

ISPP REMINDER

March 2016

OUR NEXT MEETING. . .

. . . is at

Lake Forest College

Wednesday

April 20

6:30 - 9:00 p.m.

Scroll down for map and directions.

THE FREE GIVEAWAY

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

FUTURE MEETINGS. . .

Apr 20 (Wednesday) Lake Forest College - Mike Kash/Tom Senior

May 9 (Monday) Northwestern University - Art Schmidt

AT OUR LAST MEETING. . . .

Gordon Ramsey (Loyola University) opened the meeting by thanking his student helpers: **Penelope Revis** and **Adam Davenport**. Thao Tran helped set up the room and signs. Our next meeting is at Lake Forest College Wednesday April 20. Gordon pointed out that the dome atop the physics building had undergone a renovation and was restored to the original copper finish. He also noted that they would be graduating a record 45 students in the spring. This may be the tops in the nation for an institution with an undergraduate program only. We asked for new teachers to be recognized. **Jeff Heo** from Glenbrook North introduced himself. He had come as a guest of **Nate Unterman**. Nate also reminded us that Thursday April 28 is Physics Day at Great America.

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Martha Lietz (Niles West High School) showed us a lab exercise she does using a meter stick as a balance. She has been tending toward using inquiry-based labs. She passed around her lab sheet. The lab asks a series of questions. Find the mathematical rule for balancing unequal masses. Then find the rule for two different masses on one side and one mass on the other.



Then find the rule when both masses are on the same side. Of course this is a challenge for some students. What could go wrong? She has her students draw the three-body diagram of the stick in balance. She found that students are often puzzled by questions like, "What is the linear acceleration of the meter stick and then what is the net force. Then how do the forces balance?" It took a long time for

students to realize that the pivot point exerts an upward force. Martha discovered that if she has a student use his or her finger to replace the pivot point they could personally experience the force. Gordon Ramsey played the role of a student and attested to having 'felt the force'. Martha uses paper clips (the ones for thick stacks of paper) to attach masses to the meter stick. Quick and cheap!

Pete Insely (Columbia College (ret.) had constructed his own gold leaf electroscope using a glass jar, which he charge rubbing a plastic ruler with a cloth. He told us how he was stymied from playing with an electroscope in high school and went to Loyola to study physics, but learned that access to this instrument was reserved for grad students of which there were none. He got a job teaching at Steinmetz High School, which had gold leaf electroscope. He tried to demonstrate it by charging it with a Van de Graff and with so much charge available it tore the leaves right off. The one he made works just fine...at last. Pete's son found a place to buy the gold leaf. It wasn't prohibitively expensive. However you can't just get a small piece.



Nathan Unterman (Glenbrook North) is a member of Quarknet and has his students working with cosmic ray detectors at his school. He was wondering if anyone knew how the flux might change with barometric. Art Schmidt said he had a movie from the 50's where the experimenters determined the flux change from the top of mountain Wilson near MIT compared to sea level. There, the effect was attributed to the time dilated decaying of muons in flight as a function of height. The movie is still available on YouTube. Art asked how one could separate the effects of natural decays from atmospheric absorption. Nate described the problems with trying to bring the detectors on a commercial flight with TSE restrictions. One of us asked if it was portable enough to take up in a small plane and he thought it could.

A second question referred to a result they got when testing the scaling of the detectors arranged to form an equilateral triangle. When displaying the data linearly they get a nice inverse square relationship. On a log-log scale the data reveals a linear pattern with a distinct break in the line. Nate suggested that the roof of the green house where the detectors are set up may be having an effect. We could offer no suggestions.

The third challenge addresses the question of whether muons are wave or particles. They would like to test if muons are diffracted in particular at the air water interface. He diagrammed the experimental arrangement to test this hypothesis with detectors strategically placed around the school's swimming pool. Martha Lietz asked if anyone knew what to expect for the angle and that perhaps the angle of refraction would be too small to discriminate with the size of the detectors. We suggested they set up the first using figures from the optical analog.

Bill Blunk (ret) used to hate teacher institute days. Now he loves them because it gives him an opportunity to do physics with his granddaughter. When looking through a Galilean telescope she noticed that the field of view was narrower though she didn't know how to express this. Bill made an angle measurer to determine the angle of field of view using a ruler. If he used a ruler around the circumference of a circle with an inch representing a degree, the radius would have to be 57 inches. A half-inch would represent a degree at a radius of roughly 28 inches. He glued a section of yardstick into an arc and attached it to another ruler piece 28 inches long and at right angles. He had looked up the proper term for his device. It is called a Goniometer.

Bill Shanks (ret) had clipped a piece from the paper in which weatherman Tom Skilling was asked if the 'green flash' seen as the sun set on the horizon was real. Bill wondered if there were any good demonstrations showing the effect of light refracting in a variable index of refraction medium. He recalled that Gerry Lietz once showed a laser light taking a parabolic arcing path through a tank of water, bouncing off the floor and arcing again as if it were a bouncing ball. Gerry had poured sugar water into the bottom of the tank to increase the index of refraction near the bottom. Bill used a pencil to show how the index would cause the light to bend toward the higher density. He also reminded us how light refracts up away from the surface of a hot plate. This principle is also responsible for mirages.

So, the green spot is real. The atmosphere refracts sunlight such that the sun physically is set when we see the last refracted rays being bent around the surface of the earth. The shortest wavelength or the last color to be seen should be blue but this is absorbed from the spectrum by scattering, which gives the sky the blue color.

Kevin McCarron (Oak Park – River Forest High School) recently hitched a ride on NASA's Sofia, the Boeing 747 based infrared telescope flying at 43,000 feet. He described some experiments they were able to perform on the flight. They tried to measure change in the gravitational constant g between sea level and 43,000 feet. With a one-meter pendulum they predicted a difference of 0.004 s. A photo-gate has that capability ± 0.001 s. Being off by a millimeter on the pendulum length would make a difference of 1 thousandth of a second. They had to use a half-meter pendulum where at sea level they expected $T = 1.419$ s as opposed to at altitude $T = 1.416$ s. Considering the hostile environment of a jet airplane, they got pretty consistent results though he admitted they did not prove anything. What a fun opportunity!

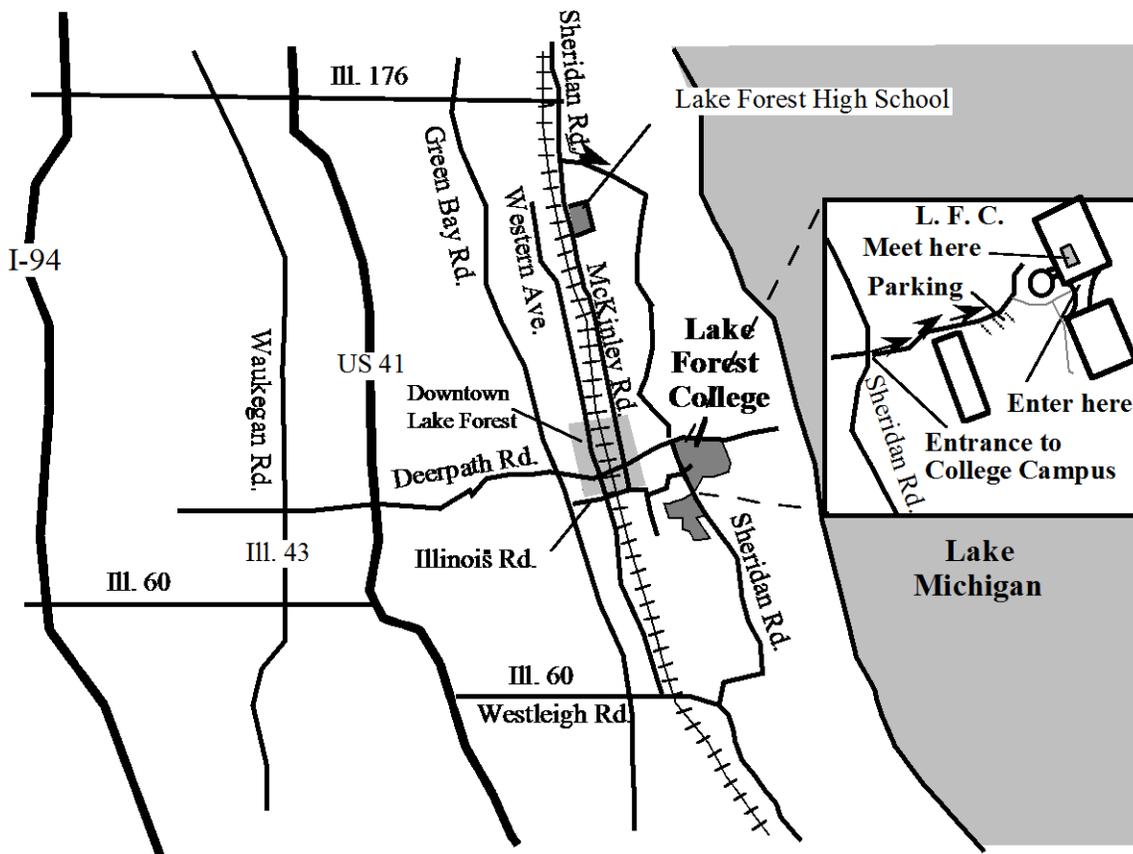
The purpose of the mission was to look for water on asteroids and they found the ratio of deuterium and tritium to be more like what we find on earth as opposed to the ratio found in water on comets. So, did earth's water come from asteroids or comets? Interesting?

Kevin's wife had done an exercise with her students comparing fields of view of different telescopes. They took a piece of card stock and drilled hole comparing the fields of view. A telescope with a 42 arc minute field would be represented by a $3/8^{\text{th}}$ of an inch hole at arms length. Hubble's three arc minute field of view is represented by a pushpin. Impressive!

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. Then he presented us with our free giveaway, a set of six 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 sealed the ends of the tubes with caulk to make semi-closed tubes. He passed out a sheet with details. Thanks Gordon.

Sunbmitted by Art Schmidt

For more info about ISPP go to the URL < <http://isppreminder.blogspot.com/> > or Google ispp.info.



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.