



NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS
(an affiliate of the American Association of Physics Teachers)
Volume XV, Number 2
Winter 1993

EDITORIAL:

I Teach Physics, Therefore I Am...

Contemplating OAPT's existence while typing an editorial at midnight

I was at my first OAPT executive meeting. It was a beautiful fall day in a hidden subdivision in Mississauga; you could not see the sky for the trees with their red and gold leaves. It was a good day to be a member of OAPT.

One of the concerns raised at this meeting was the slow decline in membership over the last few years from over 400 to approximately 300 today. We estimated that there are 10^3 high

school physics teachers, plus 10^2 or so university physics teachers involved with first year students in Ontario, only a third are members of the OAPT. Since the two main benefits for OAPT members are the newsletter and the summer conference my first task as newsletter editor was to look into ways of promoting OAPT.

The Newsletter should inform physics teachers about what's

going on in physics education, help physics teachers by printing demonstrations, reviewing teaching materials, allowing physics teachers to "touch base" (I don't think this buzz word is being used any more, but you know what I mean) and discussing future trends in education.

Over the next year we hope to implement some of these things, but we need your input. So call us, write us, fax us. Let us know what you want, what you don't want; be critical (well...not too

critical, how about "constructively critical"). Help form the direction of the Newsletter (otherwise I'll be making it up myself, and who knows where that will lead).

In this issue we have information about the upcoming OAPT Conference (get your p.d. requests in now before the money runs out), where to write to get your video tape of Kenneth Laws lecture on the Physics of Dance, ideas for computer hardware and software

for those of us on a budget (some of it free!).

Remember to pass this newsletter on to other members and encourage them to join.

Fax Us!

We want to hear from you
Send correspondence to:

OAPT Newsletter
c/o Paul Laxon
201 Chestnut St.
St. Thomas, ON
N5R 2B5

work: (519) 631-4460
fax: (519) 633-9014

1993 OAPT Contest

This year's OAPT contest for Grade 12 Physics students will be written on Tuesday, May 18, 1993. The answers will be sent out shortly after the contest, enabling schools to determine local winners at an early date.

Consequently, we have scheduled the contest a week later than in previous years. This will enable teachers to get further along in the course. Prizes will be awarded to provincial winners.

The committee members are:

- | | |
|-----------------|--|
| Peter Scovil | Waterford District H.S. (administration) |
| Malcolm Coutts | City Adult Learning Centre, Toronto (test paper) |
| Greg Marshall | Lisgar C.I., Ottawa |
| Dianne Ness | Humberson C.I., Toronto |
| Pauline Plooard | Fenelon Falls S.S. |
| Peter Spencer | Stephen Leacock C.I., Scarborough |
| Ron Taylor | Woburn C.I., Scarborough |

Both Peter and Malcolm will be stepping down at the end of this year. Volunteers will be needed to fill their positions.

40th Annual Conference
Michigan Science Teachers Association
Feb. 26-27, 1993
Westin Hotel, Detroit, MI

Hands-On Science Across the Border

For more information write to:
Western Michigan University
Office of Conferences and Institutes
Division of Continuing Education
Kalamazoo, MI 49008-5161

Adaption of a Zen Koan you can tell your students before beginning a study of Newton's Laws of motion and force.

Before you study Physics, mountains are mountains and rivers are rivers; while you are studying Physics, mountains are no longer mountains and rivers are no longer rivers; but once you have had enlightenment, mountains are once again mountains and rivers again rivers.

High Tech on a Low Budget

Greg Marshall

Lisgar Collegiate

29 Lisgar Street, Ottawa

K2P 0B9, (613)239-2696

(This article was part of a talk given by Greg at the 1992 STAO Conference)

HARDWARE

COMPUTERS:

Local Bulletin Board Systems have Trade/Sell sections that often list parts and computers for sale. Recent sales on the BBSs that I subscribe to include:

- i286-12 in large flip-top case
- 1 MB RAM
- math coprocessor
- 40 MB SCSI HDD w/controller
- Imtec EGA monitor w/ATI EGA Wonder card
- 1.44 MB FDD (Panasonic)
- 360k FDD
- 1 parallel, 2 serial ports
- 101 keyboard
- DOS 5.0

In excellent condition...Asking \$350

The actual selling price of this unit was \$285

PARTS PRICES:

These same services often serve as a good source of parts. As long as you get the right sort of assurances from the seller regarding the operability of the parts, you should be okay. I've picked up the following parts to use in a system I put together.

- 386SX-25 motherboard with 1 MB RAM: \$135
- Serial-Parallel-Hard/Floppy drive card: \$19
- VGA video card, 512K video RAM: \$25
- Case and power supply: \$35
- Floppy drive (3.5"): \$35
- Hard drive (20 MB IDE): \$75
- VGA Gray-scale monitor (IBM!): \$70
- Keyboard: \$15
- Game cards: 5 for \$25
- 4 meg SIPP RAM: \$100

Some of these parts can now be had for as little or less, purchased new from assemble shops that import parts in bulk from SE Asia.

A check of low-end Mac systems has shown:

- Mac SE, 20 MB HD, 4 MB RAM, keyboard, mouse: \$600
- Mac Plus, 45 MB HD, 4 MB RAM, keyboard, mouse: \$550

SOFTWARE

Vernier Software provides some the best value for the money of any supplier. Most programs are in the range of \$39 to \$59 US, and you get a site license so that you can install the program on any computer in your school. My favourite and most used are Graphical Analysis (also available for the Mac), Precision Timer, and Millikan. They also sell the curriculum materials for Workshop Physics, which are a bargain if you're interested in moving to activity-based learning for either grade 12 or the OAC course.

Vernier Software, 2920 S.W. 89th St., Portland, OR, 97225, (503) 297-5317

Physics Academic Software has a broad selection of material, mostly for OAC and up. *Mathplot*, *Fit Kit*, *Gradebook*, *Physics Simulations*, *Orbits*, *Spacetime*, and *Maxwell* are some of their titles. I've used *Spacetime* (also available for the Mac) as a graphic simulation of length contraction and time dilation for teaching an optional unit on relativity for OAC. Prices are variable, but *Spacetime* cost \$149.95 US for a lab pack of ten.

Physics Academic Software, TASL, Box 8202, NCSU, Raleigh, NC, (919) 515-7447

Microsoft Canada will sell your school their top-of-the-line business software at very deep discounts, at least equivalent to the educational price charged university students and faculty. Microsoft Excel for the Mac, for example, can be had for \$129.95, which about 1/3 to 1/2 what even the best corporate purchasers have to pay. This can be considerably reduced if you can purchase through the Ontario Software Assistance Program (OSAP). This program is usually publicized to your board computer coordinator or responsible superintendent. The price list may or may not percolate down to the science department.

Health and Welfare Canada has an on-line database for the International Registry of Potential Toxic Chemicals. Register by calling (800) 267-3364. This is useful for health and safety, environmental science, or Science in Society. You get an operations manual when you register, and there is no charge.

Applied AI Machines and Software is one of the Canadian distributors for the program *Derive*, which is a general purpose mathematics program. It allows you to plot functions on the computer screen, solve equations, do matrix operations, and



do most of the math stuff that senior physics requires. It is not as ornate as *Mathematica* or *MathCAD*, but it is a lot cheaper, and will run will on basic PC-compatibles. I use it for doing graphical solutions to kinematics problems, so that while the kids crunch the numbers, I make the graphs. Then when we discuss the problems, we can look at the effects of changes of value for things like initial velocity, position, and so on. *Derive* tends to do things the "right" way, form a math point of view. It does a good job of differentiating and integrating, and allows you to have many graphs on screen at a time, either in separate windows or as overlays. Cost is around \$300 for a single copy, but goes down to \$85 per copy when network licenses are purchased in groups of 10 or more. Stand-alone licensing is a bit higher.

Applied AI Machines, Suite 504, Gateway Business park, 340 march Road, Kanata, ON, K2K 2E4, (613) 592-7729

(see BUDGET, page 3)

...Budget (from page 2)

MATERIALS, EQUIPMENT, SUPPLIES

Lasers:

Meredith Instruments, 5035 N. 55th Ave, #5, PO Box 1724, Glendale, AZ, 85301, (602) 934-9387

Cheap lasers, tubes, power supplies, optic parts. e.g. He Ne laser: \$59 US (12-volt supply), Diode laser Module (runs off batteries): \$99

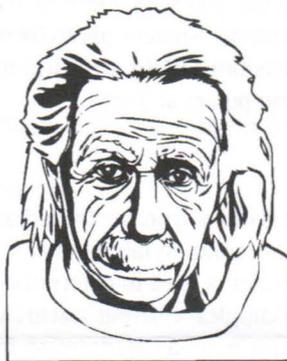
Midwest Laser Products, PO Box 2187, Bridgeview, IL, 60455, (708) 460-9595

EDITORS NOTE:

There are a couple of good programs that I should mention. These programs were developed by Toronto Image Technologies Ltd. and are licensed by the Ontario Ministry of Education for educational use only by its elementary and secondary schools and faculties, schools and colleges of education.

Electronics Workbench allows you to construct a schematic for an electronic circuit (analog or digital) on a computer display, simulate the activity of that circuit, display its activity on test instruments contained within the program, and print a copy of the circuit, the instrument readings and parts list.

Autoelectric is a similar program for automobile electrical systems.



Physics Day at Cedar Point

Annual workshop for teachers—April 24, 1993

\$10 fee for workshop

For more information contact:

Dr. Robert R. Speers
BGSU—Firelands College
Huron, OH 44839
(419) 433-5560

Physics Day—May 19, 1993

To be placed on the mailing list, and for information about tickets, call (419) 627-2237.

For information about the educational aspects contact Dr. Robert Speers at (419) 433-5560.

JOINT REGIONAL SPRING MEETING

of the

Detroit Metropolitan Area and the Ohio Sections American Association of Physics Teachers

hosted by the

Bowling Green State University—Firelands College
and

Plum Brook Station of NASA/Lewis Research Center
March 19-20, 1993

In order to encourage communication between members of regional AAPT organizations, this joint regional meeting will be held at Plum Brook Station of NASA/LeRC on March 19 & 20, 1993. All physics teachers and faculty in the Indiana, Michigan, Ohio and Ontario regions are invited to attend.

The featured speaker will be Dr. Richard E. Berg, of the physics department at the University of Maryland and an editor of *The Physics Teacher*. He will present "The Physics IQ Test", a series of demonstrations—that are often counterintuitive. Tours of several of the "big physics" research facilities at Plum Brook Station (Bob Kozar, manager) will be conducted Saturday afternoon.

In order to accommodate Dr. Berg's presentations, regular section business, and the tour of the research facilities of Plum Brook—the conference will be held from Friday evening through Saturday afternoon. Please note especially that "off-season" motel rates are in effect during this weekend.

SCHEDULE

Friday—

- 6:00—7:00 Registration, Wine and Cheese Reception.
7:00—8:00 Buffet Dinner
8:00—9:45 "Physics IQ Test"—by Dr. Richard Berg, University of Maryland

Saturday—

- 8:00—9:00 Registration
Follow-Up Meeting of the 1992 CWRU Workshop Participants
9:00—10:30 Physics of & Answers to "The Physics IQ Test"—Dr. Richard E. Berg
10:30—10:45 Break (with coffee & donuts)
10:45—11:05 Project Discovery, Larry Badar, CWRU
11:05—12:05 How-I-Do-It (or whatever) Send a brief description for a ten minute presentation by 3/10/93 to: Barbara Bates, Lakeland Community College, 7700 Clocktower Drive, Mentor, OH 44060, (s)216/953-7104
12:10—12:30 Section Business Meetings
12:30—1:15 Lunch
1:15—4:00 Discussion & Tour of the Research Sites at Plum Brook
B-2—A facility to "soak" a rocket engine (up to Saturn in size) in the cold and vacuum of space (with a sun beating on one side) and then start & restart the rocket engine.
SPF—The largest space simulation tank on Planet Earth.
K-2—A mach 7-8 engine test facility. Will be used to test ram- & scram-jet rocket engines

Questions regarding the Meeting should be directed to:

Dr. Robert Speers, BGSU—Firelands College, Huron, OH 44839 ---- (s) 419/433-5560

Bob Sledz, President, OS/AAPT, 12000 Maple Leaf Dr., Garfield Heights, OH 44125 ---

(h) 216/333-7827

Chris Deyo, Editor, DMAPT Newsletter, 5597 Oregon Rd., Lapeer, MI 48446 ---

(s) 313/652-0122

Plum Brook Station - NASA, Sandusky, OH 44870 --- 419/625-3205

Preregistration (in the mail by March 10) is requested so that we can properly accommodate attendees.

Cut off Registration Form

Name _____
Address _____
City, State, ZIP _____
School Phone _____
Home Phone _____
Registration -----\$5.00 _____
Friday Dinner -----\$8.50 _____
Saturday Lunch -----\$5.00 _____
TOTAL _____

Make checks payable to: OS/AAPT
Mail with this form to arrive by 3/15/93 to:
Don Cope, Secretary
Firelands Area Physics Alliance
407 Indiana Avenue
Sandusky, OH 44870

Spouses are welcome to attend at no charge for registration, but we need to charge for the meals.

Trent University Research Areas

The following is a description of some of the physics research that is taking place at this year's OAPT Conference host university

ASTRONOMY

The main emphasis is on the study of the stellar population structure in the immediate neighbourhood of the Sun. Spectroscopic and photometric observations of stars of high proper motion (some as faint as $V = 19$) are analysed to obtain their space velocities and, where suitable theoretical models are available, their chemical compositions and ages. After statistical selection effects have been accounted for (typically by Monte Carlo simulation), the data are used in an attempt to determine the density normalizations and other parameters of the local stellar populations and, ultimately, to shed some light on the formation and evolution of the Galaxy.

P.C. Dawson, R.G. Johnson

ATMOSPHERIC PHYSICS

Measurements are carried out of the ozone layer and the greenhouse effect using remote sensing technology from the space shuttle, satellites, balloons, aircraft and ground based locations. The effect of chlorofluorocarbons on the depletion of the ozone layer and contributions to the greenhouse radiation budget are studied. Model simulations of these effects are carried out by computer. The consequences of depletion of the ozone shield on ultra violet radiation at the earth's surface are researched.

W.F.J. Evans

CONDENSED MATTER

SURFACE PHYSICS

The experimental side of this program investigates the electronic and topographical structure of clean metal surfaces, and the oxides which form on these surfaces. Measurements are carried out in two ultrahigh vacuum chambers, using a range of analytical techniques including scanning tunneling microscopy and spectroscopy, Auger electron spectroscopy, low energy electron diffraction and electron energy-loss spectroscopy. Some of this work is carried out in collaboration with industry.

Theoretical models of surface adsorbates are constructed to provide insight into the interactions in adsorbates. Monte Carlo simulations of these models provide results which may be directly compared with experiment. Current work is closely linked to the experimental work on surfaces in this department.

K. De'Bell, A.J. Slavin

THEORY OF MAGNETIC SYSTEMS

Magnetic systems display a wide variety of ordered structures. The interactions between ions which give rise to ordering in specific magnetic materials are studied by a number of theoretical methods. Computer (Monte Carlo) simulations are used to provide results which may be directly compared with experiment. Current work includes the study of magnetism in layered rare earth compounds such as the high T_c superconductors.

K. De'Bell

THEORY OF PHASE TRANSITIONS

A phase transition occurs when a system undergoes an abrupt change of state as a physical parameter is varied. Theoretical studies of phase transitions in a variety of systems, including polymers, magnetic systems and surface adsorbates, are being carried out. Methods used include Monte Carlo simulation and the application of field theory (and renormalization group) methods.

K. De'Bell

THERMAL CONDUCTIVITY OF CERAMICS

Measurements are made of the thermal transport through packed beds of ceramic spheres under a range of gas pressures. These studies are carried out in collaboration with industry, and have applications in development of fusion nuclear reactors and high-temperature thermal insulation.

J.W. Earnshaw, F.A. Londry (Research Associate), A.J. Slavin

SUBATOMIC PHYSICS

ELECTRONUCLEAR REACTIONS

Research into the nature of the hadronic interaction is being carried out using the tagged photon spectrometer at the Saskatchewan Accelerator Laboratory (SAL). Experiments are performed using the 300 MeV electron beam of the SAL facility to create monochromatic photons. Nuclear photodisintegration studies using these photons include the reactions $^{12}\text{C}(g, p)$, $^2\text{H}(g, np)$ and $^{16}\text{O}(g, np)$. Data analysis is done using computers at Trent.

J.W. Jury

ENVIRONMENTAL RADIATION

Studies of the extent and changes in levels of environmental radiation are being carried out at Trent's environmental radiation laboratory. A supersensitive, large volume liquid scintillation counter is used to determine the nature and degree of radiation in natural water samples. Current research is investigating the hypothesis that mineral leaching by acid precipitation can increase the level of the isotope ^{222}Rn in natural waters.

J.W. Jury

THEORY OF ION DYNAMICS IN THE QUADRUPOLE ION TRAP

The research is concerned with the dynamics of ions inside a quadrupole ion trap when they are excited by an auxiliary electric field. The collisions of the excited ions with molecules and ions present in the ion trap are also being investigated. This work is being carried out in collaboration with the Mass Spectrography Research Group in the Department of Chemistry at Trent.

L.C.R. Alfred

1993 OAPT CONFERENCE

PHYSICS AND THE ENVIRONMENT

THURSDAY (EVENING), JUNE 24 — SATURDAY (AFTERNOON), JUNE 26

Tentative Information:

Registration	
Members	\$50
Non-members	\$65
Student teacher	\$25
OAPT membership	\$8
Residence accommodation (includes bed & breakfast)	\$45
Lunch	\$9
BBQ Banquet	\$20
Liftlock boat cruise	\$15
Parking	free
For three full days you will need:	
1 Registration (member)	\$50
2 Residence Accommodations \$90	
2 Lunches	\$18
1 BBQ	\$20
1 Cruise	\$15
Total	\$203

Other Accommodations:

Holiday Inn (close to the water, walk to downtown)
\$81 + tax (double)
(705) 743-1144

Ramada (formerly Red Oak, close to downtown)
\$77 + tax (double)
(705) 743-7272

Some details:

Three speakers have been lined up so far.

Wayne Evans World renowned theoretical physicist doing work at the cutting edge of atmospheric ozone research

Anne McMillan Physicist doing practical physics implementing laws involving the Air Toxics Program on the Great Lakes

Kenneth McNeill Health physicist advisor on radiation who has studied the environmental impact of the Chernobyl incident

The boat cruise leaves shortly after the BBQ from the University campus and will take us down the river/canal system through the liftlocks to the harbour downtown, near the Holiday Inn. Buses will transport us back to the campus after a brief city tour.

Schedule:

Thursday	4:00 - 6:00	Check in/Registration — Lady Eaton College
	6:00 - 8:00	Equipment Supplier/ Teacher experiment demos — Science Complex
	8:00 - 10:00	Reception (Lady Eaton)
Friday	7:30 - 8:20	Breakfast
	8:30 - 8:45	Opening remarks — Science Complex Lecture Hall
	8:45 - 10:15	Papers
	10:15 - 10:30	Break / exhibits — Native Studies Lounge
	10:30 - 12:00	Papers
	12:00 - 12:50	Lunch / exhibits
	1:00 - 2:30	Papers
	2:30 - 2:45	Break / exhibits
	2:45 - 4:30	Papers
	5:00 - 6:30	BBQ
	6:45 - 9:15	Boat Cruise / tour
	9:15 - 11:00	Reception
Saturday	7:30 - 8:20	Breakfast
	8:30 - 10:15	Papers
	10:15 - 10:30	Break
	10:30 - 12:00	Papers
	12:00 - 12:50	Lunch
	1:00 - ?	Papers

“Papers” include invited speakers, submitted papers, “My Favourite Demonstrations,” etc.

Not confirmed are post conference tours on Saturday of:
University owned Hydro Electric Power Station
Physics Research Labs of some of the professor’s

Physics of Dance Lecture

The video tape of Kenneth Laws lecture from the 1992 OAPT conference is available for \$25 if ordered from North America, \$30 overseas
Send your orders to: Physics of Dance Video, c/o John Wylie, The Toronto French School, 306 Lawrence Ave. East, Toronto, Ontario, Canada, M4N 1T7

Membership Due?

The date on your address label is the expiry date for your membership. If it says **June 92**, your membership has already expired. You may use the coupon below to renew it.

Membership Application Renewal

Name _____

Address _____

\$8.00 per year, payable to the OAPT

Send to: Ernie McFarland, Department of Physics, University of Guelph,
Guelph, Ontario N1G 2W1

THE DEMONSTRATION CORNER

THE CLASSROOM WAVE

by

Bonnie Edwards

Our Lady of Lourdes High School
54 Westmount Rd.
Guelph, ON N1H 5H7

How about a physics demonstration with hundreds of moving parts that never needs to be fixed and doesn't require storage space? Hard to believe? Try doing THE WAVE in your grade 12 physics classes.

The following variations on THE WAVE let the students feel first-hand some of the points we try to teach in the Waves and Acoustics Unit. However, a caution is appropriate: I use only a few of these variations in a given year to liven things up and make a few points. As any regular Blue Jays fan knows, too many WAVES can become tedious.

UNIT OPENER

On the first day of the Waves Unit, I start the class by choosing something to celebrate (excellence on the last test, a great snowfall, the school football team). "To show our joy," I state, "we are going to do THE WAVE." I move my arm up and down along the rows of lab benches and we do THE WAVE a couple of times. By now, the students who were half asleep have realized that something is happening and we are ready for the unit introduction.

MOVEMENT OF A WAVE VS. MOVEMENT OF THE MEDIUM

Students sometimes have difficulty separating a wave from the medium the wave travels in. I use a question/answer routine following a WAVE to help distinguish the two: which way did you move; which way did THE WAVE move; after THE WAVE passed you, where were you? A wave is a disturbance that passes by, leaving the medium more or less back where it started.

WAVE SPEED

Leading up to the universal wave equation, it is important to understand wave speed. On occasion, we do THE WAVE and measure the wave speed a good example of "How far did it go and how long did it take?"

As often as not, someone is not paying attention and THE WAVE stumbles going past the guilty party. This is a good opportunity to talk about wave speed being related to the interaction between neighbouring people or molecules in the medium. Wave speed is a property of the medium, not of the particular

wave. Any factor such as density or temperature that can affect the response time between neighbours affects the wave speed.

WAVE AMPLITUDE

We make big WAVES and little WAVES and discuss wave amplitude. I was concerned the first time I tried this, that the students would unintentionally adjust the wave speed too. This doesn't happen, and it encouraged me to explore the properties of a classroom WAVE further.

UNIVERSAL WAVE EQUATION

Actually THE WAVE is a wave pulse but my classes can make respectable continuous waves too: the first student simply starts a new WAVE at regular time intervals. This is great for a discussion of period and frequency of the motion of an individual student. Furthermore, crest-to-crest distances are easy to estimate and we're set to discuss wavelength. Trying two different periods, we can verify the universal wave equation.

TRANSVERSE AND LONGITUDINAL WAVES

With three dimensional visualization being difficult for some students, I use three weird versions of THE WAVE to discuss transverse and longitudinal waves. The students stand in a U around the edge of the room to perform these WAVES. In the first version, each student steps forward and back into line. In the second, each student does a small knee-bend. In the third, each student steps sideways to GENTLY bump the next student. The obvious follow-up questions are "Which way did you move?" and "Which way did the wave go?" This experience also leads naturally to a discussion of polarization.

A MODEL STRETCHED TOO FAR!

One year, I tried to show the effect of two colliding wave pulses. The students at the point of collision were so baffled that they did nothing and both pulses died. To this day, those students believe in their hearts that the superposition principle is a hoax. I still regret that I wasn't fast enough on my feet to turn the experience into a lesson on the breakdown of analogies in scientific thought!

A FIELD TRIP?

Doing THE WAVE a few times is good fun. Almost every year, a student suggests that we put our theories into practice and plan a visit to the Sky Dome. And hardly a WAVE goes by without someone adding "GO, JAYS, GO!"

Column Editor: Ernie McFarland, Physics Dept., University of Guelph, Guelph, Ontario, N1G 2W1

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

