ACU Department of Engineering and Physics
Weekly Summer Research Newsletter

Volume 19 Issue 3
June 10, 2013

DANGO (Doings and Goings On)

Winner of last week's Photo of the Week Contest

"We found Ghost Rider" –Ryan Pinson

Updates from the Students

From Adam Simpson:

Hello DANGO!
For those of you who don't know, I'm doing research in Colorado with a theoretical physics research team. Today is officially two weeks since I started. The goal of the group is pretty interesting, we are focusing on the question "what is the macroscopic?" This question arose from a paper that my research professor read and conversations he had while abroad last summer. The gist is to explain classical phenomena through quantum mechanical means. And this goes beyond just quantum gravity. While thermodynamics is pretty well explainable through a quantum mechanical theory, the effects of chaos theory in classical mechanics doesn't actually come out or make sense in quantum mechanics. Looking at these gaps is sort of our overarching theme.

Interestingly, each person in the research group works on distinct projects. My first week was devoted mostly to exploring different possibilities for my own research and trying to decide on a particular focus for my work. It really put me in perspective when my research professor asked me, on my second day, to try to derive the bright and dark soliton solution to the nonlinear Schrödinger equation (NLS). What was even better is that this was only one of three requests he made for that

day. Most of that day was spent trying to understand what he had actually asked me to do. I found out that solitons are elastically interacting, non-degenerating waves. An example of a soliton is a surface wave in shallow water. They also come out of optics and are used in fiber optics since they can preserve information so well. A 2-D soliton is called a vortex.

Ultimately, I have chosen to focus on the soliton solutions of the NLS and attempt to add potentials to the equation to see how a gravitational effect might influence the solutions. In particular, I am looking at the gravitational self energy that is theorized as a gravitational effect a particle enacts on itself as one end of the probability density pulls on the other end. I then will alter the potential into a screened Yukawa potential and see what happens. A Yukawa potential is the screening potential used to explain the screening effect of internal electrons on valence electrons for the electromagnetic force on atoms. Adjusting this into a screened gravitational potential will be interesting and I am looking forward to the possible results I may get.

However, my research professor has been on vacation with his two sons for the past week or so, and I am still basically trying to derive the right soliton solutions. I have produced an equation for a Lorentz invariant system, but I don't believe that the Lagrangian that produces the NLS is Lorentz invariant. Hopefully I can resolve this soon and get into some of the more interesting aspects of the research I will do.

On another note, Emily and Eaoin should be arriving today (June 5th), and I am incredibly anxious to see them! They were back in Abilene until now so that they could move into our new house, but I needed to come up to start my work. I haven't seen them in two weeks and I couldn't be more excited. If anything exciting happens I will let you know. Until next time, keep it classy DANGO.

–Adam Simpson

BROOKHAVEN NATIONAL LABORATORY

From Ramsey Towell:

Annyeong DANGO,
So this entire week we have been on our own up here in the wild North East since my father and Dr. D left us. We don't really know where we are going to be working on the lab for the rest of the summer, so we have been working in a different building almost everyday. We have been writing code that takes information about the high voltage of the RPCs from the PHENIX database and thanks to Andrew's programming prowess, we are way ahead of schedule.

Also, we had the PHENIX End of Run 13 party on Thursday so we got a pretty good free lunch and got to watch a bunch of old physicists shoot off a bunch of bottle rockets with varying amounts of success. Next week there is the RHIC End of Run 13 party and I just hope that it is as entertaining as the PHENIX one.

In other news, we are watching Arrested Development from the beginning so that we can watch the new season that just came out. We are also keeping up with the NBA Finals so that we remain cultured about American society, and we almost exercised yesterday by playing ultimate frisbee with some people, but we ended up just playing League instead. Oh and if you didn't do this already, you should zoom into Ryan's photo from last week and read the guy's motorcycle. It makes a whole lot more sense close up.

Tchuss,
Ramsey

From Andrew Miller:

Hello DANGO,
This past week we started writing some programs to read through the high voltage database and find out when all the channels of the high voltage are on, so that we can use those times to make efficiency measurements of the RPCs. We actually

already have several programs that work! Now we just have to decide if what they are doing is what we want. Aside from our computer work, we also began taking down the hodoscopes that are set up on the cosmic test stand in the factory. Apparently the PMTs and some of the scintillators were borrowed from UIUC, so we need to figure out which ones are which and pack them up to be shipped back. In the meantime, there are some hodoscopes being made for a smaller test stand, so we may also be helping with that next week.

There was an End-of-Run Party yesterday that was a lot of fun, there was some really good food being grilled and also a bunch of experimental bottle-rockets being launched. Unfortunately, we all forgot to take pictures, so just imagine a 4-gallon water jug being launched into the air. Maybe next week I will remember to take some good pictures for the PoTW...

This weekend we have some work ahead of us as we'll be moving all of our stuff to a new apartment, and cleaning our current one for the Towell family when they arrive on Sunday evening.

Until next week,

Andrew

From Marshall Towell:

Hey Dango,

This week we went to the factory a couple of times in the morning and removed about 22 hodoscopes and have them all laid across the table and covered with padding so we can ship them out when we need to. I have also been working a lot in the terminal and have been making a code that will go through the cosmics runs and then list the run number, the time time the run began, and the time run ended for each run that did not trip. We also had the end of the run luncheon yesterday which was very good and it had some good BBQ for NY. Nothing comparable to Texas though. It's been raining a lot and we're about to go to a Seminar after work so until next week Dango.

From Ryan Pinson:

Hey DANGO,

This week was quite eventful on the work front. We started programming code for our first project and have made quite a bit of progress. This project mainly focuses on pulling information from a database and filtering it in varies ways. We have been using a combination of sql, c++, and csh codes to accomplish this purpose. Also we took down hodoscopes from a rack, that were not being used, in preparation to return the pmt and scintillator components their places of origin. Mainly I have been practicing programming as well as writing some small pieces of code to be used in a project.

As always, there has been a considerable amount of League of Legends. This week started the end of run parties and there was a luncheon Thursday which made an extremely good lunch break. Also we have begun to move into a new apartment in anticipation of the Towell family's arrival and I am looking forward to the next few weeks of work as well as looking forward to going and visiting NYC in the near future.

–Ryan Pinson

Fermilab

From Lacey Medlock:

Hi,

This week we made lots of clip lines and I sorted through a lot of tapes. I put tape on the resistors and zip ties on the clip lines and tested them with the multimeter. I think I'm going to be doing that in my sleep for a while. I still don't have a project for the rest of the summer, but I'll probably get one soon.

Have a great week,

Lacey

From Noah Kitts:

Greetings to all! Yeah so this week has been really productive! We finished making clip lines for

all the Hamamatsu bases for station 3X. I also set up the cosmic ray testing for my beam monitors. We have also started sorting through / throwing away all the old tapes in the counting house. There are a ton! (Last time I counted there were about 197,000 tapes). I hope everyone is having a great week.

–Noah Kitts

From Ryan Castillo:

At Fermilab, we've started the summer off with hodoscope inspection, improvement, and testing. Each of us also has solo project, so we've got our hands full at the moment. This week I've participated in assembling clip lines for our Station 3 hodoscopes. These devices consist of a BNC "T" connector with a 20 inch long twisted pair of wires soldered to one side and the other side open for the signal cable from a PMT. A 27 Ohm resistor is soldered to the other end of the wire. These clip lines are intended to cut the hodoscope signal widths in half. My solo project for the summer is to write a generic interface for controlling HV on our hodoscopes, wire chambers, and ASDQ cards. This is going to involve learning some more Perl and diving into the MySQL database. Should be fun.

Outside of work, I've been watching Doctor Who, enjoying my girlfriend's presence, spending time with her family, and putting lots of barbecue sauce on my food. Fermilab's internet is lazy where we live, so we have been spending a solid amount of time playing board games, socializing, and not sleeping.

Best,
Ryan

From Spenser Lynn:

Hello DANGO,
We finally arrived at UIUC on Friday and have gotten settled in our apartment. Between graduation and now, I've been traveling around Texas visiting family and relaxing a bit. Over Memorial Day weekend, I went to Lawton for Tyler Hague's wedding which was a ton of fun. We start work Monday morning so there will be more physics things to report on in my next entry.

–Spenser Lynn

From Kristin Holz:

Hello!
I'm glad to be joining in on the DANGO. I've actually been at UIUC for two weeks now and a lot has happened during that time. I'm working with Dr. Steve Errede on a physics of musical instruments internship where I get to do research on my clarinet and collaborate with another research group making graphene loudspeakers and microphones.

During my first week I played four notes on my clarinet and analyzed the sound recordings in MATLAB to determine inharmonicities. I have also run three acoustic impedance tests on my clarinet where microphones measure the pressure and particle velocity at the mouthpiece and bell of my instrument across a range of frequencies that the "reed" vibrates, the "reed" being a piezoelectric transducer. My clarinet has to be placed in a somewhat soundproof box, and I have had to be creative in finding ways to plug up the holes and press down the keys to test different notes. But it's been interesting finding out the frequencies my clarinet resonates at and all the frequencies of any note or squeak I could possibly play for certain key combinations. In addition to clarinet testing, I have been working on COMSOL Multiphysics software to create a graphene electrostatic speaker simulation.

Apart from research, I joined summer band here, am starting to get connected with a church, went salsa dancing, and checked out the farmer's market. There are 14 other physics interns in the REU program at UIUC that I have been getting to know as well. One UIUC intern I recently met is working with Dr. Errede and is researching sono-

luminescence, which happens to be the topic of the latest MinutePhysics video if anyone's interested.

–Kristin Holz

P.S. You can look forward to some chocolate cupcakes in the near future. I just pulled them out of the oven. =)

From James Mallon:

How goes it DANGO,

We really haven't started any research or anything yet, but that's not going to stop me from reporting my doings and goings on. The trip up here was fairly uneventful, thanks to a newfound trust in America's Best Value Inn (there are really, really sketchy motels in Memphis) and my brother willing to do some driving. Europa House has some... interesting décor and, as necessary, Dr. Daugherity, Spencer and I acquired some swanky jackets to go with. Working on getting one for Chris. We're now settled in with all of our thrift shop goods and Wal-Mart groceries, and ready to start research in earnest this upcoming week.

Stay alive out there,

James

(apologies for the various advertisements)

From Chris Campbell:

Hi DANGO,

Wow, it feels strange to be writing my first DANGO report after compiling them all last summer. After spending the first four weeks of summer hanging out with family, I arrived in Urbana-Champaign by plane last Friday and met up with James, Spenser, and Kristin. We spent the weekend getting groceries, eating dinner with the Daugheritys, and going to the UIUC Rec Room for pool and bowling. Also, we had a bit of fun with the UIUC webcam that overlooks the Main Quad. Work starts tomorrow at nine, so I'll definitely have lots of cool COMPASS stuff to write about for the next DANGO.

–Chris Campbell

From Erik Forrister:

Well DANGO, I'm still working on the same project (the stepper motor to move the lens). On Monday, I successfully figured out how to stop the wheels with a single word, "sleep." I was then able to write a program to make it stop in half a rotation. This half rotation will move the lens about an inch. Now that I got this (assembly) code working, I decided not to switch languages (to C) quite yet, as I supposed I would do in my last post.

I spent the rest of the week learning about interrupts and serial communication. Through this experience, I was able to create a reset button earlier in the week. The reset button will cause my program to run again every time it is pressed, but eventually I will want to do something different. Up until Friday, I didn't see any real progress on the serial communication (serial communication is the communication between the computer and the motor while the program is running). With Dr. Head helping, we figured out a basic receive program. The next step is to get the transmit program working, and to implement it into my program to control the motor. I also will be working on the switch interrupt that will tell the motor to stop before it runs off the track.

This week felt a lot more productive than last week, but still it did not seem that productive. I believe my colleges have made significant progress in their various projects. Hopefully things will continue to improve.

–Erik Forrister

Updates from the Professors

From Dr. Michael Daugherity:

I spent most of the week packing, traveling, and trying to figure out how to work while dragging

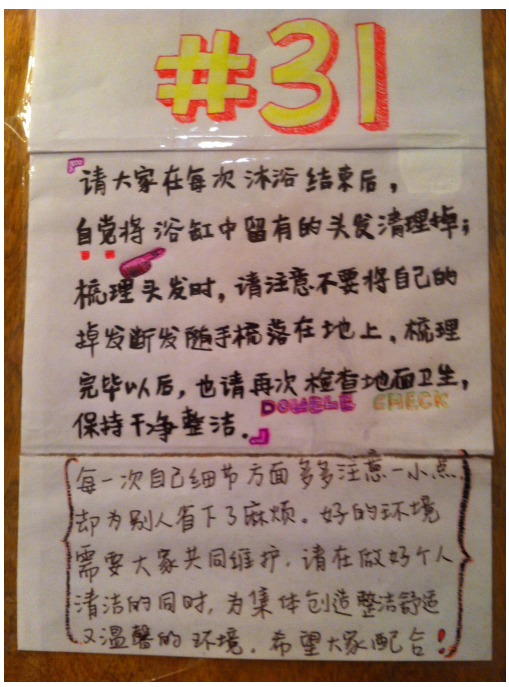
my family across the country. It might gratify you all to know that your professors have spent many late nights and early morning writing a paper and a powerpoint presentation to turn into the DOE. Every Department of Energy funded research group is getting called into headquarters for a review. It has been really interesting collecting the facts and figures to support our case that we are the world's best university for undergraduates in nuclear physics. My two favorites are:

1. ACU students have given over 100 CEU presentations in the last fifteen years

2. 77% of our summer research students go on to grad school in science or engineering

In a few days we will all fly out to Washington DC to give the presentation, so have fun being on your own!

–Dr D.



"The sign taped inside the bathroom door of my apartment at UIUC." –Dr. D.

From Dr. Josh Willis:

Liebe Dango,

I will try to keep the German to a minimum, but thought it might add an international flair to Dango. Or I'll change my mind and have progressively more of my entries in German as the summer progresses, who knows.

This past week has seen work on two fronts. First, I continue to have fun with trig identities (kids, pay attention in your pre-cal class!) as I work on what is called the B-statistic for precessing waveforms. Still no clue if that will all work out, or be for naught. On the other front, I ran our full analysis pipeline (called "ihope", and to be sung to the tune of the Seven Dwarves' song*) as a test. My main goal will be to rip out its guts and replace them with pycbc, but first I needed to make sure I could get it to run in its current incarnation. Since it took twelve hours to run on twenty-four hours worth of data (and I need to analyze two months), I'm not terribly optimistic this will all get done before the end of June when people like me working on inspiral searches will all meet up in Syracuse, NY to discuss these things. There's a reason American Airlines likes me...

Aside from that, we had not terribly cold weather and some sun for the last few days, so everyone has been saying variations of "summer—it's the nicest day of the year!" Yesterday they had what they refer to as a barbecue and I have given up correcting their usage. Many of you are spending the summer in parts of the US where people are similarly confused. I am also still trying to get paid—the secretary told me that the HR staff (who are not in Hannover, but outside of Berlin) had emailed me asking for my bank account details, but I had received no such email. Only later did I think to look in my spam folder, since that's almost certainly where an email asking for my bank account details would be likely to land. It wasn't there either, but they assure me I'll get some money next week, hopefully before rent is due again at the end of the week.

If it has not been on the US news (and I don't

know) please keep in mind that there has been severe flooding throughout much of Germany (especially the south) as well as Austria, Hungary, the Czech Republic, and possibly elsewhere. In many cases the worst flooding in several hundred years, and some rivers are still a few days away from when they are expected to crest. So please keep that situation in your prayers.

Tschüss, (spelled correctly this week, complete with umlaut!)

Josh

*The author list of the first draft of the paper describing this pipeline was in fact "Snow White and the Seven Dwarves," so I'm not the only one to think that.

From Shon Watson:

Dear DANGO,

I am back in Abilene this week. I have been busy working on the NIFFTE fast data acquisition software. I have been trying to improve the performance of the packet receiver program.

Recent tests measured the packet receiver's performance to be around 55 megabytes per second, but the desired throughput is 100 megabytes per second. I have almost finished improving a buffer issue that should save some CPU time. I will continue to work on this next week. I hope to make a lot of progress.

–Shon

From Dr. Rusty Towell:

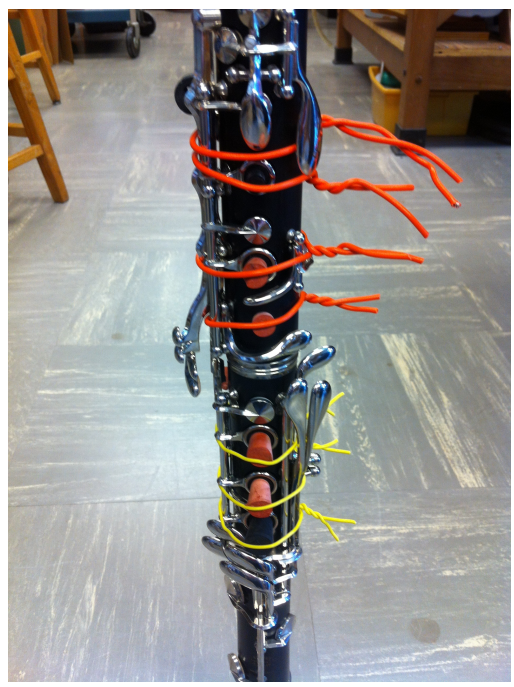
Hello Dango,

I worked in my office at ACU on mostly departmental and administrative stuff. On Thursday my family and I started the long drive to BNL.

–Rusty

Photo of the Week Candidates

#1: "Traditional ACU group picture in front of the BNL sign." –Dr. Rusty Towell



#2: "It seems that rubber stoppers and scrap wire is a decent equivalent to fingers in this case." –Kristin Holz

#**3:** "Scrabble Night" –James Mallon

#**4:** "Kristin is a pool shark." –Spenser Lynn

#**5:** " Spenser and James chowing down on Kung Pao Squid." –Dr. Michael Daugherity

#**6:** "My family's view (from Abilene) of me on the UIUC QuadCam." –Chris Campbell

Other News

25 Years of Cookies

Lois Marie has served our department for 25 years. Please take a minute to estimate how many cookies she has lovingly baked for us then drop her an email and tell her how much you appreciate her.

New Students

The department of Engineering and Physics expects to welcome over 60 new students this fall. This will be by far the largest group of new students ever for our department and three times the number of engineering students as expected. Plan now to help us welcome them to our department.

Wildcat Video Minute

We are highlighting the Physics and Engineering departments in our July episode of the Wildcat

Video Minute. The only footage we are lacking is some shots from the students in New York and Chicago at the laboratories. We will need about ten different shots of students working in groups, close-ups of machinery, classroom setting, etc., to help show the students in action. You can review the script below in case there is something specific at your location that makes sense to film and send to us.

We are hoping you and/or your students can provide us a few shots in the next week or two to work with. iPhones, other smartphones or digital cameras will be perfect. Just make sure to keep the phones turned sideways and shoot horizontally, not vertically. This will match the footage we have shot.

- Keep your shots steady
- Hold on your subject for a good five to ten seconds
- If there is action you think you should follow, please be careful to move smoothly, then wait at the end of the move to steady-up for a few seconds
- If in doubt, hold your shot
- Oh, and shoot more than you think you could possibly need.

Fall conference

2013 Fall Meeting of the APS Division of Nuclear Physics October 23-26, 2013 Newport News, VA. http://www.aps.org/meetings/meeting.cfm?name=DNP13

New alias for our department:

acu.edu/engineering-physics

New Faculty

Dr. Matt Steele arrived in Abilene on May 25. He will join the Engineering and Physics faculty in the fall. Be sure to give him a warm welcome!

The Particle Data Group Announces:

The 2012 edition of the Review of Particle Physics is now available on the Web: http://pdg.lbl.gov/

- Summary Tables
- Particle Listings
- pdgLive
- Review articles

The PDG recommends our website for the public: ParticleAdventure.org

We thank the 700 members of the particle physics community who contribute to the Review of Particle Physics.

We always welcome your suggestions for improvements.