UP undergraduate physics newsletter

Volume V, Issue #7, April 2008
UP News Online: ***http://www.phys.ufl.edu/~upnews***

THE NEW FACES OF SPS

by James Stankowicz

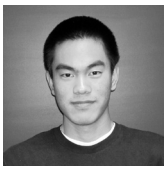
The University Of Florida Society Of Physics Students had its officer elections for the 2008-2009 school year on Thursday, March 29. Without further adieu, we introduce the 2008-2009 officers:

President
Art Ianuzzi
He's grilled your burgers for the last two years at the annual SPS picnic, and he was the driving force in the SPS lounge's recent acquisition of brand new, brand name appliances. The future of SPS is in capable hands, as last year's treasurer picks up the reigns.

Vice President
Cameron Thacker
You may recognize him as a baker of cookies at the bi-weekly SPS cookie and coffee sale, but this second year physicist-in-the-making also wrote those brilliant, thought provoking SPS event reminder e-mails all of this year as the SPS secretary, and kept minutes at every meeting.

Treasurer
James Stankowicz
As someone who understands that free things are much more delicious, be on the look out for a wider selection of free, delectable goodies at SPS meetings in the future, when purchasing power falls into the hands of this second year physics major.

Secretary
Alicia Swift
She's a third year nuclear engineer major, with Spanish and physics minors, who likes the fantastic combination of physics, photography, and cookies. This UPNews writer and editor promises to bring hitherto unforeseen organization to SPS meetings. Also, she may or may not tame lions professionally.



Historian
George CB Ling
This first year physics student has historian potential not seen since the Golden Years of the UF SPS. He has already made strides in restoring the age old battle between good and evil that was once called the Chemistry versus Physics paintball fight.

Propagandist
Daniel Bannoura
He's a third year physics major with his first SPS officer position. In tandem with the other new propagandist, he is breaking SPS into the digital age, utilizing such things as the 'internet' and 'Facebook' to promote and expand SPS.

Propagandist
Chris Mueller
He's a third year physics and math major with aspirations to study condensed matter theory in graduate school. Like many physics majors, he spends more time in NPB than at H-O-M-E, so count on being well informed as he takes over the publicity aspects of SPS.

Webmaster
Steven Hochman
He's wise beyond his four years as a physics, math and electrical engineering student. If you need to know how to navigate UF's listserves, he's your man. Expect great things of the SPS website in the future, as this UPNews writer marks his territory over the internet.

Don't forget to join the SPS List-serve (see the SPS website at http://www.phys.ufl.edu/~sps for more info), and the UF SPS Facebook group (simply search for UF SPS on Facebook to locate it).

who we are

UP is a monthly undergraduate physics newsletter sponsored by the University of Florida's chapter of the Society of Physics Students, for students, by students. We seek to strengthen the undergraduate physics community at the University of Florida by providing a forum for undergraduates to share their views and experiences with each other and to act as a source of information for opportunities and events in physics.

Visit Department
Coffee Time
Mondays & Tuesdays
3-3:45pm in NPB 2205
Professors, staff, and students are all invited!
Coffee, tea, hot cocoa, and cookies only 50 cents

what's UP
in this issue

Professor Spotlight

DR. STEPHEN HILL

by Steven Hochman

UPNews: *Where were you born?*
Stephen Hill: Canterbury, England. When I was young, I moved to near Oxford.

UP: *Where did you go to school?*
SH: I went to the University of Oxford for both my undergraduate and graduate studies. My father was a chemist, thus I was drawn to the chemistry-end of physics. In England, specialization occurs as early as the last semester of undergraduate studies and I decided I wanted to go into condensed matter physics. I continued at the University of Oxford to get my Ph.D which they call at Oxford a "D.Phil". I graduated at the normal pace in England which is three years for a bachelor's degree and then three years for a PhD.

UP: *Do you have any tales that you would like to share from your days at Oxford?*
SH: At our triannual exams we are actually required to wear subfusc. Subfusc is what you would call a cap and gown suit in the United States. It technically consists of a dark gown, black socks, black shoes, white collared shirt, white bow tie, and mortarboard.

UP: *What was your doctoral thesis, and how much work was it?*
SH: My doctoral thesis was "Far-infrared and millimetre wave magneto-optical studies of interacting quasiparticles". This work involved using mainly far-infrared spectroscopy to study the properties of interacting electrons (quasiparticles) in various interesting conducting and superconducting materials. It was about three to four months of work.

UP: *What did you do after you recieved your Ph.D?*
SH: I crossed the pond right after I finished at Oxford. I went to work at the National High Magnetic Field Laboratory (NHMFL) at FSU in Tallahassee. I worked there on high field spectroscopy of superconductors. The lab was new when I arrived, and so there weren't many people working and conducting experiments yet. It was easy to get access and do what you needed to do, so I was able to be very productive. After working there for two and a half years, I got an assistant professorship at Montana State. After four years there, I came to UF in 2001.

UP: *Can you tell me a bit about your research?*
SH: My group has developed unique spectroscopic techniques spanning the frequency range from a few GHz up to nearly one THz. We currently use these techniques to study various novel molecule-based magnetic and superconducting materials. One example is the study of quantum effects in molecular nanomagnets. This work involves close collaboration with chemists who synthesize crystals for us containing molecules with up to 84 magnetic transition metal ions such as Fe, Mn, Ni, and so on. We then use magnetic resonance spectroscopy to study the quantum energy-level structure (the Hamiltonian) of these molecules, which are of relevance to future magnetic information storage technologies. At present, the memory in your computer hard drive is manufactured via top-down methods, i.e. simply by making smaller and smaller particles from conventional magnetic materials. The molecular, or bottom-up approach, takes advantage of chemistry (nature) to controllably design nanoscale magnetic objects. The point where these two approaches meet also happens to coincide with the length-scale at which the quantum and classical worlds meet. Consequently, this research is also of immense fundamental interest. Finally, there are connections to biology: for example, the very well-known iron storage protein in your blood, ferritin, is a huge molecule containing around 4,500 Fe(III) ions.

UP: *What is this research like?*
SH: This year I've collaborated with Dr. Cheng, and Dr. Christou of the chemistry department. Many of our papers are published in chemistry journals. Condensed matter physics, which has historically been a strong field of study, necessitates me to work with many different kinds of professors from other universities. I have hosted graduate students in chemistry and physics from other universities. The NSF, which funds much of our work, is supportive to the many vital component departments of this research. One of the defining qualities of condensed matter physics is its interdisciplinary nature.

UP: *What are your thoughts on teaching?*
SH: I've taught Statistical Mechanics and Thermal Physics before that. I have also taught Electromagnetism, Modern Physics, and Intro-level classes. I hope to teach the 300-400 students in physics once again in the lower level physics classes. I usually prepare a lot for class, even if I have taught the class recently. I will sit down and go over the material again. I also like to do in-class demos if I can, and I like to stress the underlying principles of the subject. I have always thought that students asking questions is good. Most students think I'm tough on tests, but I think in the end I can also be quite lenient at times. I'd prefer to give long tests like the final, however I am usually restricted to the fifty minutes in class since I don't like doing night tests.

UP: *Who are your graduate students and undergrad researchers?*
SH: I have two graduate students working with me: Saiti Datta and Changhyun Koo. My graduate students work on a little bit of everything: simulation and lab work. I also have two undergraduate student researchers. Erica Bolin, a senior, has published papers and works on many Matlab simulations. Gage Redler does instrument development in the lab, building hardware circuits and crystats. Since Erica is graduating this semester I will only have one undergraduate student next year. I always welcome inquiries for research positions. I find that the undergraduate students I get are very helpful.

Spotlight on Science

HIGH ENERGY PHYSICS

by Victor Albert

Throughout the last 100 years, science has fragmented into a mess of various disciplines, most of which overlap with each other. This section attempts to clear up and organize the various scientific kingdoms and phyla one topic at a time. This is only an attempt, as the distinctions among the fields are almost always debatable. This month we deal with the complicated world of high energy physics.

High energy physics, or particle physics (as opposed to particle science, which partially is the study of how to make paint), is the study of the fundamental constituents of matter and energy. The reason it's called 'high energy' is because most of the cool, exotic, and unknown particles do not exist at day-to-day energy levels. Physicists need a lot of energy (and taxpayer money) to find and track down these exotic particles - the most popular method being accelerating and colliding known particles.

As with all physics, high energy can be classified into theoretical and experimental. **Theorists** try to use math to make models about current experiments as well as predict new particles and/or experimental results. The predominant group of theoretical physicists concern themselves with the physics of the standard model. However, there are several other divisions of theoretical high energy physics such as lattice field theory (the idea that the universe is basically a lattice) or string theory (the idea that the universe is made up of little strings). All of these theories require a solid mathematical background and computer calculations (some more than others, particularly lattice field theory, which deals with simulations because a lot of lattice theories are not solvable).

Experimentalists try to verify theories as well as run interesting experiments that would potentially produce results that would expand our understanding of the world. They actually try to implement, design, and build the massive colliders that are required to gain any headway in today's high energy science. While theorists try to determine what to look for, it's up to the experimentalists to determine how to look. Thus, experimental particle physicists study the many techniques, such as particle acceleration and ionization, that are used to find out more about matter.

Since experiment and theory in high energy are closely intertwined, at least for those theories that have the possibility of ever being experimentally predicted, a new subcategory of physics has formed which can be classified as phenomenology. **Phenomenologists** are the middle men; they attempt to determine the experimental consequences of a theory. They try to determine what experimenters should look for in determining whether a theory is correct. This includes calculating exact numbers that can be compared to the numbers obtained in an experiment. However, since theoretical particle physics is very complex and mathematically abstract, these are not your regular plug-and-chug calculations. Phenomenology is also quite mathematically intensive as many phenomenologists are, in a sense, theorists hanging out with experimentalists.

SENIOR'S PARTING WORDS

by Harold Rodriguez

I think the best part of the physics program at the University of Florida is that after you finish it, you never want to do physics again. It's a true test of staying power. If you end up wanting to go to graduate school for physics after the undergrad version, you should probably go. Many students drop out after their freshman year (those are the smart ones). The prideful ones keep going until it's too late to turn back. Hence, seriously consider getting a Bachelor of Arts in Physics instead of the Bachelor of Science, and double up with something else like math. The B.A. is arguably 10 times easier (you don't have to take much of the upper level courses which take up a lot of time) and the degree is virtually the same in the outside world. Furthermore, getting a math minor is a cinch if you're a Physics major (it's only like one or two more classes). Speaking of math classes, take Computational Linear Algebra (not proof-based Linear Algebra), Differential Equations, and Fourier Transforms before you take Mechanics, Optics, or Electromagnetism. Even if you don't need them to graduate, the later physics classes make so much more sense.

INTERESTINGLY STUPID **MOVIE PHYSICS**

by Alicia Swift

Have you ever left a movie theater, shaking your head because the screenwriter never took a Physics class in college? Apparently, a group of physicists became so angry they formed a website entitled: "Insultingly Stupid Movie Physics", located at www.intuitor.com/moviephysics. Their mission statement says it all: "In the name of physics decency, to protect the minds of children everywhere, so that they may grow up in a world where they know the difference between speed and velocity, we have taken the responsibility to rate movies for their portrayal of excessively bad physics". These ratings range from GP ("Good physics in general") and PGP ("Pretty good physics (just enough flaws to be fun)") to RP ("Retch") and NR ("Obviously physics from an unknown universe").

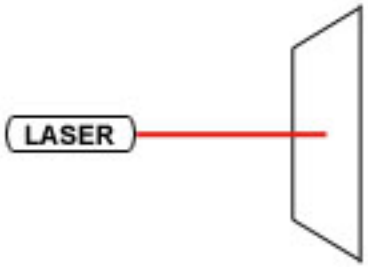


Figure 1
A Conveniently Visible Hollywood Laser

Figure 2
A Real Laser

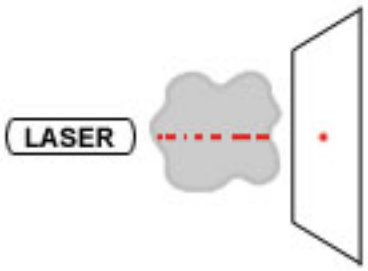


Figure 3
A Real Laser Shining Through A Cloud

One of the best (read: funniest) reviews was of Jumper, which was given the rating of Retch. An excerpt asks, "Do jumpers jump out of their clothes when they teleport? Well, no, not unless they're having a romantic moment. In fact, jumpers can apparently create an aurora around themselves allowing them to jump with their surfboard, lawn chair, car, or whatever. How they do this is amazing. On trips we can't remember to pack our socks. Imagine what it would be like to be a jumper and arrive at your destination naked due to a moment of distraction."

Additionally, they give an analysis of common mistakes, such as flashing bullets, exploding cars, lasers (see image), cigarettes, and breaking glass, "to avoid repetition" which includes formulae and dry humor. With a wide range of reviews, which include Independence Day (RP), The Terminator (PGP), and 10,000 B.C. (RP), you will find plenty of ways to procrastinate on that problem set.

UP News Nostalgia

by Erica Bolin

Here I am, finishing up the last issue I will ever put together. I remember fondly seeing an e-mail four and a half years ago from Cathy Yeh looking for volunteers to start a newsletter for undergraduates in physics. Having done yearbook in high school and having some graphic design experience I quickly replied. The first staff was all female. It was quite amusing considering the male to female ratio in the department. As we wrote, we established traditions: introductions to the undergraduate advisors, professor spotlights, and a close tie to SPS events. Since then we've had everything from restaurant and movie reviews to short stories...one time we even included a coupon (from Sweet Dreams, a local ice cream shop). I have to say it's been fun. Our monthly meetings are always the same - trying to strike a balance between order and chaos. I'll certainly remember UP News as I move on, and thankfully I have the online version as a chronicle of my undergraduate career.