undergraduate physics newsletter

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Physics and Phun-ness

by Cathy Yeh

"Don't kill the pickle!" begged the audience of 4th and 5th graders. The hapless, failed cucumber was impaled on two spikes. Then, leaving no doubt as to cruel and unusual punishment, 120 Volts were applied. Five seconds of silence followed. Then "sizzle"! The pickle began to glow orange, spraying sparks off the stage and also creating an unpleasant smell. The kids loved it.

On Thursday, February 23, SPS performed a "Physics is Fun" show at Williams Elementary School. SPS members had so many physics demonstrations to share that they actually ran out of time. A simple demonstration like Minski's Cannon, in which a bouncing basketball transfers its momentum to a light ball sitting atop it and causes the light ball to bounce unexpectedly high into the air, was an example of a physics experiment that could be performed at home.

Jacob demonstrates an effect caused by Bernouli's principle during the show

There were also more expensive setups like the Van de Graaff generator, which most people don't have lying in a corner of their garage. The crackling sound of electricity and the sight of current flowing in the air from the charged metal globe of the Van de Graaff to the demonstrator's wand filled the audience with the sort of awe that people generally accord to something that might end their lives in a sudden, toasty manner. Imagine their reaction when the demonstrator, Chris, nonchalantly held his fist a few inches from the globe.

Despite the current flowing to his fist, Chris apparently was fine, and many children cried out, "Pick me!" when he asked for a volunteer. One boy held his hand toward the Van de Graaff, screwing up his face with the anticipation of a shock. Losing his nerve momentarily, he snatched his hand away, much to the amusement of himself and his classmates. However, he put his hand back and, receiving a pleasant little shock (if shocks can be pleasant), returned triumphantly to his seat.

The Van de Graaff was not the only demo in which SPS members called for volunteers. Audience participation was encouraged as much as possible. Two girls tried to pull apart an electromagnet and found that they couldn't when the electricity was on. Another girl blew a beach ball several feet away from a jet of air and discovered that the ball was still stable and floating as a consequence of Bernoulli's principle. When students couldn't come on stage, the demonstrators brought the exhibits to them. Jacob passed around the tortured remains of the pickle and Michael let children play two slightly off-pitch xylophone keys that demonstrated the phenomenon of frequency beats.

The show ended with a bang—or rather, several. Chris hugged an air cannon, a modified garbage can, to his side and thumped the cloth that was stretched over its top, sending out huge gusts of air as much as 40-60 feet. The effect of the invisible "whomp" of air moving across the unsuspecting audience could be seen as Chris directed his aim around the room and received shouts of happy surprise from the columns of people in his path.

Present at the "Physics is Fun" Show were SPS members Brad, Cathy, Chris, Jacob, and Michael. A clip of excerpts from the show is available at www.phys.ufl.edu/~sps

what's UP
in this issue

Tuesday, March 7th
SPS General Meeting & Officer Elections for 2006-2007
6pm, Free Pizza
Check the SPS website for location

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 acting as a source of information for opportunities and events in physics.

It's a Bird! It's a Plane! It's a...Blimp!

by Katherine Keller

You've seen it soaring above you in the O-Dome, taunting you with that little slip of paper that dangles beneath it. You've heard the whirl of its motor as it flies by, pushing speeds upwards of 10 mph! Yes, that's right. I'm talking about the MegaBook Blimp. Since I'm sure that many of you have often pondered the story behind "the blimp," I met with the pilot, Joe Gleason, to find out what really goes on with that big blue balloon.

The blimp was originated by Jay Curtis. While the bag was of course manufactured, he built the rest of it from scratch, and apparently he did a good job, because the blimp has yet to break to down. However, when Curtis found that he didn't really have time to keep flying the blimp at games, his friend Joe Gleason took over.

The main workings of the blimp include three fans, the front two of which are mounted on a rotating rod for controlling up/down and forward/backward motion. The rear fan allows for turning left and right. The blimp is piloted via a remote control with throttles for the fans and a lever for rotating the front fans. A 7.2V NiMH battery supplies power and a simple rotating screw holds the coupons to be dropped. The bag of the blimp is filled with helium and then loaded with lead weights to achieve neutral buoyancy.

Joe Gleason with the Megabook blimp

I bet you're thinking flying a blimp sounds easy. Well apparently it isn't as simple as it seems. Joe has let others take a crack at flying before: "Whenever I let someone else fly the blimp they usually fly into the seats." While he claims that he hasn't hit anyone straight on, Joe did admit that he's had some close calls. "The hardest part of the job is deciding where to drop the coupon," he said.

MegaBook sponsors the blimp and supplies the Red Baron coupons that it drops from the sky. For those of you who can't enough of those pizza coupons, the blimp can be seen at gymnastics meets, volleyball games, and men's and women's basketball games.

Who will be Einstein's Successor?

by Jonathan Young

The World Year of Physics has already passed, yet many are still wondering when the next Einstein will arrive. Some scientists who have reflected on this question doubt that it will be any time soon. They claim that a major leap in mathematics must be made before a unified field theory can be developed. Maybe so, but these achievements need not be made separately. Sir Isaac Newton developed the calculus and also managed to give us his laws of motion and gravitation. It is certain that unification will involve great mathematical depth (much like string theory does), so it is possible that a qualified genius could usher in a new branch of mathematics as part of a grander scheme of developing the unified field theory. Such a person would need to possess an incredible mathematical ability in addition to an amazing proficiency in physics.

But where will a genius with an unsurpassed grasp of mathematics and physics be found? The search for the next Einstein ultimately relates to the question of how genius is achieved. Genius certainly involves a mix of nature and nurture, but in what proportion? With the world population at a breathtaking 6.5 billion, surely someone somewhere has had those Einsteinian genes. So where have all the Mozarts, Gausses and Shakespeares gone? The fact that the world population is so large offers one clue. Those with Gaussian, Newtonian or Einsteinian genes are all likely running into each other, making it harder for any one genius to rise above the rest. Like Brian Greene said, "Maybe there is an Einstein out there today, but it would be a lot harder for him to be heard." In Einstein's day, there were only about a few thousand physicists around the world, and only a handful of them could match wits with Einstein. Today, competition is much more fierce. The amount of mathematics and physics knowledge one is required to study grows larger and ever more complex.

Despite the odds, most scientists are confident that a new Einstein will arise, though when that will happen is anybody's guess. Most of the pioneering discoveries and inventions were made by great scientists when they were young, so it is likely that Einstein's successor will also be young. The task at hand of unification may well be one of the most challenging tasks ever posed. Those courageous enough to tackle such a gargantuan obstacle faces overwhelming odds. Nevertheless, physicists are hopeful that unification can be achieved and when it is, it will go down in history as the pinnacle of human endeavor and a testament to the intellect of mankind.

Getting Ye Olde Medieval On

by Stacy Wise

There is only so much unwavering devotion to the harsh mistress of Physics that undergrads swamped with homework or graduate students, like me, in the throes of dissertation-writing, can muster before something must give. When it gives, and give it will, it is preferably in favor of something completely frivolous. For this, the annual Hoggetowne Medieval Faire is ideal.

Two weekends a year, which this time around fell on January 28-29 and February 3-6, the Alachua County Fairgrounds are transformed into Gainesville's homemade feudal carnival. On the last Sunday of the Faire a handful of physics students and friends braved chilly winds and sunburn to take advantage of this event. Although a medieval festival sounds like an opportunity to learn something about life in the past, children and adults alike can be assured the Faire prefers fun to historical accuracy. Take for example the annual chess match between good and evil put on by the local acting troupe The Thieves' Guild. Each year a mythical conflict is played out in a live-action board game, with human chess pieces on a 200 sq. ft. board surrounded by bleachers. This year the theme was Robin Hood and his Merry Men (and Women) versus the Sheriff of Nottingham's posse. Last year saw King Arthur fight Mordred. The good and evil kings, Robin Hood and the Sheriff, respectively, direct the match. When one piece overtakes another, staged combat decides the outcome. This might involve a well-choreographed swordfight or something more akin to WWF wrestling, with fair play devolving into airplane spins, kidnapping, and the dreaded fake backbreaking drop-kick. At least no folding chairs were involved. The crowd loves it. Supporters of Good and Evil seem equally bloodthirsty. My friends and I cheered,

"Two, four, six, eight. Who will we decapitate? Mutilate? It's your fate. Kill! Kill! Kill!"

That alone could be worth the $10 admission, but there's plenty more to see. There are jousts on horseback. When you get hungry or feel like shopping the Hoggetowne Faire offers up a smorgasbord. One can get food that varies from vegetarian treats to huge smoked turkey legs. Vendors peddle costumes, jewelry, weapons, musical instruments, and leatherwork like whips and cuffs (Faires everywhere seem to harbor a Flagellant-inspired masochistic undertone). There are carnival activities such as axe-throwing and elephant rides. My personal favorite in this category is archery with live human targets. Just 25 cents buys an opportunity to shoot a rubber ball-tipped arrow at a person in armor. I saw one young woman apparently working out some pent-up aggression with about $20 worth of arrows. The brave targets are volunteers from the local branch of the Society for Creative Anachronism, or SCA. These are the folks you might have seen at the Reitz Union of a Friday night, demonstrating the ancient art of beating people in homemade Freon-can armor with padded sticks. All I can say after having participated a few times is that it's a blast.

At several stages throughout the fairgrounds one will find performances by the Davinci Brothers comedy show, musical acts like the Empty Hats (featuring the famous Bedlam escapee Loony Lucy) or bawdy wenches singing songs full of naughty euphemisms that leave parents cackling and kids looking around in confusion, wondering what they missed. While many of these acts are part of the itinerant Renaissance Faire crowd that travels like gypsies from festival to festival, the Hoggetowne Faire mixes in local talent such as the Sahnobar Dance Ensemble. It is composed of Middle Eastern dance artists and musicians from Gainesville and surrounding cities who shimmy and shake in pseudo-Bedouin costume to live drum, flute and viola. This was the last show we saw that day. It was getting late, and with the sun hiding behind the tree line we huddled together on the benches for warmth. Inevitably the physics crowd was called up out of their seats for some audience participation, and we shook our booties mightily for the assembly. Then it was time to go home, sun burnt, well-fed, and happily, no wiser for the experience.

The troop, with the Medieval Faire's most colorful charater

Mentor – Mentee Ice Cream Social

by Amruta Deshpande

What? Free Ice-Cream!?! `T was true! If you're an SPS mentor or mentee, that is you either signed up to show a freshman or sophomore a few ropes around physics, or you are such a freshman or sophomore, SPS decided to pay for your ice-cream at Gainesville's Mom n' Pop, Homemade Ice Cream Shop - Sweet Dreams. On Friday, February 17th, mentor-mentee pairs and singletons gathered at Sweet Dreams to mix, mingle and be treated to ice cream.

As usual, there was an assortment of new and colorful flavors. That Friday featured flavors, Crème Brulee and Guinness. There was also a full section of sorbets and Italian ices for those vegans and lactose intolerants among us, in a variety of flavors from bright berries, to white coconut.

Over these cool, creamy sweets, people shared a pleasant evening. While some mentored, others joked, and others still, solved physics problems. Whether you were glad to have found out something useful, had a good laugh, or solved something that your scalp was losing skin over, you were glad to be there. So socialize, share your wisdom and good ideas, become a mentor or a mentee, and SPS might continue to provide you with delightful fora such as Sweet Dreams.

ROFU Recap

The Research of Dr. Ho Bun Chan

by Jonathan Young

On February 8, 2006, Dr. Ho Bun Chan gave a presentation at the Research Opportunities for Undergraduates symposium. Dr. Chan focuses his research on microelectromechanical systems (MEMS). MEMS are miniscule structures that are created using integrated circuit technology. The specific work conducted by Dr. Chan on MEMS includes Casimir force measurements and development of subwavelength surface plasmonic devices.

The measurements of the Casimir force basically investigate the behavior of surfaces in close proximity. The Casimir force, named after the Dutch physicist Hendrik Casimir, relates to zero-point energy. Classical physics maintains that a vacuum is devoid of matter and energy. However, according to quantum mechanics, a vacuum is actually filled with fluctuating energy. Hence, the zero-point energy is caused by subatomic particles that suddenly appear and then rapidly disappear. This energy can be directly observed when two neutral metallic plates are placed next to each other, separated by distances that are smaller than certain electromagnetic wavelengths. As a result of the close distance, more zero-point energy develops on the outer surface of the plates than in between them, so the two plates are drawn together. This is the Casimir force. In the past, Dr. Chan has created a microelectromechanical device to probe the Casimir force. Currently, Dr. Chan is now investigating how energy can be dissipated between two surfaces in close proximity.

An additional focus of Dr. Chan's research is the development of subwavelength surface plasmonic devices. The plasmon is a particle-like entity that results from the quantization of plasma oscillations. Surface plasmons are plasmons that are confined only to surfaces. Their interactions with light produce polaritons and are involved in explaining unexpected observations relating to diffractions from metal gratings. For example, a metal film containing slits of width smaller than a specific wavelength can, under the right circumstances, transmit an incredible amount of light even though one would expect the light transmission to be limited by diffraction. Dr. Chan hopes to develop his work with surface plasmons further to enhance the applications of plasmons. Currently, surface plasmon resonance is employed by biochemists to detect the presence of a molecule on a surface. Other applications include the use of plasmons for the transmission of data on computer chips and high-density optical data storage.

Dr. Chan has indicated a willingness to accept undergraduates into his laboratory who are interested in contributing to his research. He can be contacted at hochan@phys.ufl.edu.

ROFU Recap

There's astrophysics in the air

by Larry Camarota

Venus is her favorite planet. Considering that her area of expertise is planetary atmospheric physics and chemistry, this is not surprising. An assistant professor here at UF, Katia Matcheva, presented her research during the February 8th ROFU presentations.

Dr. Matcheva started her talk with a guided tour of the solar system. Despite having no atmosphere to speak of, Mercury still provides much information about what atmospheres do for planets. Venus, on the other hand, has such a thick atmosphere that its surface can only bee seen through radio wavelengths, or probes at the surface. The Earth is studied in the same way as any other planet. Mars' atmosphere is currently being studied for atmospheric waves. Jupiter and Saturn have many, different layers of clouds, and spin rather quickly. Uranus and Neptune haven't received as much attention as their neighbors. Pluto's atmosphere is frozen for much of its year.

One of the bigger events in Dr. Matchevas career happened in graduate school; the Galileo probe went into orbit around Jupiter. She ended up writing her thesis (involving gravity waves in Jupiter's atmosphere) using data collected from Galileo. While we are still not sure what the clouds on Jupiter are made of, we do know that there are three distinct layers. With Cassini's recent arrival at Saturn, Dr. Matchevas focus has turned to the atmospheres of Saturn and Titan.

She has an undergraduate research project underway, analyzing the atmosphere of Mars. Specifically, she is looking at the atmospheric occultation. Using a variety of analysis methods, she is examining the phenomenon of atmospheric waves. These are periodic changes in pressure that have many, varied effects on a planet and its atmosphere. For example, many Cirrus cloud formations are formed in part by these atmospheric waves.

Dr. Matcheva said she does little experimentation, relying on data collected from Mars orbiters. As a result, this lab does not offer much for undergraduates to work on. However, if you are interested, she advises that you stop by her office (room 2073) to talk to her. Work in her lab will involve Fourier analysis, spectral analysis, wavelet analysis, and various other areas of computer modeling. A lot of reading will be involved in this project. Some programming knowledge is necessary, and a strong mathematics background is a plus.

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Submissions

We welcome your news!
Please send submissions to upnews@phys.ufl.edu by the third Monday of the month

Bye Lanie!

Leilanie Merrill, who managed the physics website and publications such as the Proton and UF Physics Alumni Newsletter, has left for work at the United Way of North Central Florida, where she will be the new Administrative Assistant. She'll be helping with brochures, the website, and general office duties.

The department held a farewell party for her on February 8. The UP staff is grateful for her support when UP Newsletter was just starting in 2004. She was encouraging and very helpful, and we'll miss her. Thanks for everything, Lanie!