of science historians and philosophers during the four decades since its publication. Kuhn believed that scientists normally spend their time making routine measurements, comparing their results with the predictions of existing theories, filling in the gaps in our knowledge. Eventually anomalies in their data begin to appear, fundamental objections to well-established beliefs are raised, and something revolutionary occurs. What follows is a "paradigm shift," a basic change in the prevailing ideas. The subject area undergoes a major revision during a spasm of intense exploration of the radically different notions that are promulgated. Ultimately the new paradigm is widely accepted and a period of normal activity returns.

Kuhn used the Copernican revolution as the main example to support his thesis. Certainly, the Copernican heliocentric picture of the solar system was truly revolutionary in that it completely overthrew the Ptolemaic geocentric model. However, Kuhn erred, I believe, in assuming that the two major advancements of physics in the 20^{th} century – relativity and quantum mechanics – represent a total refutation of earlier theories.

Take special relativity, for example. Einstein replaced the Galilean transformations with the Lorentz transformations, which reduce to the Galilean expressions when speeds are much less than the speed of light. Newtonian mechanics was by no means supplanted; it will always be used by physicists. Nor was Einstein motivated by anomalies in empirical results. There is no indication that he was influenced by the unexpected outcome of the Michelson-Morley experiments.

What, then, brought about the theoretical breakthrough of relativity? In a wonderful recent book, the distinguished historian of science Peter Galison offers a fascinating explanation based on previously untapped archives, mainly in Europe. The title of his book is *Einstein's Clocks and Poincaré's Maps*.

In 1905, the date of Einstein's first paper on relativity, the young Albert was a patent clerk in Bern, Switzerland. Across the street from his office was the train station, displaying an array of clocks coordinated within the station and along the tracks. The Swiss were compulsive about making the trains run on schedule (and still are). The problem of synchronizing the clocks led Einstein to ponder the concept of time, duration, and simultaneity. Like Einstein, the French mathematician and physicist Henri Poincaré noted that in synchronizing clocks, the time of transmission needed to be taken into account in any telegraphically communicated signal. Poincaré had an important reason to be interested in time: He was president of the French Bureau of Longitude, responsible for determining the coordinates of maps across continents. To determine longitude, he knew, geographers had to solve the problem of simultaneity. Interestingly enough, Poincaré produced, independently of Einstein, a mathematical physics that incorporated the relativity principle.

So, it seems to me, the pattern of at least one modern scientific advance is quite different from that of Kuhn's Copernican example. Science is a very human endeavor; perhaps it is futile to try to make generalizations about how it progresses.

Dr. Ashley Carter

Physics Quotations

"Like Darkwing Duck, Carter appears out of nowhere in the library at 10:30 at night and puts a stack of books in front of me…" Colin, QM

"Duck in Flight"

Notes From the Out-

As diligent *Dilated Times* readers know, I spent the second year of my Drew career studying physics in Ireland. It was on a program run by Arcadia University, and most of the work of moving to a new country including orientation, housing, telephone/utility service, etc, was provided by a support staff of four people. There were only 18 students participating in the program. Needless to say I had a wonderful time, so good in fact that I decided to return to Ireland for graduate school.

During the application process, one fact became brilliantly apparent – this time I was more or less on my own, with no accommodations or outside support provided. The international office at University College Dublin is there to answer any questions, and ran an orientation program (although it was mainly for undergrads). But for the big things such as housing, it's every student for him/herself. I was lucky though, as I had made several friends in Ireland during my last visit, and was able to stay with them until I did find a place to live. Many of my new classmates were less fortunate having not been to Ireland before.

I am in a Computational Science M.Sc. program which is given jointly by the departments of Computer Science and Mathematical Physics. In a nutshell, Computational Science is a common ground between computer science and most of the other sciences. The emphasis is on modeling the processes from other fields and the algorithmic techniques necessary to do so. There are 15 other students in the program, with China, Pakistan, India, Greece, Sweden, England, France, and the US (just me!) represented, and the balance from Ireland or Northern Ireland. There is an amazing diversity in academic backgrounds, however computer science, physics, and math (or maths as they call it here) seem to be the majority. Some students have never programmed or seen Linux, so it is interesting to say the least.

I am currently taking High Performance Programming (basically efficient program design in c++), Numerical Algorithms (we're still going over machine architecture, data storage, floating point arithmetic, etc.), Mathematical Modeling (we are taking integral conservation laws and getting PDE's from them, then doing non-dimensionalization, and now we have just started perturbation techniques), and Scientific Visualization (which is the technique of efficiently and effectively displaying up to Gigabytes of data).

In three weeks High Performance Programming ends and we begin Parallel Algorithms. In December, Numerical Algorithms and Parallel Algorithms end and the second semester will bring more Modeling, Parallel Programming Systems, and a choice of five from Data Mining, Financial Mathematics, Meteorology, Geophysics, Case Studies in Computational Science, Signal Processing, Heterogeneous and Grid Computing, and Bioinformatics. The summer is reserved for completing our theses.

So far I am way ahead of the game in the computer and programming areas (I am so glad that I entered Drew while c++ was still the language used!). I am doing a substantial amount of work in modeling, but my mechanics and math phys courses are coming in handy, and I really hope that my thesis work at Drew will prove to be an advantage for the parallel classes.

Of course some of the most interesting things about studying in a foreign country are all of the things that differ from home. One big exam at the end of the year with very little cumulative assessment, remembering to look right first instead of left when crossing the road, not a 24 hour store to speak of, light switches being located outside of the doors to the bathrooms they illuminate, and the lack of your favorite comfort foods and TV shows. However the country is changing (and in ways becoming more like England and the U.S.) since I last lived in Ireland. Product availability is increasing, with watermelons, pineapples, fresh corn, and limes all easy to find now, being quite the opposite only a few years ago. The number of TV and radio stations has increased dramatically, and things are much more expensive since Ireland has changed over to the Euro.

I think the most important experience, however, is meeting new people. The amazing cultural diversity that exists in my program is not out of the ordinary here as many people in Europe (and the rest of the world) cross national borders like we cross state borders at home. There is always someone new to talk to and learn from (despite the inevitable and normally mild language barriers!). Do you wish you went abroad but now it's too late? Go to grad school abroad, and bring a little of Drew out into the world.

Brett Becker, '03

Physics Quotations

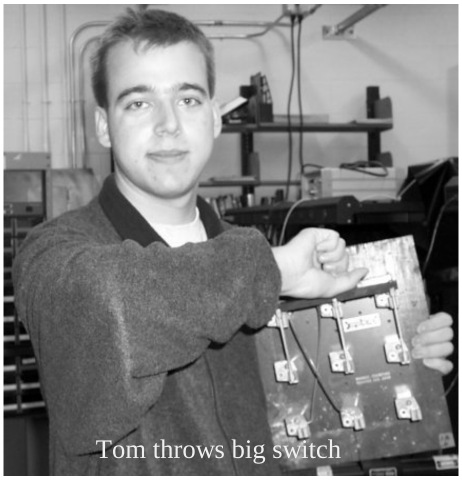
Karen: I got this book from the library: Cold Fusion, the Fiasco of the Century
Tom: Ooh! Ooh! I borrowed that!
Karen: uh, so did I...
Brett: what a lucky library book! —Seminar

Emily: I have an equation named after me: Emily HAMILTONian
Adam: I do too: Adam Fried... RODRIGUES… man—Mechanics

"I'm good at standing up" Adam, Spring Saturday

"That's just evil" Katy—Electronics lab, about the digital oscilloscope.

Tom Zielinski Corner


Tom throws big switch

This past summer, I participated in an REU (Research Experience for Undergraduates) at Penn State University. My research was in the field of condensed matter, specifically the investigation of a desorptive effect at the critical point of nitrogen in a confined geometry.

Let's put that deceptively fancy title aside for a moment, and just start by saying that the choice to go to Penn State was a huge leap of faith. In short, Penn State is a gigantic graduate research university with a focus in materials and condensed matter research*. I come from a small liberal arts college that knows absolutely nothing about condensed matter. Nothing we do here at Drew really compares, so the experience was at least guaranteed uniqueness. The prior summer I had worked for Dr. McGee in the optics lab as a part of DSSI (Drew Summer Science Institute). One of the first differences that struck me was the fact that here at Drew, in the optics lab, E-lab or even A-lab, everything is already put together into very tidy packages. If you want a laser, a linear polarizer, or even a lock-in, chances are that it is already sitting somewhere on a shelf waiting for you. Condensed matter, on the other hand, is a very different, much messier branch of physics. You are handed a box of raw copper, some greasy vacuum equipment, rough schematics, and pointed in the direction of the department's machine shop. You actually get the joy of building your apparatus practically from scratch, refining it, dipping your masterpiece in a brutal cryogenic liquid, and watching it fail miserably time and time again. If nothing else, I have learned to justify this by convincing myself that the laboratory techniques learned from repeated failure are among the most valuable.

Physics Quotations:

Adam: It's like Hilbert Space
Emily: That's where Tom lives—Mechanics

If you have apprehensions about committing your summer to physics research in a field you know absolutely nothing about, in the middle-of- nowhere Pennsylvania, let me assure you that the Penn State REU was simply fantastic. The science and lab work actually turned out to be very understandable. In fact, most of the other students in the program had a very similar lack of background in condensed matter. Additionally, all of the students received fairly comprehensive machine shop training which will undoubtedly prove very useful in any area of physics. Despite a lot of initial frustration I did leave having set up an experiment that promises to be very important in settling a theoretical debate in critical point phenomena.

There was a very social atmosphere both inside and outside of the lab. We had picnics, a huge pig roast, weekly seminars, movie nights, and even a complimentary trip to the Franklin Institute in Philly. After work and on weekends there were plenty of State Parks, caves, and so forth to explore, along with a huge network of bars and clubs within walking distance of campus. The 4th of July fireworks at State College are supposedly ranked among the very top shows in the world. Additionally, State College hosts a huge week-long annual arts festival that brought a very distinctive, extended street fair atmosphere to the entire town, along with big events like several free concerts from famous national recording artists and evening theatrical performances. The housing that the program provided was simply amazing, all travel expenses were covered, and the stipend was quite competitive with all other similar programs. Most importantly, you get a wonderful taste for grad school. In addition to the graduate level lab work, you are likely to get issued your very own grad student! In essence, you are then *allowed*, even *encouraged* to follow them around the entire summer and harass them with questions about your future. Despite my initial apprehensions about diving into condensed matter, I highly recommend this program to anyone looking to have a great time while "test driving" a graduate school in physics.

**A handy tip for anyone looking to apply next year: you MUST put down condensed matter as your research preference, or they won't even consider you! It's basically a test to see whether or not you even looked at the website!*

Tom Zielinski, '04

Send us your favorite physics quotations!!

Afriedma@Drew.edu
Ehamilto@Drew.edu
Caragona@Drew.edu

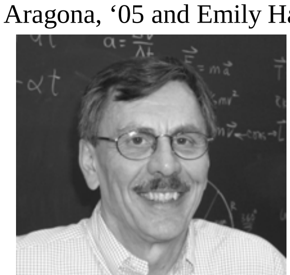
The Mysterious W. Shanks

Although I had never seen him before, I was curious enough to seek out the mysterious W. Shanks, the new adjunct to the physics department who is teaching one section of the Physics 11 & 12 labs, and more interestingly, he is not new to the Drew community. He taught here part time about 25 years ago. Shanks also served as a TA while completing graduate work at Cal Tech, and he is looking forward to figuring out different approaches to explaining physics topics to Drew students who generally don't have the mathematical background that Cal Tech students do.

Dr. Wes Shanks attended Cal Tech, for both college and graduate school. He described his graduate school experience as both "stimulating and grueling," the longest and most stressful aspect of the experience being waiting to obtain results from his data. Nearly a year passed before he had sufficient information to create a thesis. He did complete his thesis in high energy physics after the arduous task of collecting data, and the topic continues to hold much interest for him today, partly due to its fundamental nature.

For Drew students planning to pursue studies in physics, Dr. Shanks has this advice: to paraphrase the words of Joseph Campbell, "follow your bliss." Figure out what truly excites you and pursue that interest. Other positions may hold lucrative benefits, but they may be far less interesting.

Tina Aragona, '05 and Emily Hamilton, '04



W. Shanks

Clip 'n' Save!

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

$$\nabla \bullet E = \frac{\rho}{\varepsilon_O}$$

$$\nabla \times B = \mu_0 \; J + \mu_0 \varepsilon_O \frac{\partial E}{\partial t}$$

$$\nabla \bullet B = 0$$

Mr. Tom Goes to Washington

Last spring I was elected SPS Associate Councilor for Zone 3. The Society of Physics Students (SPS) is geographically divided into 18 zones spanning the country, where each zone has one student and one faculty representative. Zone 3 includes all of New Jersey, Delaware, and Eastern Pennsylvania (the part that counts in terms of universities). One of the responsibilities that this office entails is attendance at the all-expense paid National SPS Conference in Washington D.C. This September, after a week-long delay caused by Hurricane Isabel, I had the opportunity to represent our zone as a part of the 2003 SPS Council.

Upon arrival on Thursday, we started with an informal cracker and cheese party at the hotel, in which we had a chance to meet all of the other Councilors, followed by a more formal dinner. Friday we all met early in the morning at the American Center for Physics for a full day (12+ hours) of meetings. Some of the matters addressed were the distribution of scholarships, diversity, zone meetings, communication, SPS statistics, and a new revised statement on the teaching of biological and cosmological evolution. For instance, the distribution of SPS leadership scholarships has been changed to allow one to be designated specifically for future physics educators, and another for SPS students' continuing education after a junior college. As an associate Zone Councilor, you not only have the opportunity to participate in the discussion, but also to affect policy by proposing motions, and voting on everything. In the afternoon, we divided into smaller groups given the task of investigating a designated matter. My particular group looked into the current progress of the ComPADRE REU/Internship resource. The goal of this project is to provide employers the opportunity to list REU/Internship information on a centralized website, and then allow students to browse the listings and respond with résumé's. We found that excellent progress is being made, and offered many suggestions for streamlining the posting/searching process in a PowerPoint presentation I delivered to the council. Saturday morning, the meeting was moved back to a hotel conference room, where we worked out the final details on the evolution statement, wrapped up some other loose ends, and adjourned. We were allowed to spend the rest of the day playing tourist in Washington D.C., with the understanding that we were expected to return in time for a fancy farewell dinner at a local restaurant.

In summary, holding this office is a wonderful experience and an excellent opportunity to represent not only Drew University, but also our region of the country. The elections for the 2004 SPS Council will be held this spring, and I encourage anyone interested to run for the office.

Tom Zielinski, '04

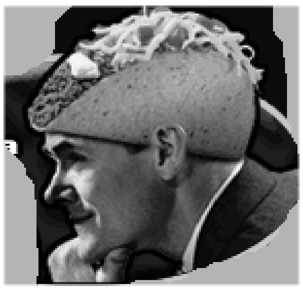
2003-04 SPS Officers

Tom
Arlene
Tina
Karen
Emily
Adam

Upcoming SPS Events

Science Day!!!
Drew Welcomes Prospective Science Students
Friday November 7th

Annual Taco Party at Dr. F.'s House!!!
Monday, December 8th



Dr. Supplee

Career Corner

In a recent survey of physics PhD holders by the American Institute of Physics[1], median salaries at all experience levels increased well ahead of inflation during the years 2000-2002. Members with PhDs working in hospital and medical services earned the highest median salary, $108,000. The median salary in Federally-Funded Research and Development Centers ranked second with $104,000, followed by $100,000 in the private sector. Those employed at 4-year colleges continue to earned the lowest median salary $55,000.

Median salary and age for major employment sectors, PhDs 2002. (a)

Academic Sector		**Salary**	**Age**
University	9-10 Month Salary	$72,000	48
	11-12 Month Salary	$80,000	48
4 Yr College	9-10 Month Salary	$55,000	46
Non-Academic Sector		**Salary**	**Age**
Hospital, medical services		$108,000	49
FFR&DC (b)		$104,000	48
Industry, self-employed		$100,000	45
Government		$97,000	50
Nonprofit		$85,000	47
UARI (b)		$82,000	45

(a) Employed U.S. resident members only. Post-doctorates not included.
(b)FFR&DC= Federally-Funded Research and Development Center;
UARI= University-Affiliated Research Institute or Observatory.

[1] Data courtesy of the Statistical Research Center of the American Institute of Physics

The Dilated Times

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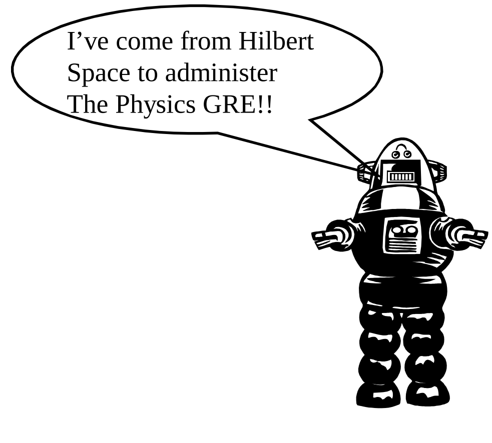

inside...

Research, Research and more Research, Dr. Carter gives it to Thomas Kuhn, Brett speaks, and more!!

Contributors: Tina Aragona, Katy Rolfe, Adam Friedman, Emily Hamilton, Tom Zielinski, Karen Mooney, Dr. Ashley Carter, and Brett Becker