ISPP REMINDER

March 2013

OUR NEXT MEETING. . .

. . . is at

Lake Forest College
Wednesday
April 10
6:30 - 9:00 p.m.

A map and directions are enclosed.

THE FREE GIVEAWAY . . . .

. . something you should find useful to excite student interest in physics - and who knows? - maybe even your own!

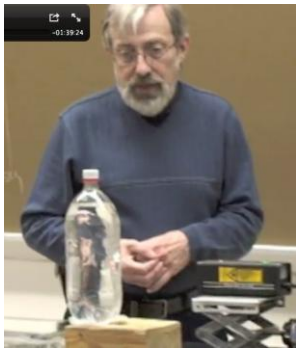
FUTURE MEETINGS. . .

Apr 10	(Wednesday)	Lake Forest College - Mike Kash/Bailey Donnally/Tom Senior
May 6	(Monday)	Northwestern University - Art Schmidt
June 4	(Tuesday)	Museum of Science and Industry – Ruth Goehmann

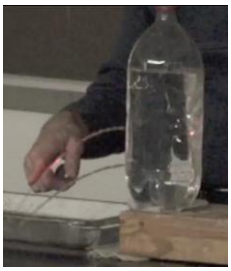
AT OUR LAST MEETING. . . .

Gordon Ramsey (Loyola University) opened the meeting by thanking his student helpers: Joe Kamberos and Alexandra Remus. He also introduced Tom Ruubel the lab director. Our next meeting is at Lake Forest College Wednesday April 10. Paul Dolan reminded us that the NSCA will meet in Chicago in 2015. They usually ask the local AAPT to do something. Stay tuned.

We asked for new people to be recognized. Al Glodowski from IIT had been encouraged by Roy Coleman to come.



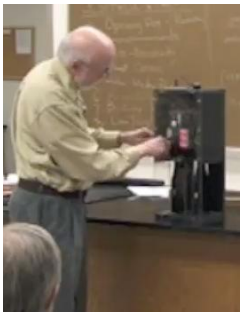
Gordon Ramsey (Loyola University) led off with a demo showing us a 2 liter bottle into which he had drilled two holes, one about 6 cm above the other along the vertical side. Prior to the meeting he taped over the holes and had filled the bottle with water. He asked us when he removed the tape and the water poured out, which stream of water would go further from the bottle, the lower one or the upper one? What do you think? The stream from the top hole went further at the start. But the as the water level in the bottle dropped, the upper stream fell off and landed at the same distance away as the lower stream. Then even later the streams crossed with the upper one going a shorter distance than the lower one. Finally when the water level inside the bottle dropped below the upper hole, the flow ceased from that hole.



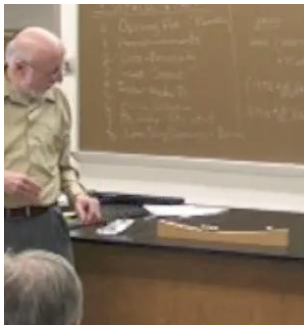
John Milton (DePaul University ret.) reminded us of an article in *The Physics Teacher* that used a similar setup to measure the barometric pressure. While that was happening Gordon aimed a laser at the side of the bottle opposite the upper hole so that the laser beam exited through that hole. The beam was channeled through the stream as it emerged from the bottle and followed the stream down its trajectory. The stream acted as a light pipe for the laser beam.

Gordon noted that students typically like to see demos go wrong. He does a demonstration where he pulls a piece of cardboard out from under a beaker of water. Once he didn't notice that the cardboard had developed a notch so when he yanked on the cardboard the beaker came with it. He was able to catch the beaker in mid-fall, and got all wet. But the students gave him a big hand.

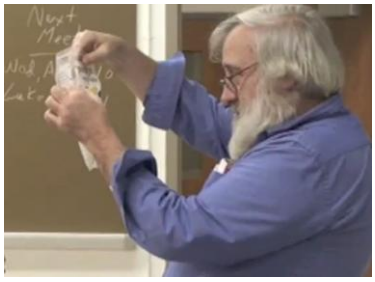
Martha Lietz (Niles West High School) showed us how she designed an experiment to measure electrical resistivity using conductive paper. She mentioned two sources of the paper, PASCO (PK-9025 @$45 for 50 sheets) and Science First (SKU615-6195 Kit @ $99.95 includes 25 sheets). She cut the paper into strips of the same length, about 10 inches but varied widths 1, 2 to 3 inches. The student would measure the resistance using an ohmmeter. Knowing the thickness of the paper (about 0.22 mm for the Science First and 0.17 mm for the PASCO paper) as well and the length and width they could determine the resistivity of the paper. She ran through a typical calculation and arrived at a value of 0.397 ohm-meters. She passed out a hand-out with more details including a plot of Resistance vs. Length for both types of papers. From these plots she arrived at resistivity's of 0.38 ohm-meters for Science First in good agreement with her first value, and 5.8 ohm-meters for the Pasco sheets. The PASCO resistivity was surprisingly different.



Art Schmidt (Northwestern University) displayed a large black box with a clear plastic side. Through the plastic side we could see a circuit board with a three-digit display. Also visible were two paddle scintillators placed one above the other. Art explained that this was a Cosmic Ray Telescope that he and a few staff people at Northwestern had constructed from plans published by Berkley Lab that they published on the internet (cosmic.lbl.gov/documentation/CosmicDetector2-0.pdf). The apparatus consisted of two paddle detectors placed side by side and run in coincidence mode. Only cosmic rays that passed through both detectors would be counted. He switched on the counter with the paddles oriented one atop the other to catch rays coming vertically down. In a minute the counter recorded 120 events. He then turned the box on end so the paddles were sensitive to rays coming in horizontally. The coincidence count rate dropped to about 40 per minute. Art interpreted that to mean that the flux of cosmic rays was stronger coming down than coming horizontally and presumed this to be due to absorption coming through more atmosphere coming in sideways.



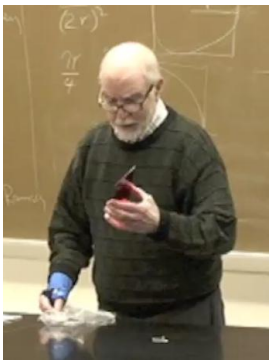
The Art set up a wood ramp in the shape of a shallow "u" with the lowest part in the center. He set four identical steel balls on the ramp and pulled one aside. He let it roll down into the other balls and as that ball hit the array the ball at the opposite end flew out. It rose up the ramp almost as far as the initial ball had been released from on the opposite side. Obviously there was a lot of friction in the system because the balls quickly came to rest together in a clump at the lowest part of the ramp in the center. We were reminded of the familiar demonstration known as Newton's Cradle. Then Art placed a fifth ball, which looked identical to the others, on the ramp and let it roll into the array. Only this time the ball on the opposite side shot out very rapidly and ran the full length of the ramp and off the end. Art revealed that the fifth ball was magnetized and the force of attraction to the other balls accelerated it just before impact resulting in an increase in mechanical energy in the collision. This was a nice example to show that the magnetic force is capable of doing work. The apparatus is called a Magnetic Accelerator available from Arbor Scientific (P4-1365 @$29).



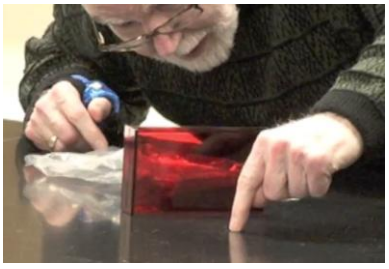
Paul Dolan (Northeastern Illinois University) reminded us that π day (3.14) was coming up this Thursday. He wanted to explain why he had asked us to contribute random numbers at the last meeting at NEIU. It was a project to calculate π. He drew a square on the board and then drew a circle to fit just inside the square. The area of the circle is given by πR^2 The area of the square is $(2R)^2$. So the ratio of areas of the circle to the square is π/4. From the random numbers he created random pairs (x,y). By counting the number of pairs that fell within the circle and comparing to the total, he could come up with a value for π. He had collected 300 ordered pairs that yielded a value of π = 2.85. We discussed just how 'random' his set of numbers was. Martha Lietz pointed out that some calculators have random number generators too.

Paul had recently purchased a bag of mixed colored potatoes and noticed that the bag had holes in it. He filled the bag with water and observed the streams of water that flowed from the holes.

John Milton (DePaul University ret.) remarked, in regard to Martha's resistance experiment, that we should teach conductance as well as resistance. For parallel resistances you can add conductance, which is the reciprocal of resistance. So one would just take the reciprocal of each resistance and add them. Then with this total conductance, the final resistance is again the reciprocal. He recalled the old unit of conductance, the mho, had been replaced by the siemel. He described a set-up for measuring the conductivity he had put together using a meatloaf sized rectangular plastic dish at the Dollar Store. He put aluminum electrodes at each end and connected a 22 volt AC (so ions don't plate out) power supply along with an ammeter.

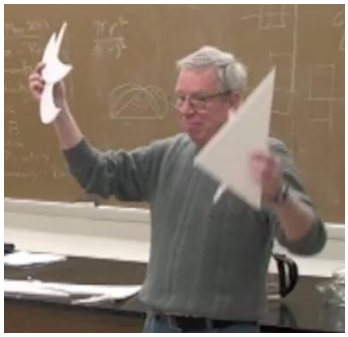


John had brought a piece of red tinted clear plastic plane roughly 10 x 20 cm with a thickness of a few millimeters. One of the short ends had a 't' molded into it that allowed it to be set vertically on end. John found it in the Arbor Scientific catalog under the name Reflect-View ($ 5,10 or more $ 4.50 each). It reminded John of an imaging exercise Anne Brandon (Joliet West High School, ret) did. John demonstrated how he could view the reflection of his finger in the plastic and then place the finger of his other hand at the same place as the image.



He could measure object and image distances and construct ray diagrams. Why red? Martha Lietz suggested it improves the reflective properties. Art Schmidt thought of making such a device on the cheap by getting plastic stands used for displaying menu items in restaurants. A piece of cellophane could be slipped into the stand instead of the paper announcement. The stand part would function as the 't' to allow the piece to stand on end. Marsha suggested an office supply store as a possible source.

Pete Insely (Columbia College) had brought up the problem of "squaring the circle" at our last meeting. He had promised to cut the problem out of poster board and bring it to the next meeting. He fulfilled his promise and produced the problem in a poster board example. Quoting from Pete in the last reminder "To draw the problem, first inscribe a right triangle using the diameter of a circle as the hypotenuse. Then use each leg of the triangle as a diameter of a new circle. As soon as you see the two new semicircles must have the same area as the original semicircle, it's easy to see the two crescents formed must have the same area as the triangle". With the problem physically executed in poster board, the proof can be demonstrated by weighing the two crescents and the triangle, and comparing the weights. Pete found the weight of the triangle to be 16 gm and the two crescents were 11 gm and 6 gm. Close enough.



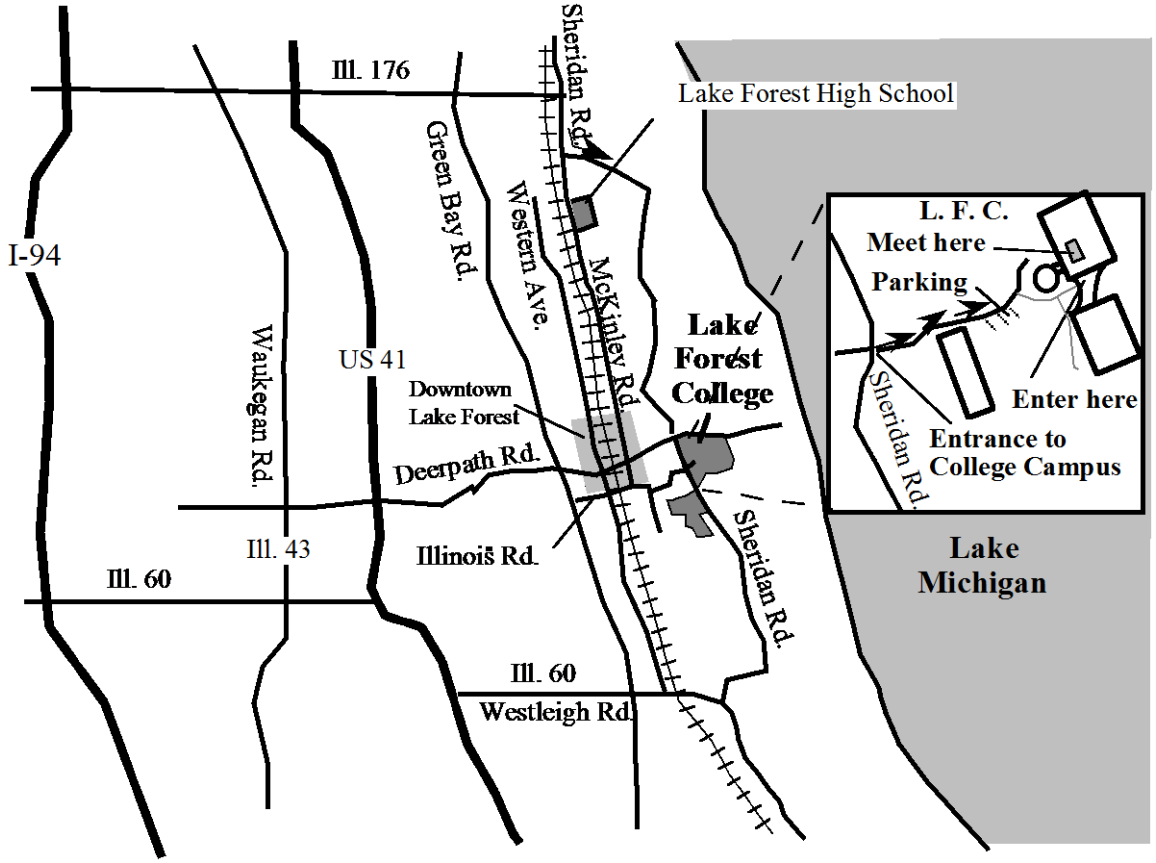
Pete also brought an amusing puzzle from Educational Innovations (Perplexing Puzzle Paradox @ $6.50). A picture of 13 cartoon people is cut in half lengthwise separating the upper portions of the figures from their legs and feet. The top half of the picture is cut into two pieces. Reversing the two upper pieces left to right results in a whole picture in which there are now only 12 people. What happened to the thirteenth person? The answer lays in the way in which the people are drawn, but Pete came up with an interesting analysis. He added the heights of the 12 people and got a total of 87.8 cm, with an average height of 7.31 ± 0.85 cm. When displaying the thirteen people he obtained an average height of 6.75 ± 0.81 cm for a total combined height of 87.8 cm. While the thirteen people averaged less of a height the total height of all the people was a conserved quantity. Very neat!

Pete told us that he has been taking the ACT exam with his family at home. Pete confessed that he couldn't finish any of the sections in the specified amount of time. When you take the ACT you can get a copy of the test, the answers and the correct answers, as long as you have taken the exam.

Sarah Moyer (Stars Project Engineering Academy) is involved in the start up of this high school level charter school opening in 2014. She was looking for suggestions for books and curriculum ideas to start out with along the lines of common science course standards.

Gordon Ramsey (Loyola University) teaches a physics of music course and admitted that he purchases many of his musical instruments at Menards and FedEx. He explained that he uses PVC pipe and mailing tubes to make music by intoning the pipes with a stream of air from a PASCO air source. He demonstrated how to get two tones an octave apart from the same length tube by covering the end of the tube that was away from the air stream. Which mode had the lower tone? He drew wave diagrams showing how the standing wave was formed in the open-open tube (open at both ends) as compared to the wave in an open-closed tube (open at one end). He also showed how second and third harmonics were formed in the open-open tube and how every even harmonic was skipped in an open-closed tube. Then he presented us with our free giveaway, a set of four tube pan flutes. The pipes were cut from copper tubing to the appropriate length to make notes on a scale. The two end pipes were cut to make an octave. He also included real corks for each tube to change the tube from an open-open to an open closed tube. He passed out a sheet with details. Thanks Gordon. Gordon also passed around a sheet with links to u-tube videos of sessions from the New Orleans AAPT meeting videoed by Cathy Ezrailson. He would send you the links if you asked.

Sunbmitted by Art Schmidt
For more info about ISPP go to the URL < http://isppreminder.blogspot.com/ >



From Chicago — Take I-94 (Edens Expressway) north toward Waukegan. When I-94 splits off toward Milwaukee, stay on the Edens, which becomes U.S. Route 41. Exit at Deerpath Road, turn right (east) onto Deerpath and continue through the town of Lake Forest and toward the College.

From points North — Take I-94 south from Milwaukee. Just south of the Wisconsin-Illinois line, stay left and follow U.S. Route 41. Exit at Deerpath Road, turn left (east) onto Deerpath, and continue through the town of Lake Forest and toward the College.

From points West & Southwest (including O'Hare Airport) — Take I-294 (Tri-State Tollway), which becomes I-94, north to Illinois 60 (Town Line Road). Exit and turn right (east) on Route 60. Continue east to Route 43 (Waukegan Road), turn left (north) for 1/2 mile to Deerpath Road. Turn right (east) onto Deerpath and continue through the town of Lake Forest and toward the College.