ISPP Reminder

Our Next Meeting… December 2009

…is the Tri-Phys Meeting at Elmhurst College
Wednesday, January 13, 2010
5:30 for Pizza ($5) and 6:30 for Meeting

At our last meeting…

John Milton and his colleagues at DePaul welcomed us.

John Milton (DePaul University) opened the meeting with a twist on a familiar torque demonstration originally presented by Roy Coleman. He took a PVC Jensen bar and hung two containers of water from each end. The bar was in equilibrium in the horizontal position. He then removed one bottle of water from the right end, and immersed the lower of the two bottles from the left end in a beaker of water. When the bar was released, it remained in equilibrium in the horizontal position. This demonstration illustrates that the buoyant force on the lower of the two jars on the left is equal to its weight, so the net torque on the bar is still zero. All of this was done with an inexpensive PVC Jensen bar and some old "Koolaid" containers, reminding us that "torque is cheap," to quote one of our phunny attendees.

John then made several announcements:
The Materials Research Center at Northwestern University has Research Experience for Teachers available this upcoming summer. The program runs from June 21 through August 13, 2010 and teachers receive an $8500 stipend for the summer. The application deadline is March 15, 2010. For more information, or to apply, please visit http://www.mrsec.northwestern.edu/content/educational_programs/ret.htm.

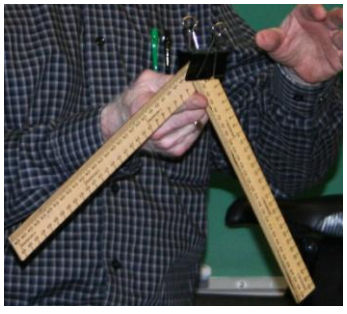
The National Space Society's 2010 International Space Development Conference will be held Memorial Day weekend (May 27-31, 2010) here in Chicago Illinois at the new InterContinental O'Hare Hotel. For more information, visit www.isdc2010.org. They are accepting papers up until March 1, 2010.

DePaul University announces a joint B.S./M.Ed. program in Secondary education: students obtain a B.S. in physics (or one of the other sciences) after four years, and during years 3-5 incorporate education courses and experiences in schools, culminating in student teaching during the 5th year. The student would also have a M.Ed. and Secondary Certification at the end of five years.

The AAPT High School Photo contest is accepting entries until the May 15th deadline. See the website at http://www.aapt.org/Programs/contests/photocontest.cfm for more information. There were more than 800 entries last year, and the top 100 from the first round of voting are displayed at the national meeting and then voted on by the attendees at the national meeting.

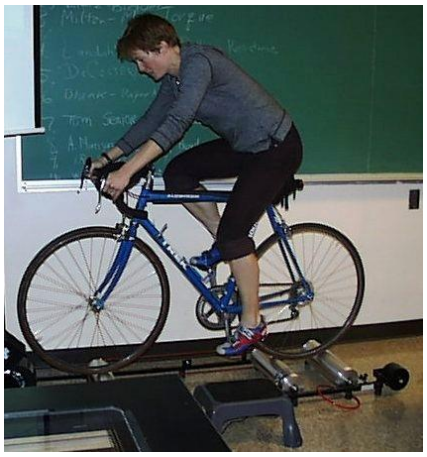
The CSAAPT Spring meeting will be hosted at Chicago State University on Saturday, April 24th, 2010. Eric Mazur, from Harvard University, and Nadya Mason from University of Illinois will both be speaking so mark your calendars.

Gerry Lietz (DePaul University, retired) then showed several pictures related to a recent interest of his: recumbent bicycles. A comment from a non-physicist related to the lower center of mass and thus relative "ease" of riding the bikes led him to explain the physics behind the bikes to us. He had several pictures of various types of bikes, including the tadpole trike, which is the type he rides. He talked about the higher center of mass on a standard bike creating a greater moment of inertia about the contact points with the ground, and thus a greater stability for the standard bike, contrary to popular belief. An article by David Jones on "The Stability of the Bicycle" is available at http://www.phys.lsu.edu/faculty/gonzalez/Teaching/Phys7221/vol59no9p51_56.pdf.



John Milton (DePaul University) then demonstrated a lab he has his students do where they clip three rulers together and measure the change in center of mass (or center of gravity, as they are the same in a uniform gravitational field) as the orientation of the rulers is changed. The three are clipped together at one end, and the outer two each make an angle q with the center ruler. The students plot the center of mass location as a function of q, with the result being a cosine graph (plus a constant). The giveaway was a set of rulers, a clamp and the write-up for the lab that John has his students perform. He also discovered that the rulers, even though they came from the same manufacturer ($7.95 per dozen from Sargent Welch) varied in mass from 10.5-14.5 grams per ruler. The clamps have a mass of about 22 grams.

Gerry Lietz then used the rulers and clips to demonstrate how the ruler with a low center of mass is less stable against changes of rotation than a ruler with the clip at the top and a higher center of mass.



Eric Landahl (DePaul University) and his wife, Sarah Rice (biophysicist, Northwestern University) demonstrated the use of Vernier Logger Pro to measure power output of a cyclist and to measure rolling friction on the roller she uses at home to train for her triathlons. Robbie Ventura is local to the DePaul area and he trains cyclists to maximize their power output on a bicycle as they train for prestigious races such as the Tour De France or the Chicago Triathlon. Rollers are a great way of looking at power output on a bicycle. Eric and his wife measured the deceleration rate on a "coast down test" using the Logger Pro and a photogate. A piece of duct tape on the center roller was used as a flag for the photogate. Sarah rode the bike up to speed and then let it coast to a stop on the rollers. A paper that they wrote describes how to use the acceleration as measured by the photogate to calculate the coefficient of rolling resistance ($F_{f\text{-}rolling} = C_{rolling} * F_N$). You can get a copy of the paper by contacting elandahl@depaul.edu. Robbie Ventura, in his training studio, can hook up the rider to a machine that uses user-defined Eddy currents to simulate various stages of the Tour De France. The training roller runs a couple of hundred dollars for a state of the art version such as they used in the demonstration.

Rich DeCoster (Niles West High School) used two toys to demonstrate some basic (though misunderstood) concepts in physics related to Newton's Laws. He cited a question from two textbooks he uses which ask the student to explain how a rocket can move forward in space with nothing to push against. He launched the water-rocket vertically and showed that the water moves down, and the rocket moves up. He then compared that to a spring-loaded jumping toy, which pushes down on the table as the spring expands and jumps upward. The jumping toy, however, when held horizontally, simply expands and doesn't jump as it has nothing to push against. The rocket, however, functions just fine horizontally: the rocket pushes backward on the expelled water and the water pushes the rocket forward. And excellent demonstration of Newton's Third Law in action. He showed us how $F = \frac{dp}{dt} = \frac{d(mv)}{dt} = \frac{dm}{dt}v + m\frac{dv}{dt}$ and thus $F = \frac{dm}{dt}v + ma$. Most of the problems we do have a very small *dm/dt* so we just write *F=ma*. To be more correct, and accurately understand rocket problems, Newton's Second Law should be written as *F=dp/dt*.

Rich also brought us up to date on the latest news from the Large Hadron Collider at CERN in Geneva, Switzerland. One URL for updates on the LHC status is http://cms.web.cern.ch/cms/News/e-commentary/cms-e-commentary09.htm. As of 30 Nov, both beams in the LHS have now been accelerated to 1.18 TeV.

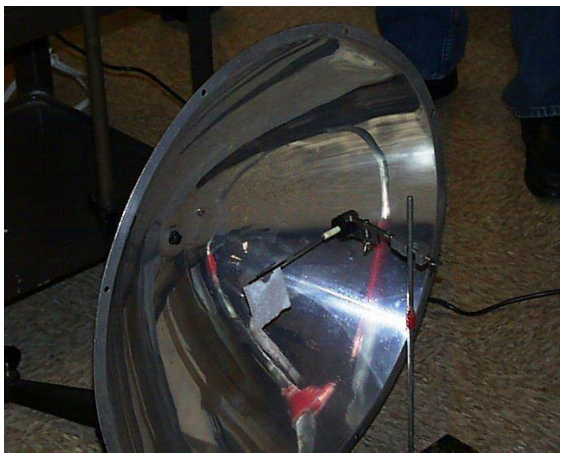
Bill Blunk (Joliet Central HS, retired) showed us an electric paper airplane launcher kit that he got at Amazing Toys in Great Falls Montana. It can be put together in roughly 30 minutes. These can be obtained from http://www.physlink.com/estore/cart/ElectricPlaneLauncherKit.cfm for $10 (though they are temporarily sold out as I write this) or from Amazon.com for $14. Simply "Google" "electric plane launcher" to find them. Bill suggested they could be used on one of those inconvenient days when half the class is out on a field trip: the remaining students could have a paper airplane contest. With the launcher, the variable "launching ability" is removed from the experiment and the planes can be compared on a more even basis.

Tom Senior (New Trier HS, retired) hooked up two speakers and played pipe organ music to demonstrate the effect on the sound of hooking up the speakers in phase and out of phase. When the two speakers face each other, the sound is significantly decreased in volume when the speakers are out of phase. He also demonstrated the effect of in phase and out of phase for white noise. When the speakers are close together and out of phase, one hears a higher frequency. As the speakers are moved apart, the "pitch" of the white noise decreases. This is not so pronounced an effect when they are in phase. The attendees spent a significant amount of time discussing why this effect is observed.

Tom's white noise generator comes from Audio Toolbox, which he also used to measure the frequency of certain palm pipes he made. He cut various lengths of palm pipes from ¾" tubing he purchased, and plotted frequency vs. 1/L and used Logger Pro to get the best fit line. Thus, one can make palm pipes from any inexpensive scrap pipe one has around, using the line of best fit to dictate which lengths make which frequency. We then played various tunes on the palm pipes that Tom brought and some that John Milton had in the stock room. http://download.cnet.com/WaveWindow/3000-2170_4-10532772.html for the Mac.

Andrew Morrison (DePaul University) gave us a demonstration of coffee cup acoustics. He demonstrated that by tapping at two different locations on the coffee cup, one obtains two different notes. One note is obtained when the handle (and its extra mass) are at a node, and the other when it is at an anti-node. When there is more mass (handle) oscillating, the pitch is lower. Then he filled it up with water. He talked about an experiment that can be done as one adds a fixed amount of water to the cup each time, measuring the change in pitch of the cup. The surprising result is that as a fixed amount of water is added, the pitch does NOT change by a fixed amount. He then used a microwave to heat up some tap water. He added some coffee and stirred it. As he tapped the inside bottom of the cup, the pitch slowly increased. Then he stirred the foam from the hot chocolate back into the solution, and the pitch dropped again. As he continued to tap, the pitch again started to rise. This demonstration showed how the presence of air (gas) in the liquid decreased the speed of sound in the liquid, thus decreasing the pitch of the sound. As the mug is tapped, the bubbles come out of solution, increasing the speed of sound and the pitch. When the bubbles are stirred back into the solution, the pitch decreases again.

Lee Marek (Naperville North HS, retired) demonstrated using parabolic mirrors and a heat source to set a piece of paper on fire. The two mirrors were placed roughly 2-3 feet apart, facing each other (concave sides inwards). The heat lamp filament was placed at the focal point of one mirror and the piece of paper at the focal point of the other metal. Lee also brought a second give away with some screws and nuts and some small incandescent bulbs, and springs. Art demonstrated the giveaway and challenged us to do something creative with the kits.



Eileen Wild (retired) showed us a mirrored ornament she found at Menards for roughly $15 which serves as an excellent convex mirror. She also talked to us about the astronomical society of which she is a member. She told us of an observatory built by the University of Illinois at Walnut Creek State Park. She said that her astronomical society has obtained permission to use this observatory for free, and she is inviting other star party groups to come use the observatory. Walnut Creek State Park is located about 3.5 hours south of here, east of the University of Illinois.

Future Meetings (Some dates to be determined)
Elmhurst, Wednesday January 13
NEIU, Thursday, February 4
Loyola, Wednesday, March 3
Lake Forest College, Tuesday, April 6 or 13
Northwestern, Monday, May 3
MSI, Tuesday June 1 or 8

Reported by Martha Lietz

Directions to Elmhurst College

For more information see the Elmhurst College web site:

http://www.elmhurst.edu/~earls/triphysics/

By way of Interstate 290
(Eisenhower Expressway)
* Exit at St. Charles Road, just west of I-294
* Travel West on St. Charles, past York Road, to Prospect Avenue
* Turn right onto Prospect for two long blocks, past the front of the campus on your left, to Alexander Boulevard
* Turn left onto Alexander Boulevard, then right again, into the main parking lot

By way of Interstate 294 (Tri-State Tollway)
* From the south, exit at I-290
* From the north, exit at I-290 West, then exit again immediately at Illinois Route 64 West (North Avenue)
* Follow North Avenue about a half mile, past York Road, to Maple Avenue
* Turn left. Follow Maple Avenue another half-mile, two blocks past railroad tracks to Alexander Boulevard. (Maple Avenue becomes Prospect Avenue after the tracks)
* Turn right onto Alexander Boulevard, then right, into the main parking lot

By way of Interstate 88 (East-West Tollway)
* Exit at York Road, just west of I-294. (Take ramp marked I-294 South)
* Travel north on York for about two-and-a-half miles to St. Charles Road
* Turn left on St. Charles to Prospect Avenue
* Turn right on Prospect for two long blocks, past the front of the campus to your left, to Alexander Boulevard
* Turn left onto Alexander Boulevard, then right again, into the main parking lot