NEWSLETTER
ONTARIO ASSOCIATION OF PHYSICS TEACHERS
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Report on the OAPT Conference

University of Waterloo
June 18-20, 1998

reported by Peter Scovil, Section Representative
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The theme of this year's conference was "Tools to Teach Physics". A number of tools for teaching physics were introduced at the workshops Thursday evening. They were *Interactive Physics* by Bill Syniura, *Computer Delivered Tutorials* by June Lowe, *Pasco Physics Interfaces* by Shawn Clement, and *Holography* by George Vanderkuur. Dr. James Downey, the president of the university, and Dr. John Vanderkooy, conference host, welcomed us as the regular program started Friday morning.

Of great concern to us is the future of high school education in Ontario. It may not be rosy, but we must learn to cope with the changes as well as possible. Denis McGowan of the Ministry of Education spoke on the direction of the science curriculum. The documents we can expect will be similar to the Science and Technology, 1 - 8 document. It is likely to be highly consistent with the Pan-Canadian Common Framework. It suggests that physics topics in 11 and 12 be force, motion, work, energy, momentum, waves, fields, radioactivity and modern physics. In grades 9 and 10, physics-related topics would be atoms and elements, electricity, motion, space exploration, and weather dynamics. Heat, optics and mechanical efficiency will now be in grades 7 and 8. There will still be 2 compulsory science credits with an additional one other from either science (11/12) or technology (9-12). In grades 9 and 10 there will be two streams for science (applied and academic). Documents should be in schools by March 1999, especially for grade 9. Information on curriculum development can be followed on the STAO web site http://www.stao.org . The present suggestion for grade 11 is to have one stream for college/ university and another stream for workplace, instead of four different streams. In grade 12, the ministry had suggested a college stream and a university stream, but the committee felt that only a single college/ university stream was necessary. The workplace stream could involve two years of a science credit, or a single year of each of the individual sciences in either 11 or 12.

Several people did presentations on using computer applications as tools for the classroom. Roberta Tevlin discussed how she used spreadsheets and interfaces to produce motion graphs of physics concepts, and then explored how air resistance would affect the results by inserting air resistance functions into the spreadsheet. This would allow study of drag and terminal velocity and the effect on projectiles. Simple harmonic motion can be studied with and without damping. Peter Scovil presented Graphical Analysis, a program by Vernier that he has used in class for motion graphs. It is easily mastered by students and a single copy gives a site licence at a very reasonable cost. This allows it to be put on the school network for access in the library and computer labs. It also takes data from TI82/83/92 programmable calculators. Joseph Saikali uses Maple V's mathematical and graphical capabilities to show waves in motion, superposition, reflection at fixed and open ends and standing waves. This helps students to 'see' what happens at each instant in a wave. His web site is http://www.delasalle.toronto.on.ca/~jsaikali.

Acoustics and waves were involved in a number of presentations. John Petrie talked about how the cochlea in our ear is a Fourier analyser with high tension, high frequency response near the oval window, and low response at the free end. He then demonstrated his famous Chladni plate to get two-dimensional standing wave patterns using nylon fishing line on his bow. Peter Scovil described a demo he uses involving a small Radio Shack woofer ($20) as a driver for standing waves, and

Waterloo continued on page 2

Waterloo...continued from page 1

how, using a light spring on an overhead, he can demonstrate a longitudinal standing wave. John Vanderkooy, an acoustics specialist, discussed the basic principles of a loudspeaker, the importance of the box and the tweeter. He also discussed digital audio and how a signal is digitized.

Doug Abe's described and showed videos of how he used Rube Goldberg Machines as very interesting projects for ISUs. Patrick Tevlin from Ontario Science Centre promoted the new Scream Machine show which will be on for the next year on the science of amusement park rides. It included a bicycle in a 5.5 m vertical circle with an accelerometer, and a 5 m rotating platform with a 20 s period on which students can roll bowling balls and see the effect of the rotating frame of reference. Students can make their own roller coaster and see the effects of klothoid versus circular loops, and the effects of height. E-mail him for handouts. Doug Hayhoe suggested that we need to capture student's imaginations with one of the great themes of science, specifically the Standard Model (now the M theory). He has prepared a unit, available from STAO (web site above) for $20 on neutrinos, quarks, leptons and the rest of the particle zoo, and the principles and conservation laws that apply. John Petrie talked briefly about using fridge magnets for demonstrating magnetic domains. They work well as the domains are in alternating strips on the back. Dragging one magnet over the other causes the one to bounce up and down noticeably due to the changing fields. Iron filings will line up along the domain walls.

A couple of people described research projects they were working on. Serena Schlueter discussed her research in microgravity on the effect of a laser beam on an absorbing medium, e.g. to improve welds. Fluid flow is no longer dominated by sedimentation, buoyancy or convection, but by surface tension and conduction. In a single plane flight, the researchers flew 40 parabolic trajectories of about 20 s each to obtain microgravity, sandwiched between valleys of higher than normal gravity. Stefan Idziak described his research in complex fluids (the physics of goo), with a lot of attention into how liquid crystals work in polarizing light with and without electric fields. It has applications as well in work with polymers, in drug delivery systems that don't get attacked by the immune system, in getting burn treatments to stay on, and in gene therapy to replace a defective gene.

On a more personal level, two long-time OAPT members were given life memberships for all the work they have put into the organization and physics education in general. Malcolm Coutts was honoured especially for his past work on the newsletter, the physics contest and as a presenter at conferences. Bill Konrad was recognized for his work on the executive in many roles over the years and for many presentations at conferences that we all have found useful and entertaining. Phil Eastman entertained us at the banquet with stories of SIN. Next year, the conference will be held June 24-26 at Queen's University in Kingston. Hamish Leslie of Queen's and David Gervais of Sharbot Lake School are the organizers. The executive would appreciate any comments and suggestions arising from this year's conference to guide us in planning for the next one. An e-mail list is included should you wish to contact any of the speakers.

OAPT Executive 1998/99

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A RESPONSE TO THE GRADE 11 AND 12 POLICY DOCUMENT FOR SCIENCE

The OAPT is planning to make an informed response to the latest science curriculum deliverables which are available at the stao website (http://www/stao.org/gr11prt2.htm).

We invite those members interested in contributing to this response to contact Dianne Ness via email at dianness@sympatico.ca or by fax at 416-393-0009.

Physics News Update

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

THE 25 GREATEST ASTRONOMICAL FINDINGS of all time, according to the editors of Astronomy magazine (October 1998) are as follows: the discovery of quasars (1963); the cosmic microwave background (1965-66); pulsars (1967); Galileo's observations of the phases of Venus, Jupiter's moons, and craters on the moon (c 1609); extrasolar planets (1992); supermassive black holes (early 1990s); Newton's Principia, formulating the mathematics of our heliocentric system (1687); the discovery of Uranus (1781); the first known asteroid (1801); discovery of Pluto (1930); Neptune (1846); spectroscopic proof that nebulae are gaseous in nature (1864); recognition of galaxies beyond our own (1923); the advent of radio astronomy (1931-32); studies of globular clusters help to map the Milky Way (1918); cometary explosion over Siberia (1908); an accurate measurement of the speed of light (1675); Southern Hemisphere celestial objects cataloged (1834-38); Cepheid-variable period-luminosity relationship worked out (1912); Copernicus' De Revolutionibus sets forth the heliocentric system (1543); Laplace's theory on how the solar system formed (1796); a transit of Venus suggests Venus has an atmosphere (1761); the Hertzsprung-Russell diagram for understanding how stars age (1913); scheme for classifying star types (1890); the use of parallax for finding a star's distance from Earth (1838).

ECONOPHYSICS is the application of physics techniques to economics problems. Like a collection of electrons or a group of water molecules, the world economy is a complex system of individual members (in this case, countries) that interact with each other. In a situation that many experimental physicists would surely envy, the world economy produces an incredible amount of data—one year of US stock-exchange transactions results in 24 CD-ROMs of data. These data provide the opportunity for extensive statistical analyses which can lead to a better understanding of the behavior of these complex systems. In an earlier study of business firms (Stanley et al, Nature, 29 Feb. 1996), physicists and economists found that the probabilities associated with observing a given growth rate for a firm could be described with a single mathematical function for firms of all types and sizes (from sales of $100,000 to $1 trillion). Furthermore, they found that the width of the curve showing the probability distribution follows a "power law,"in which the width is proportional to the firm size raised to a power of approximately 1/6. Now, a Boston University-MIT physics team (Youngki Lee, Boston University, 617-353-8051) collaborating with a Harvard economist (David Canning, 617-495-8401) has found the same universal patterns and power law for the fluctuations in the growth rates of the gross domestic products (GDP) of 152 countries from 1950-1992. (Lee et al., Physical Review Letters, 12 October 1998.) These models raise the exciting possibility that complex human organizations can be studied with methods and concepts developed in statistical physics. (Amaral et al., Phys. Rev. Lett., 16 Feb. 1998.

Why wait until it's too late?

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

Call for Questions:

Now is your chance to contribute to the 21st OAPT Prize Contest! Have your name acknowledged on the front page! If you have an interesting or creative question (or even an idea for a question), simple or challenging, send it to Contest Coordinator Doug Abe at:

Agincourt C.I., 2621 Midland Ave.
Scarborough, ON M1S 1R6
or via e-mail to dougabe@echo-on.net

All donations are cheerfully accepted! Send in those pet questions and see your name in print!

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

An Inexpensive Vibrator for Standing Waves

by

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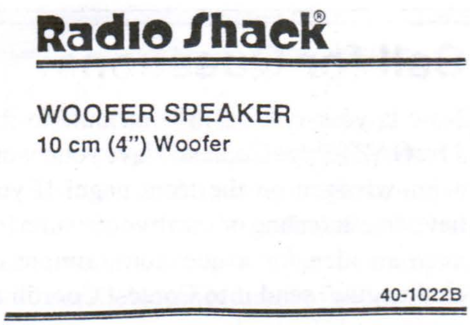
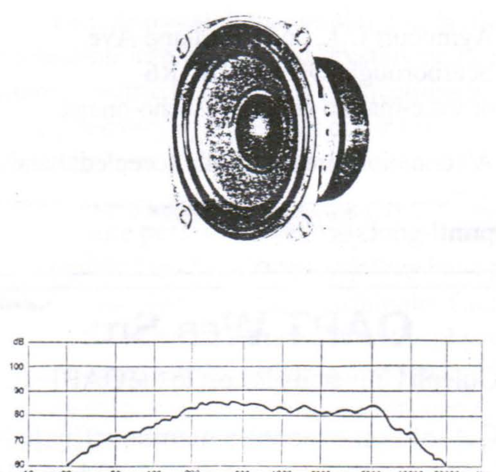
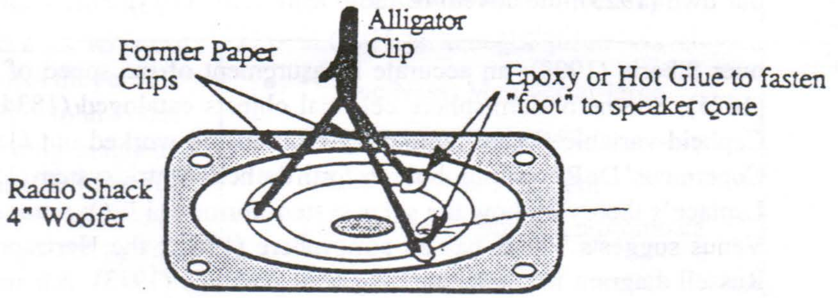
At the OAPT Conference this past June at the University of Waterloo, I gave a short demonstration of a vibrator I built from a Radio Shack speaker. It allowed me to produce longitudinal as well as transverse standing waves. This is based on an idea from one of the AAPT conference workshops.

The speaker I used is the Radio Shack 10 cm (4") woofer 40-1022, which cost me $19.99. It is quite compact, but gives good low frequency response so that vibrations can be clearly visible.

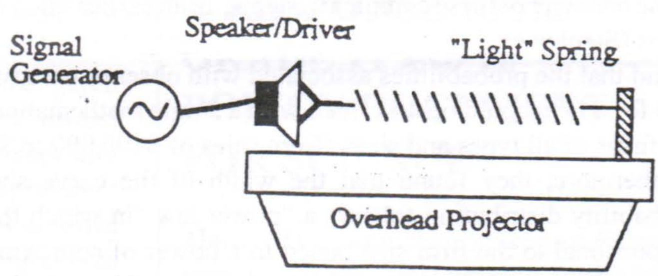




To connect this speaker to a spring or a cord, you can make a tripod using straightened out paper clips and an alligator clip, and epoxy or hot glue to fasten things together. See diagram. Make a 90° bend in the end of the paper clip that is fastened to the speaker so that it won't pull out of the glue when tension is applied.



For longitudinal vibrations, use a light spring, and place the demonstration on an overhead projector (see diagram). I found the spring from my Pasco dynamics cart set worked very well. You can illustrate the characteristics of nodes, antinodes, and changing mode number with changing frequency. It is possible to use a hand stroboscope to slow the action down so that the motion of the coils at the nodes can be studied.



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