NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS

(an affiliate of the American Association of Physics Teachers)

Volume XXII, Number 1 **Fall 1999**

AAPT News

- AAPT is once again offering half price memberships to new members.
- AAPT Winter Meeting is being held in Kissimmee, Florida January 15-19
- AJP (American Journal of Physics) is now available on the web. For info on subscriptions visit http://www.aapt.org/pubs_catalog/pubs.html or contact Member & Subscriber Services at 301-209-3333 or email aapt-memb@aapt.org
- Radio JOVE Project - Students have an opportunity to participate in the exciting field of radio astronomy by joining the Radio JOVE Project. Observations of radio emissions from Jupiter will be the highlight of this activity. Radio JOVE will provide teachers and their students opportunities to participate in any of three ways.

a Build a radio receiver and antennae and make observations,
b Use the Radio JOVE Online website to make observations with radio telescopes at the University of Florida or
c Investigate these interesting radio signals using the archivaed data found on teh Radio JOVE site.

For more info visit the Website at http://radiojove.gsfc.nasa.gov or contact Bill Pine at the INSPIRE Projet, Inc., Chaffey High School, 1245 N. Euclid Avenue, Ontario, California 91762

IS THERE A SANTA CLAUS?

(from http://physics.wm.edu/Courses/Phys101/santa.html)

No known species of reindeer can fly, BUT there are 300,000 species of living organisms yet to be classified, and while most of these are insects and germs, this does not COMPLETELY rule out flying reindeer, which only Santa has ever seen.

There are 378 million children for Santa to deliver to according to Population Reference Bureau. At an average (census) rate of 3.5 children per household, that's 91.8 million homes. One presumes there's at least one good child in each.

Santa has 31 hours of Christmas to work with, thanks to the different time zones and the rotation of the earth, assuming he travels east to west (which seems logical). This works out to 822.6 visits per second. This is to say that for each household with good children, Santa has 1/1000th of a second to park, hop out of the sleigh, jump down the chimney, fill the stockings, distribute the remaining presents under the tree, eat whatever snacks have been left, get back up the chimney, get back into the sleigh and move on to the next house. Assuming that each of these 91.8 million stops are evenly distributed around the earth (which, of course, we know to be false but for the purposes of our calculations we will accept), we are now talking about .78 miles per household, a total trip of 75-1/2 million miles, not counting stops to do what most of us must do at least once every 31 hours, plus feeding and etc.

This means that Santa's sleigh is moving at 650 miles per second, 3,000 times the speed of sound. For purposes of comparison, the fastest man-made vehicle, the Galileo Jupiter probe, moves at a poky 29.72 miles per second - a conventional reindeer can run, tops, 15 miles per hour.

The payload on the sleigh adds another interesting element. Assuming that each child gets nothing more than a medium-sized lego set (2 pounds), the sleigh is carrying 321,300 tons, not counting Santa, who is invariably described as overweight. On land, conventional reindeer can pull no more than 300 pounds. Even granting that "flying reindeer" (see point #1) could pull TEN TIMES the normal amount, we cannot do the job with eight, or even nine. We need 214,200 reindeer. This increases the payload - not even counting the weight of the sleigh - to 353,430 tons. Again, for comparison—this is four times the weight of the Queen Elizabeth.

353,000 tons traveling at 650 miles per second creates enormous air resistance - this will heat the reindeer up in the same fashion as spacecrafts

See *Santa* on page 4

Ontario Association of Physics Teachers

2000 Annual Meeting

Thursday May 25 - Saturday May 27

hosted by

McMaster University Engineering

OAPT is now welcoming your input for the following...

- Workshops: is there something you'd like to learn about?
- Classroom Demos: do you have a favourite demo old or new to share?
- ISU share-athon: how about sharing your 4A or OA ISU ideas?
- Contributed papers: would you like to present a short paper on current research of teaching tools?

If you would like to contribute to any of the above, or have any comments or requests, please e-mail or fax them to:

Diana Hall
diana_hall@ocdsb.edu.on.ca
fax: 613-828-9002

NOTE: Thursday night workshops will include 2 special sessions for Elementary teachers

AAPT Summer Meeting in Guelph

The American Association of Physics Teachers (AAPT), of which the OAPT is the Ontario Section, will be holding its Summer Meeting at the University of Guelph from July 29 to August 2, 2000. More than 1000 physics educators from across North America (and England, Australia, Mexico, etc.) will be attending this five-day conference, which presents an exciting opportunity for Ontario teachers to attend workshops and talks on all aspects of physics teaching. The conference registration fee is considerably less for AAPT members; membership information is available from the AAPT website (http://www.aapt.org/). (Membership in the Ontario Section does not constitute membership in the AAPT.)

Information about the Guelph conference can be accessed at http://aapt.physics.uoguelph.ca/

Anybody Out There?

Don't forget that I'm always interested in hearing your comments, criticisms, etc.

You can reach me—the editor—by e-mail:

pdlaxon@julian.uwo.ca

or, if the mood strikes you, by mailing a letter to:

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c/o Paul Laxon
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St. Thomas, ON
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OAPT Web Site

Guleph University is host to the OAPT site.

Get info on executive members (including a great picture of me, your humble newsletter editor), the upcoming OAPT Conference, links to other physics web sites, and much, much more!
The URL is:

www.physics.uoguelph.ca/OAPT/index.html

Why wait until it's too late?

The date on your address label is the expiry date for your membership. You may use the coupon below (or a facsimile) to renew it, or to indicate a change of address (or both) by checking the appropriate box. And, hey, what the heck, why not renew it for two (or more!) years; it will save you the hassle of renewing over and over again.

Membership Application
Renewal ❒ Change of Address ❒

Name _____

Address _____

_____

$8.00 / year x __ years = $ ___, payable to the OAPT

Send to: Ernie McFarland, Dept. of Physics, University of Guelph, Guelph, Ontario N1G 2W1; Email: elm@physics.uoguelph.ca

Physics News Update

The A. I. P. Bulletin of Physics News
by Phillip F. Schewe and Ben Stein

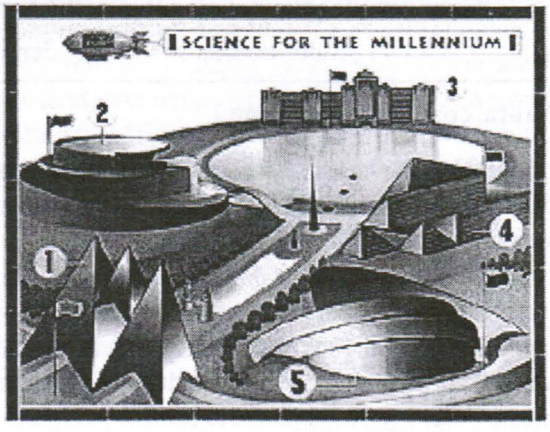
X-RAY CRYSTALLOGRAPHY OF NON-CRYSTALS has been carried out by a group at Stony Brook. X rays have long been used to determine the structure of crystalline objects: when the waves strike periodic arrays of atoms or molecules the waves diffract into patterns which, when analyzed by Fourier-transformation algorithms, provide a map of the sample's structure with approximately angstrom resolution. In the Stony Brook experiment x rays are shone onto a non-crystalline micron-sized specimen (a tiny array of letters spelled out with 100-nm gold nanoparticles). By pushing the algorithms a bit, images could be formed from the x rays scattered from this patently non-crystal object. The resolution, about 75 nm, is not nearly as good as for traditional x-ray crystallography, but still much better than could be achieved with visible light. The researchers believe their method can be applied to imaging biological specimens at the level of cells or even subcelluar objects. (Miao et al., Nature, 22 July 1999.)

GRAVITY'S GRAVITY. A new experiment at the University of Washington seeks to determine whether the gravitational binding energy of an object generates gravity of its own. As formulated by Albert Einstein, the Equivalence Principle (EP) states that if we stand in a closed room we cannot tell whether the weight we feel is the result of gravity pulling down or the force of a rocket carrying us forward through otherwise empty space. All of this gets complicated in some theories of gravity, which predict that the EP will be violated to a small degree since in addition to the usual gravity, carried from place to place by spin-two particles called gravitons, there should exist another, fainter kind of gravity carried by spin-zero particles (sometimes called dilatons). For this reason, and because recent observations of supernovas suggest that some repulsive gravitational effects might be at work in the cosmos, scientists want to explore the possibility of EP violations. Three decades of lunar laser ranging (bouncing light off reflectors placed on the Moon) show that the Moon and the Earth fall toward the Sun with the same acceleration to within half a part in a trillion (10^12). What the Washington physicists (Eric Adelberger, 206-543-4294, eric@gluon.npl.washington.edu) have done is focus attention on the subject of gravitational binding energy, or self-energy, and whether it too obeys the EP. To illustrate the concept of binding energy, consider that the mass of an alpha particle is actually about 28 MeV less than the sum of its constituents. This energy (about 7.6 parts in a thousand of the alpha mass) represents the energy (vested in the strong nuclear force) needed to hold two protons and two neutrons together inside the alpha. Gravity being very much weaker than the strong nuclear force, the gravitational binding energy, the self-energy of gravity attraction, is almost infinitesimal. For example, self- energy effectively reduces the mass energy of the Earth by a factor of only about 4.6 parts in 10^10. Is this tiny "mass" also subject to the EP? Supplementing existing lunar laser ranging results with new data from special test masses mounted on a sensitive torsion balance (see www.aip.org/physnews/graphics) to take into account the different compositions of the Earth and Moon, the Washington physicists show that gravitational self energy does obey the equivalence principle at the level of at least one part in a thousand. Thus gravitational self energy does indeed generate its own gravity. (Baessler et al., Physical Review Letters, 1 November; see also Clifford Will's article, Physics Today, Oct 1999.)

THE TOP PHYSICISTS IN HISTORY are, according to a poll of scientists conducted by Physics World magazine, 1. Albert Einstein, 2. Isaac Newton, 3. James Clerk Maxwell, 4. Niels Bohr, 5. Werner Heisenberg, 6. Galileo Galilei, 7. Richard Feynman, 8. Paul Dirac, 9. Erwin Schrodinger, and 10. Ernest Rutherford. Other highlights of Physics World's millennium canvas: the most important physics discoveries are Einstein's relativity theories, Newton's mechanics, and quantum mechanics. Most physicists polled (70%) said that if they had to do it all over again, they would choose to study physics once more. Most do not believe that progress in constructing unified field theories spells the end of physics. Ten great unsolved problems in physics: quantum gravity, understanding the nucleus, fusion energy, climate change, turbulence, glassy materials, high-temperature superconductivity, solar magnetism, complexity, and consciousness. (December issue of Physics World, published by the Institute of Physics, the British professional organization of physicists celebrating its 125th anniversary this year.)

PHYSICS ON THE INTERNET

Check out this virtual tour of a science expo
http://www.ncsa.uiuc.edu/Cyberia/Expo/



THE DEMONSTRATION CORNER

D-Ball

by

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This is a very popular game I have played with my OAC physics class. It incorporates the concepts of conservation of energy and projectile motion.

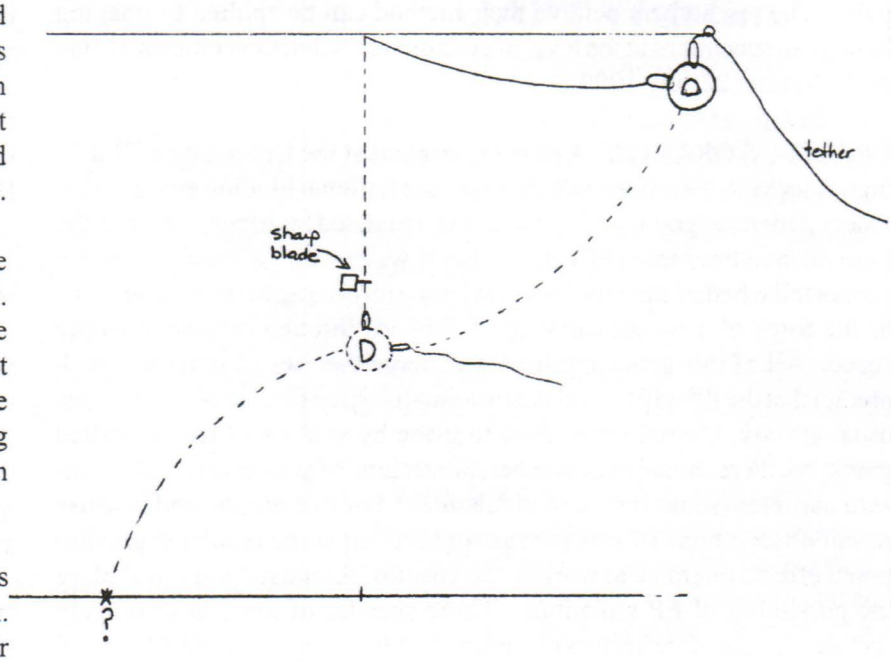
"D-Ball" is a baseball with a D marked on it. if your name doesntt start with the letter "D," you will have to make appropriate changes. D-Ball is hung from the ceiling on a piece of very thin fishing line or fine thread tied to a paper clip that is hooked through the threads on the ball. A razor blade is clamped at a position just barely above the ball as it hangs straight down. A second paper clip and thread are used to tether the ball to the side just below the ceiling.

To launch the ball, burn the thread tethering the ball allowing it to swing down, pendulum style. When the string meets the blade, it is cut and the ball becomes a projectile. The students must make appropriate measurements before the launch and calculate a prediction of the landing position of D-Ball. We mark the predictions on the floor and then launch D-Ball.

The horizontal distance travelled by the ball turns out to be within 2% of the theoretical prediction. Students reported that this was one of their favourite activities.

It is easy to make this demonstration into an exam question. I gave them a scale diagram of the set-up and they had to calculate and mark the landing position on it.

Thanks to Brian Wegley, Glenbrook South HS, Glenview, illinois, for sharing this idea.



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Submissions describing demonstrations will be gladly received by the column editor.

Santa, continued from page 1

re-entering the earth's atmosphere. The lead pair of reindeer will absorb 14.3 QUINTILLION joules of energy. Per second. Each.

In short, they will burst into flame almost instantaneously, exposing the reindeer behind them, and create deafening sonic booms in their wake. The entire reindeer team will be vaporized within 4.26 thousandths of a second. Santa, meanwhile, will be subjected to centrifugal forces 17,500.06 times greater than gravity. A 250-pound Santa (which seems ludicrously slim) would be pinned to the back of his sleigh by 4,315,015 pounds of force.

In conclusion - If Santa ever DID deliver presents on Christmas Eve, he's dead now.

(A rebuttal to this classical interpretation can be found at http://physics.wm.edu/Courses/Phys101/santa.html)