UP undergraduate physics newsletter

Volume III, Issue #1, September 2005
UP News Online: http://www.phys.ufl.edu/~upnews

Welcome!

by Amruta Deshpande

"Yes, class is out 10 minutes early!" First days of class are awesome that way. I said hello to a friend I hadn't seen all summer and still had time to write up a smashing intro to my UP article. Sadly, I experienced a mild brain fade: a small explosion of blankness in my head. The gist of my brain's output was, "UP News, the Undergraduate Physics Newsletter, welcomes you to the exciting new 2005-2006 school year!" "Snore, gag" I thought. A concise, but widely overused opening line. At its usage, UP News would wash away in the sea of forgotten allied welcomes extended by the myriad factions around campus. Consider the above paragraph a solution produced by my blank brain: a giant billboard posting the same exact statement! UP News welcomes you!

UP News is an undergraduate newsletter with an undergraduate staff. Set afoot by Cathy Yeh, still editor on the staff, UP News has been providing important dates, helpful hints, social and educational opportunities as well as entertaining accounts of events since spring 2004. See our archives at www.phys.ufl.edu/~upnews. You'll find entertaining accounts of trips made to the Alachua County Girls Club to launch rockets with girls. Becky Gorla, now a graduate student in education at UF, originally started these trips in the spring of 2004. Read the account of her continued tradition in this issue. Find yearly accounts of events hosted by the local chapter of the Society of Physics Students (SPS). At the end of each spring semester, SPS has had a paintball fight with the Chemistry club that is documented in our past issues. SPS proudly showed its spirit, and attempted intimidating the Chemistry club by traveling in an orange and blue UF mini-bus owned by first year graduate student Tim Jones. Also find yearly accounts of the year-end SPS Picnic held at lake Wauberg. Each spring professors and students combat each other in a friendly game of softball. Students have yet to defeat their masterful professors since 2004. SPS also hosts presentations on research conducted at UF by professors looking for undergraduates to join their staff.

We've had a host of guest articles about physics, and different types of reviews. In the last volume, Ivan Diaz wrote about skydiving in Gainesville and the physics behind it. Enthusiasts have offered their opinions of courses usually in the background of the physics curriculum and restaurants in Gainesville in different price ranges. If you'd like to get to know your professors better, or see how upper year undergraduates get along in their research, and lives, read the professor and student spotlights in the past and present issues. Spotlights often come with useful hints for classes and for structuring your undergraduate curriculum. If you're the type whose social life lags along with everything else (as mine evidently does from the opening paragraph) due to procrastination, you'll find helpful hints about when not to procrastinate. Rather, you'll find a collection of bloopers to warn you of possible dangers if you let procrastination take you under. Find information on summer research programs as well as accounts from students who attended them (find one in this issue). We've got loads of useful and comical information.

The newsletter is only possible due to the efforts of a fantastic staff. Erica Bolin, Katherine Keller, Cathy Yeh and myself are still here from the original staff (above). We're excited to have two new members, Jacob Tosado (bottom left) and Youssef Faltas (bottom right). While these two have eliminated the void of the hairier sex in our staff observed through spring of 2005, we're still in search of more members. We'd like to have more editors to contribute monthly articles and a webmaster to maintain the online version monthly. For editors, all that is required is enthusiasm for sharing information or perhaps even the desire to keep their writing skills from atrophying. Webmasters should know html, and past experience web-designing is great! Please contact us at upnews@phys.ufl.edu for more information. Joining the UP News staff is an easy way to get more involved in the physics community and share your knowledge and ideas of physics. Welcome (back) to UF physics.

what's UP
in this issue

SPS Summer Events

see special insert

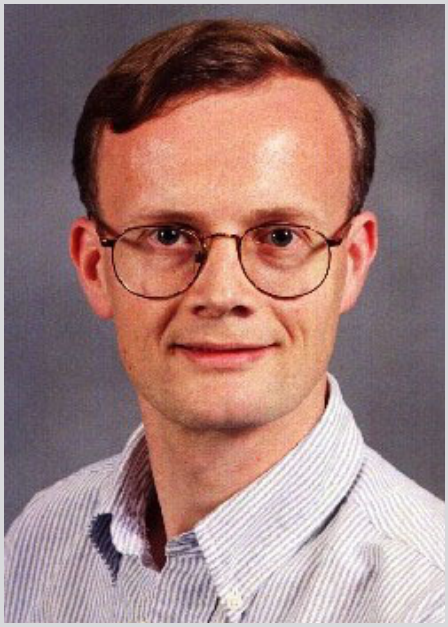
who we are

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.

Professor Spotlight

by Youssef Faltas

Kevin Ingersent



Dr. Kevin Ingersent is going to be teaching Physics Honors 1 (PHY 2060) this fall. He has taught a wide variety of courses before, from introductory level courses like Applied Physics 1 to undergraduate junior/senior level courses like Thermal/Statistical Physics to graduate level courses like Quantum Mechanics.

UP: Favorite courses you taught, and why?

I: I have enjoyed teaching different courses for different reasons. For example, I like the entertainment aspect of introductory level courses. I especially like performing demos in these courses, and the students definitely appreciate a bit of showmanship. Thermal/Statistical Physics was interesting as it gave me a chance to restudy and examine my own understanding of the subject.

UP: Tell us about your undergraduate experience.

I: I did my undergraduate studies in Cambridge, England where I studied physics, math, and chemistry. It was very different from UF. We had about 150 physics majors, and one of my introductory physics courses, which seated about 450 students, was lectured by a Nobel Prize winner.

UP: Tell us about your field of research.

I: My area of research is part of Solid State/Condensed Matter Physics. I do theoretical and computational work studying the conductivity and superconductivity of metals at low temperatures, in particular, what you might call "the physics of magnetic dirt". It is amazing what happens when few atomic impurities are added to an otherwise regular metal. These impurities make the electrons in the metal rearrange themselves in a completely different way, which changes the metal's conductivity or superconductivity.

UP: Any undergraduate students working with you currently?

I: No. I had one undergraduate student in the summer of 2004. I might be looking for undergraduates for a project for the next summer. They should preferably have taken Modern Physics and Quantum Mechanics 1, and have some computing experience. Anyone interested should contact me for further details.

UP: What is going to be your approach in teaching Physics 1?

I: I will try to explain concepts from the students' point of view. In other words, I will try to "put myself in the mind of students." However, big lectures are usually less effective than one-on-one discussions. Since each student understands concepts differently, I encourage students to come see me in my office hours, where I will be able to address their individual needs.

UP: Any other advice for students?

I: Most importantly, don't fall behind and think you will be able to catch up by studying the whole syllabus a week or two before the final exam. In any physics course, working consistently is the easiest way to get a good grade. I also encourage students to use the help resources available in the department. As I said, come to office hours, and also get help from the tutors in the department's undergraduate tutoring lab.

Bachelor's End

by Jacob Tosado

Wading through the rampant noise of your neighbor's wild party, while your legs begin to fall asleep among messy stacks of books and papers in effort to secure the final grade for your next exam, you think, "Does it ever stop?" "Will I ever have a break?" It turns out that there is some light at the end of the physics tunnel. Yes it is surely there and it lies past the quantum river rapids, beyond the great mountain of GRE prep in a time called graduation summer break.

We are all told about this hour of complete relaxation, no worries, and grand optimistic thinking, but does it really exist? Tim Jones, a 2005 graduate, over the course of this break went on a journey to Europe visiting England, Scotland, France, The Netherlands, Germany, Switzerland, Italy, Spain, and Portugal. Meeting him shortly afterward, he appeared to be totally exhausted but emanated an aura of sublimity unlike any other. No doubt his adventure, which allowed him to see things most only read about was well worth it. Tim plans to attend UF's department of physics this fall.

The romantic journey in far off lands may not be for every one. Physics over these past years has perhaps drawn you in and your enthusiasm for graduate school is enormous. Shannon Sankar, another graduate of 2005, went off to study at the Australian National University in Canberra. Joe Cainford, Linda Watson

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An Irish Research Experience

by Katherine Keller

This summer I had the pleasure of participating in the physics Research Experiences for Undergraduates (REU) program at the University of Notre Dame in Indiana. The goal of this program is to provide students with an opportunity to experience a research environment and help them decide if physics research is right for them. The program is funded by the National Science Foundation and includes a stipend, housing, and travel expenses as well as many free meals!

There were 18 other students in participating in the Notre Dame REU program and we all seem to have gotten very lucky, because everyone got along very well. We were soon planning many of our own activities, including lake trips and barbeques. There are even plans for an REU reunion this fall.

My research for the summer was in Biophysics working under the supervision of my advisor, Professor Veretennikov. The official title of my project was Magnetic Resonance Imaging of Granular Materials. The first two or three weeks consisted of me learning about magnetic resonance imaging, figuring out how to use the equipment, and asking my advisor lots of questions. The rest of the summer was spent running experiments and analyzing the data that was gathered. At the very end of the summer, there was a symposium at which all of the REU students presented their research. We also wrote research papers which will be published in a book and distributed to each of our schools.

During the summer, we had the opportunity to visit both Michigan State University (MSU) and Fermi National Accelerator Laboratory (Fermilab). At MSU we met with REU students there and received tours of several of the labs, including the National Superconducting Cyclotron Laboratory. At Fermilab we were taken on a tour of the DZero experiment and had a question and answer session with a scientist there.

Each week we attended a seminar given by one of the professors working with an REU student. We received free lunch at these so no one ever missed them! Also, every week we would get to go out to dinner with a professor and ask him or her questions.

REU programs are offered at universities around the nation in science, mathematics, and engineering related fields. I, for one, found this past summer to be an incredible learning experience. I got to participate in research at an exceptional university and made a group of friends whom I will never forget. I would recommend that all physics students participate in an REU at some point in their undergraduate career. Those interested in finding out more about REU programs can go to www.nsf.gov/crssprgm/reu/

Where Are They Now...

continued from previous page

and Eddie Calleja also hung close to the academia by continuing their research. Joe, who double majored in chemical engineering worked in UF's chemical engineering department for the summer and will be enrolled in UF's material science PhD program this fall. Linda, went to work with Dr. Fred Hamann researching Active Galactic Nuclei at UF's Astronomy department. She plans to pursue a PhD in Ohio State's department of Astronomy this fall. Eddie, who worked under Dr. Lee, continued his research for part of the summer then left for Miami to enjoy the company of his family. Eddie will be enrolled in the PhD physics program at the University of Colorado this fall.

The overall consensus is that graduation summer break is clearly a transition from one world to the next, a time less stressful from the year before. Some keep their adventures close to home and some travel abroad. What is important here is that within this time one remembers one's accomplishments and pushes on to the next level. Good times are lurking about and those who seek will surely find them.

photo in this article courtesy of Tim Jones

Restaurant Reviews

by Joe Gleason

Kazbors *$6 - $15*

Location: 39 ave. just West of 43rd st.

If you're sick of Fridays, here's a sports bar with better prices and some tasty dishes. Another plus is the Northwest location which gives one a break from the college crowd and might even remind you of your home town. The buffalo chicken sandwich is a personal favorite. For dessert the peanut butter taquitos are a must.

Moragot *$15 - $30*

Location: right next to Kazbors

I had heard a lot of buzz about this place and decided to finally try it a few months ago. Moragot (yes you pronounce the 't') serves up Thai as well as other Asian dishes in a quiet atmosphere. Indeed the food was excellent but not enough to justify the high prices. Though it was the most overpriced item on the menu, the soup was uniquely delicious among Asian cuisine in Gainesville. For a better value (minus the excellent soup) I would recommend Bahn Thai on Southwest 13th street.

Dragonfly *$12 - $40*

Location: Union St station Downtown

Unlike The previous contender this one can justify its price. Without question the best sushi I have had in any city. From the taste to the artistry, and the uniqueness of flavor and texture that goes into every specialty roll, Dragonfly is a place worth driving to from out of state to experience. Also unknown to many are their excellent Korean dishes, such as the Calbi (Korean spare ribs), which are available for lunch at a discount. As far as sushi recommendations are concerned, just throw a dart at the menu. Until the much anticipated expansion into the old Hooters building, expect as much as a 2 ½ hour wait on weekends. No they don't take reservations.

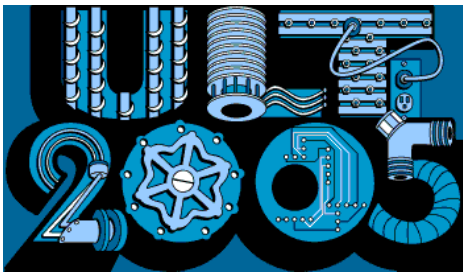
43 Street Deli *$5 - $15*

Location: Williston Road

Any native Gainesvillian can tell you that the 43rd street deli has the best breakfast in the city. What many don't know is that they recently opened a third location on Williston road just east of I-75. To any of those hesitant to stray from their old breakfast spot I can tell you fear not, this is the best 43rd street deli of them all. Not only is the food better but the service is more professional. Possibly the biggest advantage of all is that you avoid the 30 minute wait that is sometimes encountered at the 13th street. location, which by the way, has declined in quality in recent months due to a new cook. My personal favorite here is the eggs benedict available in several different varieties but only available on Sundays.

Ultra Low Temperature Physics Conference

by Amruta Deshpande



August 17th through August 20th, the New Physics Building (NPB) was host to the Ultra Low Temperature Physics 2005 conference. Such events are at those rare times of the year when the large and spacious NPB lobby shows its true capacity. Around one hundred and forty people, mainly from US, UK, Japan, and Europe, shuffled chairs and rattled tables for three days straight between efforts to recognize the new front of Ultra Low Temperature Physics. An entire conference took place amongst the lobby exhibits and in lecture hall 1001 thanks to the efforts of conference chair Yoonseuk Lee (UF), coordinator Carol Binello (UF), and co-chairs Neil Sullivan (UF) and Eric Palm (NHMFL).

The conference did not entirely occur at the NPB however. The reception held on Wednesday, August 17th, took place at the Florida Museum of Natural History and provided some wild entertainment. Amidst good food, drink, desert, and the stimulating museum, a special room was set up where Louis Gillette Jr. of UF Zoology brought in live baby alligators for the conference goers to see and touch! Dr. Gillette and with his assistant carefully placed gators on their arms and watched while people pet them hesitantly or adoringly. A few bolder individuals took on the gators themselves, reassured, I'm sure, by the fact that the gators' mouths were held closed. This event was made particularly distinct by everyone's bright orange shirts, as person after person eagerly put on the free shirts he or she received at entry. After a fine social evening the orange sea receded out doors as travelers went to rest up for the following days' physics stimulation.

Each day started with breakfast, went to sessions (talks), which had one coffee break before the lunch break, or the end of the day. Each session had a chair of its own who was allotted a half hour time window to present his or her research. The following talks were to present within twenty minutes. Two to three talks followed the chair speaker and a discussion ensued at the end. In contrast to student behavior in classes, enthusiasts here, found it difficult to hold their questions till the end and often a mini discussion took place before the next talk.

A wide variety of topics were discussed, and were sectioned off into related groups. Superfluidity, supersolidity, astrophysics, crystals, quantum effects and devices, and magnetism were a few topics. With such broad range, not everyone was an expert or even knowledgeable about all the topics which made for entertainment when one's own field was not being discussed. Popular demand encouraged a special session after all talks had finished on Thursday for a discussion on supersolidity. The nature of this session was to resolve questions that were raised due to differences between theory and experiments conducted in the search for supersolid behavior. Physicists mulled over their ideas, while gnawing on local Gumby's pizza.

Friday and Saturday remained well within schedule, and by 7 pm Saturday only four individuals were yet to leave the NPB toward their future destination. Many returned to the countries from which they traveled, while a few left in hopes of exploring the natural life around Gainesville. One ambitious pair hoped to observe alligators in the wild, while another wished to explore the natural springs and nature trails. After all was through, the student aids and benevolent helpers drew two important conclusions. The first was that conferences are very educational and well worth the fifty dollars registration fee if you're somewhat familiar with the topics. The second was that physicists looove their coffee. So as a piece of parting advice, if you find yourself on an organization committee for a conference, keep in mind that to sustain one hundred and forty people for four coffee breaks in a day, you'll have to order a minimum forty gallons of coffee!

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

Photo Credit: Pradeep Bhupati

Louis Gillette Jr. of UF discusses alligators with intrigued conference goers, while casually yet carefully handling a baby one under his arm.

"Yes," a sign said, "they do bite!" This presentation of baby gators took place at the reception that occurred the night before the conference.

The Society of Physics Students

Are we having fun yet? Stop by the Society of Physics Students (SPS) lounge, room 2229, and you'll find that question pasted to a clock inside. Sometimes, the answer is "yes", though the physics students who inhabit—I mean, visit—the lounge might not admit it. Other times, the question mocks us, and we'd be better off without its particular brand of humor at 2 in the morning.

The physics major is no walk in the park; it's more challenging and interesting than that, and getting to know your classmates is part of the fun. Joining SPS is a great way to find out about opportunities in the physics department and to meet people who share your interest in physics. **The first SPS meeting of the year will be Thursday, September 1 at 6:00 PM in rm1101 of the New Physics Building.** There are no membership fees. All you have to do is show up, help yourself to some free pizza, and we'll tell you about ourselves and the nifty activities we have planned this fall semester.

Hope you can come!
Cathy Yeh
2005 - 2006 SPS president

Shuttle Party Turned Day at the Beach

by Cathy Yeh

SPS organized a trip to see the Discovery shuttle launch on July 13. Tim Jones, fresh from backpacking in Europe after graduating in Spring 2005, offered to host the shuttle party at his home in Cocoa Beach. Wishing to avoid the traffic near Cape Canaveral and knowing that Tim's parents probably wouldn't be in town, SPS decided Tim's house would be the best destination. Around 20 people gathered at the loading dock of the physics building Wednesday morning to carpool to Cocoa. An even mixture of undergraduates and graduates turned out, with two German post-docs thrown in for good measure. Graduate students Charles Perry and Joey Nicely went to Sam's the previous day to stock up on hamburgers, buns, salsa chips, spicy mustard, and other necessary shuttle party food items.

The drive to Tim's took about 3 hours. A couple of hours before the appointed launch time, it began to rain. Florida once again asserted its identity as the suffocating sweaty towel state and the shuttle-goers could only hope for last-minute mercy from the rain gods. Then, the weather cleared! Blue skies, birds chirping, physics people frolicking, etc. Tim welcomed the travelers into his home, and many gathered around the television to follow news of the launch. Not more than half an hour after arriving at Tim's house and getting settled, the announcement was made: launch canceled. Canceled?! Something about a faulty fuel sensor. Disbelief eventually faded into peevish resignation, and a trip to the beach was in order to restore everyone to good spirits.

The vast majority of people who had turned out for the shuttle launch had the same idea, so getting to the beach was slow-going. However, when the grill was fired up and the smell of cooking burgers hit the air, it didn't seem so bad after all. Some people had the foresight to bring their swimsuits, and they sought refuge from the heat in the coolness of the Atlantic. Meanwhile, others sweltered in the shaded picnic table area chatting about anything from the Heimlich maneuver to coherent states. Around 6 PM, the shuttle-goers headed home, except for a few who stayed overnight at Tim's. Although the launch was canceled, it had still been a nice day at the beach, and the graduate slaves from the basement of the NPB received a welcome reminder of what the sun looks like.

For those who want a moral to the story: Bring a swimsuit to shuttle launches.

Note: *Discovery was finally launched July 26 and returned safely on August 9th. Foam debris, fatal to the Columbia expedition in February 2003, was still a problem. Space shuttle Atlantis' flight, originally set to for September 2005, is postponed until the foam problem is resolved.*

Female Physics Forum

by Erica Bolin

On March 21, 2005 the Female Physics Forum presented guest speaker Anna-Lisa Paul, a UF horticultural scientist. You might initially wonder how she has any connection to physics. The answer lies in the nature of Dr. Paul's research with plants (and perhaps a little in being wife to Dr. Meisel here in the Physics Department). In fact, Dr. Paul has worked with NASA on experiments studying the growth of plants at low gravity (levitating plants). Her position as a woman in one of the 'hard' sciences (as opposed to the 'mushy' social sciences) was a focus of the talk. A variety of topics were discussed, including how the trend of number of women in the sciences decreases on the scale of 'mushy' (psychology, social sciences, etc.) to 'hard' (physics, mathematics) sciences. An insightful discussion followed concerning the preference/skill of men and women, their approaches to problems, and whether different fields attract one gender over another due to higher intelligence vs. different kinds of intelligences. The issue of children and family also surfaced, and Dr. Paul had quite a profound response to the question "When is the best time to have kids?" Her answer: "There is no right time." She went on to explain that it's just something you have to make a priority and devote time and energy to if you want it to work. One factor in her success as both a scientist and a mother is the contribution of her husband. Also in the sciences, he was able to understand and support her in a way that someone in another field might not. One final topic of conversation I'll mention is probably the part I enjoyed most. When asked about her view of sexism in the workplace, Dr. Paul noted that she had rarely been victim of a direct attack and that women should not raise a red flag just to make noise, but rather when circumstances are severely inappropriate. While discrimination should not be tolerated, hypersensitivity and distrust shouldn't be the main defense, but rather being a good scientist and proving the naysayers wrong. More info on the FP Forum can be found at http://www.phys.ufl.edu/~lbaudis/wip/

A Model Rocket Adventure *What went wrong and right*

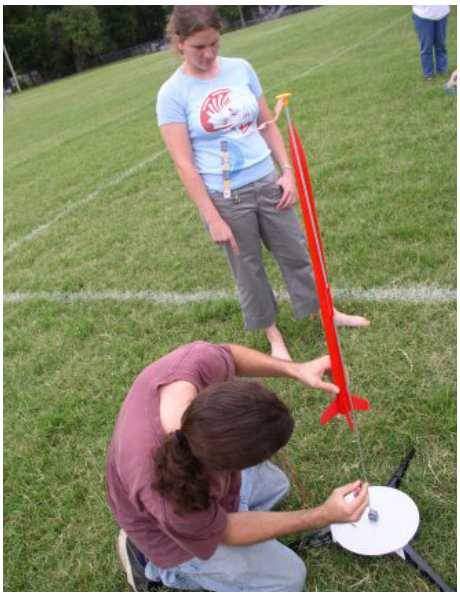
by Cathy Yeh

The UF chapter of SPS received a Marsh White Award from the national SPS organization in 2004-05 for a proposal drafted by then secretary Linda Watson. The proposal was entitled "Discovery: Rockets in honor of Columbia and with hope for Discovery." SPS proposed to build two model rockets in honor of the Columbia space shuttle which was lost in re-entry over Texas on February 1, 2003 and to inform children about the next Discovery space shuttle launch. Arrangements were made with the Girl's Club of Alachua County for the first launch and presentation.

Before the visit to the Girl's Club, SPS members Amruta Deshpande, Ivan Diaz, Youssef Faltas, Jacob Tosado, Linda Watson, and I worked on the model rockets. Two model rocket kits, the Rising Star and Aspire, were ordered from www.apogeerockets.com, and the motors and launch pad were ordered from www.ehobbies.com, all at very reasonable prices. We assembled the rockets in the first building session and spray painted them red in the second session. Then, the higher authorities gave us a thumbs-up to hold a test launch at Flavet Field (always good to let the UPD know when you are going to launch rockets on campus).

In addition to the rockets, we assembled homemade altiscopes consisting of protractors and weighted strings taped to rulers. By measuring the distance from the point of observation to the launch pad and the angle of inclination, we would be able to calculate the maximum height reached by the rockets with basic trigonometry. The altiscopes were part of an interactive activity we planned for our visit to the Girl's Club.

In the afternoon, Ivan, John Harter, Jacob, Linda, and I carried our rockets and boxes of other launching miscellany from the physics building to Flavet Field. Unfortunately, the test launch left much to be desired. The Rising Star, the smaller, lighter rocket of the two far exceeded our expectations and dashed out of the field towards Fraternity Row. We had underestimated how much the wind would affect the rocket's trajectory, and the parachute also never deployed. Furthermore, our first attempt to use the altiscopes was a disaster since our observation point was too close to the launch pad to read a reasonable angle of inclination. Our altiscopes traced 90 degree angles, which would be alright if the Rising Star really had broken a few laws of physics and traveled an infinite distance. To top it all of, it began to rain.



Above:: Jacob prepares the Rising Star rocket for the test launch while Linda looks on.

Below:: John, holding the Aspire rocket, is surrounded by tiny fans.

We decided not to risk launching the remaining Aspire rocket and terminated the test launch session. However, Linda and I were unwilling to give up on the Rising Star without a proper search. Maybe we would be able to locate our rocket the way Homer and his friends did in the movie "October Sky." Well, life and the movies are two different things. After about an hour picking through beer bottles and other sundry items one might find in the backyard of fraternities, we returned to the physics building, crestfallen and empty-handed. One rocket would have to do.

In our visit to the Girl's Club on June 13, John, Linda, and I were joined by two students from the National High Magnetic Field Lab REU program doing summer research at UF, Kim Wadelton and Marianna Worzcak. We made our presentation to an audience of middle and early high school girls, the oldest age group in the Girl's Club. Linda discussed the loss of Columbia and passed around photos of the crew. She also reminded the girls of the next shuttle launch scheduled for July. Then, Marianna and I explained the basic workings of our model rocket, and Kim tried valiantly to teach some trig. to the girls as she demonstrated how to use the altiscopes. We emphasized the basic formula: height = tangent(angle of inclination)*distance, where distance is the distance from the launch pad. The girls were divided into groups of 5, and each girl was assigned a task e.g. altiscope operator, recorder, calculator. We also promised candy prizes to the groups that could most accurately measure the height of the rocket (a little candy can go a long way).

At 1:45 PM, we headed out to the field. John, rocket in hand, turned to me and said, "I hope it launches." Surveying the field of 80-90 wriggling, expectant little girls who were lining up around the baseball diamond, I knew what he meant. Our recent hapless test launch of the Rising Star was no comfort, and who knew if the Aspire would fare any better. John began setting up the rocket while grey clouds loomed overhead. Then it began to rain. Despite having lived in Florida most of my life and knowing well the futility of shaking one's fist at a rain cloud, I couldn't help wondering if Gainesville's precipitation had a malicious mind of its own. Oddly enough, the little girls' spirits weren't dampened. Instead, they began to chant, "Rocket! Rocket! Rocket!" Finally, the rocket was ready and we began the countdown. "10, 9, 8, ..., 3, 2, 1, Lift off!" Nothing—not even a sizzle. Our audience was really reaching a critical state now. John replaced the igniter, and another countdown was started. This time the rocket shot into the air, accompanied by the sound of cheering little girls. SPS members made a mental note to buy extra igniters for future launches.

We retreated indoors as the light rain turned into a downpour and compared the groups' altiscope measurements. Everyone had measured an angle of approximately 50 degrees. Calculating that the rocket had flown up a reasonable 150 feet, we congratulated the girls for their efforts. Everyone got candy.