NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS

(an affiliate of the American Association of Physics Teachers)

Volume XIX, Number 1 **Fall 1996**

OAPT Conference Report

York University, June 20-22, 1996

by Peter Scovil, Section Representative
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A taped message from Robert Thirsk on board the space shuttle Columbia opened our annual conference at York University. We had good turnout of over 100 members who enjoyed talks and workshops on the theme of space and communications. We were able to tour Spar Aerospace. The computer and robotics technology they have is incredible.

There were three excellent workshops on Thursday evening. I attended the one on astronomy by Dr. Paul Delaney. We were introduced to CLEA (Contemporary Laboratory Experiences in Astronomy) which is available at: http://www.gettysburg.edu/project/physics/clea/CLEAhome.html

Dr. Michael De Robertis (mmdr@yorku.ca) of the Department of Physics & Astronomy, York University has adapted several of these labs for his undergraduate program. Other astronomy resources were listed, including Sky & Telescope, Sky News (Canadian), and web sites for Sky & Telescope, York U., Dominion Astrophysical Observatory, and NASA. The York U. Astronomical Observatory is open Wednesday, May to September, 9-11:30 pm for viewing and other presentations. Call 736-2100, ext 77773. An interesting project used at York involved photographing a constellation using a 35 mm camera with about 20 s time exposure and ASA 100+ film. Contact Dr. Delaney (Dept. of Physics & Astronomy, York U.) for details.

Another workshop was about atmospheric monitoring, by Shiv Pal and Don Hlang, where people learned about and tested ground based sensing technologies and saw the results of LIDAR measurements. The third workshop was on the internet - a popular topic also given at the last two conferences—given this year by Judy Libman and Ian Lumb. York has an information service for science educators at nucleus@science.yorku.ca

The conference sessions were started with Professor Marshall McCall (York U) showing us a clearer view of our galactic neighbourhood, a view needing clarifying when 15% of students identify the moon as a star. Elio Covello (Huron Heights S.S.) showed amateur science is not dead by giving us a look at the base *e* nature of Kepler's third law, suggesting there may be "allowed" orbits for planets around the sun. John Caldwell (York U) updated us on the 2.4 m diameter Hubble Space Telescope. We have heard about the correcting mission (the mirror was out by about 2 im). One problem now is diffraction about the secondary mirror supports, causing a "cross" about off-axial stars. An upgrade mission is planned for 1997, and a boost for orbit will be needed in 1999. (The Hubble Telescope website is http://www.stsci.edu/pubinfo/Latest.html)

To prove that we are open-minded, we were brought back to earth by Professor Geoff Harris of the Centre for Atmospheric *Chemistry* - York U. He described how he used tunable diode lasers to measure the trace gas nitrous oxide. Agriculture and the increased use of fertilizers is causing an increase of 0.3% per year. Nitrous oxide is a greenhouse gas and also breaks down the ozone layer.

Our banquet speaker was Dr. J. Megaw who spoke to us on Chernobyl: Ten Years After. What was the human cost? We hear fantastical claims from both extremes. We know 31 died immediately or within weeks. 237 were highly irradiated, with most still alive. 135 000 were in a 30 km radius, and show no symptoms, although 280 are expected to die as a result of the accident. There has been no increase in leukemia. There are increases in childhood cases of thyroid cancer with one death. The worst problems are psychological. Poor information handling by the Soviet government resulted in a loss of confidence. Problems with nuclear reactors occur during shutdown, not during routine operation. The positive side of the accident is the much heightened awareness of reactor safety throughout the world. And too little is said about the deaths due to coal-powered plants. Dr. Megaw demonstrated his expertise in this field in a most interesting manner.

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OAPT WEB SITE

Guleph University is now the host of an OAPT web site. The URL is:

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

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From research to the classroom, quite a number of talks were devoted to educational issues. Alan Slavin (Dept. of Physics, Trent U, aslavin@trentu.ca) talked about using flow charts to help students decide what method to use in solving problems. Most students try to memorize a specific procedure and set of equations for each "problem type". Instead, physics should involve building a solution from fundamental concepts and laws. The flow chart leads students from starting conditions to the final answer using basic principles and laws, NOT memorized formulas, resulting in improved student performance. Elgin Wolfe summarized research on steps individuals take in solving problems and pedagogical methods for improving problem solving skills. Planning is a key, as experts take longer to assimilate information than novices, and work from general principles rather than starting with formulas. We can help students organize knowledge in hierarchical form (e.g. see above), to look for similarities and differences. We can encourage them to verbalize problem solving in pairs. (Think - pair - share) Analogies are very helpful and should be used carefully and frequently. Jan Van Aalst (OISE) demonstrated CSILE, a network system that provides across-the-curriculum support for collaborative learning and inquiry. See http://csile.oise.on.ca/armstel/mst.html

Don Bosy and Nagy Riad were unable to share much of their experience in improving physics teaching due to a programming glitch. Sorry, fellows. Perhaps next year? Contact Don through C.C.S. (CCS@IO.ORG)

Bob Loree (Oakville Trafalgar High School) described the Co-operative Education Science/Technology Project with the Halton board, giving students opportunities to experience science in the workplace. You may also wish to contact McMaster regarding their Engineering Fireball Show.

Other useful ideas and demonstrations were presented. Bob Tkach (Cawthra Park SS) explained how he used bonus marks to encourage students to do extra preparation for the SIN contest. Ernie McFarland (elm@physics.uoguelph.ca) used electromagnetic induction to flash an old-style camera flashbulb. Irwin Talesnick dazzled us with an incredible variety of demonstrations. Roland Meisel (Ridgeway-Crystal Beach HS - rollym@iaw.on.ca) showed us different ways of using a Tesla coil, such as a radio transmitter, lighting up fluorescent tubes and discharge tubes, producing streamers on a regular light bulb due to the argon in it. Kim Maynard (Montcalm SS, London) described an outline of an ISU on friction. And Ronald Lewis (Lively DHS, Sudbury Bd gave us an informative primer on fractals with good examples of their applications in many fields, and hands-on activities that you could use with students. He has a course of study, text and lab manual available. (705-566-3264 - ronalewi@enoreo.on.ca)

In recognition of 10 years of service on the OAPT executive, Al Hirsch was presented with a Life Membership Certificate by OAPT president, Diana Hall.

Dave Logan and the York University physics department did a great job in organizing the conference, getting excellent speakers, feeding us and housing us. Thanks for a great time! Next year, the conference is to be held at Brock University. Our Conference host will be Dr. F. Razavi. Dates are June 19-21. P.O. Box 1169 Waterford ON N0E 1Y0

Physics News Update

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

POSSIBLE EVIDENCE FOR LIFE ON MARS has been reported by a team of scientists studying an ancient rock found in Antarctica in 1984. Minerals in the rock suggest that it came from Mars, where it was probably ejected by a giant meteor impact event some millions of years ago. The rock itself, referred to as ALH84001, was formed billions of years earlier, at a time when Mars was warmer, wetter, and presumably more hospitable to life. What does the rock tell us? Team leader, NASA scientist David McKay, says that several strands of evidence, none of which is conclusive by itself, together point toward the existence of ancient life forms on Mars. Microscopic inspection of the rock shows, for example, the presence of organic molecules called polycyclic aromatic hydrocarbons, which can come from the breakdown of biological or non-biological sources. Also present in the sample were minerals sometimes (but not always) associated with bacteria, namely carbonate granules, magnetite, and pyrrhotite. Finally, sample images show 100-nm-sized ovoid shapes which, McKay suggests, might be the fossilized creatures themselves. Various outside scientists have been impressed by the data but skeptical of a biological interpretation; they argue that non-biological causes could account for all of the new findings. Meanwhile, government officials, including President Clinton and NASA administrator Daniel Goldin, have expressed great interest in this research, and proposals for new Mars-oriented projects will doubtless receive great attention. (David S. McKay et al., Science, 16 August 1996.)

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.

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Trent Professor Wins National Teaching Award

OTTAWA — Trent University professor Al Slavin received the Canadian Association of Physicists (CAP) Medal for excellence in teaching at CAP's annual conference.

Slavin is the second recipient of the national award given by the association. It is his fourth teaching award in four years. He won Trent's Symons Award for teaching excellence in 1992, the national 3M Fellowship for excellence in teaching in 1993 and Ontario's Lieutenant Governor's Award for teaching excellence the same year.

A physics professor at Trent since 1973, Slavin is considered an outstanding and innovative lecturer whose mission to make physics understandable for first-year undergraduates has inspired more than the usual proportion of students to pursue further studies in the field. He uses a student-centred approach to learning, encouraging students to help each other in small groups and giving them problem-solving strategies to make learning physics easier. Swinging on the end of a pendulum has made his in-class demonstrations the stuff of legend. In their end-of-year evaluations, students consistently rave about his ability to make physics relevant, interesting and unintimidating.

He shares his teaching techniques with secondary school, college and university instructors at meetings of the Peterborough Physics Teachers Association, a forum he initiated.

An advocate for women in a male-dominated domain, Slavin has fostered a women-in-science support group at Trent and regularly speaks at high schools about the need for women to pursue science careers. He encourages physics students to see themselves in a wider world context and has organized a year-abroad program for third-year physics students.

Slavin also leads an active research life, supervises graduate students, is an adjunct professor in Queen's University and serves on a national research grant selection committee. He is founding chair of Trent's graduate program in Applications of Modelling in the Natural and Social Sciences.

Internet Inerest

Check out the Physics Education Research Papers at: http://www.physics.umd.edu/rgroups/ripe/perow.html

Join us in 1997 for the annual

OAPT Conference

at

Brock University

June 19 - 21

Demo Corner...continued from p. 4

27 Make static electricity.
28 Use a prism to make a rainbow.
29 Use a fine net curtain to make a rainbow.
30 Look at different street lights with your prism or your fine net curtain.
31 Split up the colours in a felt marker. Use paper towel with one end in water. Drape the towel over the edge of the glass, and colour it just above the water level. (This is chromatography.)
32 Float a needle on water.
33 Explain why battleships float, but pennies sink.
34 Make a cardboard boat to hold lots of pennies.
35 Blow a big bubble.
36 Blow a little bubble.
37 Use a piece of paper to demonstrate lift.
38 Make a paper aeroplane. Explain how you improved its design.
39 Make a kite and fly it class.
40 Make a parachute.
41 Make a windmill.
42 Do an experiment on centre of mass.
43 Do an experiment on levers.
44 Do an experiment on tension in strings.
45 Make a sundial.
46 Make a pendulum. Use different masses and lengths.
47 Make a coupled oscillator. We have a few film loops on this.
48 Compare how quickly a glass of water (the Oceans) and an identical glass of sand (the continents) heat up.
49 Compare how quickly a black covered glass of water heats up compared to a white covered glass.
50 Build a wind vane.

If you try the One-Minute Experiment, please let me know how you find the experience.

THE DEMONSTRATION CORNER

One-Minute Experiments

by

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Something wonderful happened in my Physics 21 class just before Christmas last year. There wasexcitement, wonder, great mutual support, and just plain fun as one hundred and twelve studentsdemonstrated 52 experiments in 52 minutes. Are you familiar with the idea of the one-minute paper? At the end of the class, students areasked in one minute or less to write down the best thing, or the worst thing, or the obscurestthing that happened that day. It is one way of getting a read on the mood of the class, and findingout what went well and what didn't. In Physics 21, Physics for Non-Scientists, most students arefrom the Faculties of Arts or Social Science and are taking the course because they have to takeat least one course from the Faculty of Science. This is not a lab course, but I have wonderedhow to encourage everyone to try some experiments at home, perhaps in the kitchen using thematerials from the grocery store, such as plastic wrap or aluminum foil. Then came the idea of aOne-Minute Demonstration.

I challenged the students to do a One-Minute Experiment at the last lecture before Christmas,either in pairs or alone. Would this experiment work? Could we really do demonstrations at therate of one every minute? Would they be interesting? Would we see an aluminum can filled withsteam collapse 52 times? This occasion was a highlight of my teaching career, an hour that I shall always treasure. Canscollapsed. Volcanoes erupted. Lasers lit. Rainbows glowed. Prisms parsed light into colour. Battleships floated in bathtubs. Pennies sank. Balloons popped. Aeroplanes flew. Paper bridgescollapsed in the wind. Bubbles drifted over us all.

To get started, I made a list of 50 experiments. A trip to any science or children's museum willturn up a book or two of suggestions. I happened to use Science Is by Susan Bosak, published byThe Communications Project, 164 Tomlinson Circle, Markham, Ontario L3R 9K2, and ScienceWizardry for Kids, Margaret Kenda & Phyllis Williams, published by Barrons 1992. Both ofthese are marvelous books.

1 Find the Invisible Spaces between molecules. 1 Cup of water + 1 cup of rubbing alcohol does not equal 2 cups
2 Prove that the invisible molecules are moving. Leave a glass several hours. Put in a drop of food colouring. After several hours, the water is all 1 colour.
3 Prove that molecules move faster when hot. Repeat the above with hot and cold water.
4 Make a model of the water molecule.
5 Make models of other molecules or crystal structures.
6 Make a volcano out of baking soda, vinegar and food colouring.
7 Make an acid-base indicator from red cabbage.
8 Use it to test for acids and bases.
9 Does (your favourite pop) really dissolve teeth?
10 Burn a candle inside a glass inverted and sitting in water.
11 Put some steel wool inside an inverted glass sitting in water. Leave it a week.
12 Put vinegar, salt, copper pennies and a nail into a glass and let it sit for a while.
13 Make a pinhole camera.
14 Show that water expands when it freezes.
15 Find the freezing point of salt water.
16 Hang a piece of wire over an ice-cube and show the wire goes through the cube.
17 Grow a crystal.
18 Make a kaleidoscope.
19 Explain how a mirror works.
20 Why does a mirror reflect left to right, but not upside down?
21 Demonstrate how light bends when it enters water.
22 Put out a candle with a sound wave.
23 Make music with bottles filled to different depths with water.
24 Make waves on a string or on water or in air.
25 Make a musical instrument.
26 Make a battery from a paper clip, copper wire and a lemon.

Demo Corner continued on p. 3

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