American Association of Physics Teachers

AAPT Ontario Section NEWSLETTER

Vol IV No 3 April 1983

Editor: George F. Kelly

F.O.S.T.E.R. ONTARIO

(Friends of Science, Technology, Engineering and Research)

by Mrs. Gerald DesRoches of F.O.S.T.E.R. ONTARIO

Science's link with the Public

Foster Ontario is a non-profit society dedicated to the advancement of science. It was begun at the urging of Canadian scientists, engineers, doctors and businessmen just two years ago. Dr. J. Tuzo Wilson, Director General of the Ontario Science Centre, began to plan such a society.

To date there are twenty branches throughout Ontario with interest spreading throughout Canada. The Toronto branch is closely affiliated with the Science Centre and enjoys the benefits of being able to use the facilities of the Centre. The outlying branches have had volunteer staff members bring programs to them on request. An Ontario program committee has been formed to assist the branches with their functions.

Some of the programs so far have included popular talks, film series (in particular, the series from British Columbia called "Connections" on the development of technology), "Physics is Fun" demonstrations, "Astronomy in Your Own Back Yard" (by Doug Cunningham of Ontario A.A.P.T. - ed.), a Vegetarian film and feast, a study of claims to the paranormal called "Extra-Sensory Deception", Plate Tectonics and Continental Drift, and preparations for Saturday morning classes for young children.

All the members of the Ontario Board and all the area Convenors are volunteers. Membership is restricted to individuals and costs to members are low (Adult membership is $10.00 and student membership is $5.00). Members receive a monthly copy of Newscience--the Ontario Science Centre's publication--and a F.O.S.T.E.R. newsletter edited by Marg Maher, a staff member of the Centre. The newsletter contains:

- a regular feature by Dr. Wilson called "Canadian Innovators"
- news from the branches
- news from schools, universities, engineering, medical, technical and scientific societies in and around Ontario
- notices of lecture, open houses, courses and any happenings related to science, tchnology, engineering and research

Many programs are free or are of special cost to F.O.S.T.E.R. members.

Applications for membership:

Cheques should be made payable to F.O.S.T.E.R. ONTARIO and mailed to

Dr. J. Tuzo Wilson,
Director General,
Ontario Science Centre,
770 Don Mills Road,
Don Mills, Ontario,
M3C 1T3

Include your name, address, telephone number and postal code (Students should give the name of their school, college of university).

In MEMORIUM

Prof. Donald S. Ainslie, PH.D.

Donald Ainslie was in his 90th year when he died. He was born near Windsor in a small town called Comber. After finishing high school in Leamington, he attended University of Toronto, graduating in about 1915.

He put his Physics knowledge to work almost immediately, travelling to Great Britain to help in the installation of underwater harbour defenses at ports around England and Scotland during World War I. While working at Dunure Scotland he met his future wife, Dorothy, whom he would marry about ten years later in 1927.

After the war he worked on his doctorate at the University of Saskatchewan. His teaching then took him to the University of Western Ontario from about 1927 to 1929, and then to the University of Toronto until the Second World War.

In World War II he travelled to Halifax where again he helped with naval defense and underwater mine detection.

After the War it was back to the University of Toronto until retirement at 65. Toronto's mandatory retirement could not stop a man of his energies and he worked for five more years at the expanding University of Windsor.

For the next twenty years of his life he remained active, continuing with experiments in the lab at his home, helping with Science clubs in public school, prolifically writing articles for science and Physics digests, and of course, looking forward to his annual pilgrimage to the A.A.P.T. Ontario Conference.

We of the Ontario A.A.P.T. will miss Donald Ainslie. We are consoled by the certainty that his love for Physics and his scholarship has been passed on to the many Physics students who were privileged to have been taught by him.

We thank David Ainslie, a Physics teacher at St Mary's District Collegiate and a nephew of Dr. Ainslie for the above information.

Mrs. Jackie Shaw, Head of Physics at Branksome Hall in Toronto writes to tell us that Dr. Ainslie has willed all of his Physics experiments and papers to the Physics department at Branksome Hall. His daughter, Mrs. Margaret Tuer, is a mathematics teacher there.

F.O.S.T.E.R. Ontario branches are located in Burk's Falls, Deep River- Pembroke, Guelph, Kapuskasing, Kingston, London, Niagara-St. Catherines, North Burlington, Ottawa, Peterborough,Sarnia, Sault St. Marie, Sudbury, Thunder Bay, Toronto, Waterloo-Cambridge and Windsor. If you wish to contact any of the convenors in your area, address your request to:

Mrs. Gerald Desroches.
288 Indian Valley Trail,
Mississauga, Ontario,
L5G 2K8.

Ed note: We commend to our membership this worthy organization whose aims are consistent with those of the A.A.P.T.

Analysis of an Experiment by G Kelly

This P.S.S.C. Experiment is usually the first experiment that the new grade 13 students in Physics undertake. The pre-experiment demonstration of the graphical techniques used in this experiment tend to "give away" the relationships between the height, the time and the diameter of the hole emptying the cylinder.

I now use other data in my "demo" that will do the same thing without giving away the relationships mentioned above.

A sonometer (wire stretched over a sounding box) will generate sound frequencies (f) that are dependent on
(i) the length of the string (l)
(ii) the tension (force) of the string (F)

Keeping all other variable constant (material, cross-sectional area, density,etc.) I have used the following data to demonstrate to my students the power of the graphical techniques to determine variable relationships. By using a program that I have generated on my Apple II, I have been able to demonstrate quickly the graphs (curved) of this data and manipulate this same data to give straight line graphs.

TABLE OF FREQUENCY OF THE GENERATED SOUND

		TENSION IN WIRE in Newtons			
	Force	50	64	80	100
Length					
100	I	181	205	229	256
in 80	I	226	256	286	320
cm 60	I	301	380	380	425
40	I	453	512	572	640
20	I	905	1024	1145	1280

AAPT Ontario Section

MEMBERSHIP RENEWALS AND NEW MEMBERSHIPS 1983-84

There are three ways to renew your membership in A.A.P.T.Ontario for 1983-84.

(i) You may have already renewed when you ordered your Grade 11 Physics Contest papers'

(ii)You may wish to renew when you register for the Annual June Conference (see program)

(iii) Or you renew by completing the form below and send it along with the membership fee of $5.00 (cheques payable to A.A.P.T.Ontario) to
John Hlynialuk, Wiarton District High School,
Wiarton Ontario, N0H 2T0

Name .....

School (University).....

Address.....

City.....Prov.....

Postal Code..... Renewal O New member O

A.A.P.T.Ontario meets with MINIST

by George Kelly

On Saturday morning, April 16th at Lester B Pearson C.I. in Scarborough, eleven A.A.P.T. Ontario members met with Jack Bell and Jim McTavish of the Ministry of Education to provide some input to the on going curriculum review.

Discussions were lively and frank dealing with issues crucial to Physics Education in Ontario. It was generally agreed that the meeting was a worthwhile venture, a beginning for A.A.P.T.Ontario-Ministry dialog.

When NOT to use a Micro in Physics

by P. T. Spencer,Stephen Leacock C.I.
2450 Birchmount Road,
Agincourt, Ontario M1T 2M5

Although we do not use the P.S.S.C. text in our Grade 13 Physics classes here at Leacock, we still use the P.S.S.C. Lab Guide (fifth Edition).

We start the course with Appendices 1 and 2 from the Lab Guide. Appendix 2 introduces the student to graphic techniques of obtaining equations from data, including a brief mention of the utility of using log-log plots to find power laws.

"But how do you know which is the best straight line?" we are asked many times. At this point we suggest they do a least squares linear fit (linear regression). This does not present much of a problem as many of our students have calculators that will do this automatically, and some others have taken the Grade 12 Computer Science course in which linear regression is taught.

Now, what about non-linear relations, such as, inverse and inverse square? How do they do those on as calculator? Don't they need a microcomputer now? No!!! Any power law can be handled on a calculator with linear regression. All you have to do is to take the logarithm of both co-ordinates of each point and enter that into the linear regression. The slope is then the power, whether positive, negative (inverse), and/or fractional, and the antilog of the intercept is the multiplicative constant. This simple technique can be used by any student with a multi function calculator, and can be used during tests and quizzes too! (Something you can't do with your micro!)

The P.S.S.C.Lab Guide continually askes questions such as "How closely do they agree?". We discourage, via marks, vague answers as we expect our students to provide quantitative answers such as percentage difference, percentage error, and so on.

What then do we do about Experiment #6, Centripetal Force, where in the fifth edition the students are told: "You can calculate the value of FT^2 from your table and see how close they are to their mean value". In this case we tell our students to calculate some measure of central tendency, such as standard deviation. Standard deviation functions are very common on calculators nowdays. We elicit from students that a good measure of how close data is to their mean is something like the classical deviation, namely

$$\frac{\sum_{i=1}^{n} |x_i - \bar{x}|}{n}$$

, and then tell them that the standard deviation that the calculators have is the same thing, only slightly camoflaged, namely

$$\sigma_n = \sqrt{\frac{\sum_{i=1}^{n} |x_i - \bar{x}|^2}{n}}$$

If they enter two numbers, say 10 and 20, their calculators give $\bar{x}$ = 15, and σ_{n-1} = 5, both in accordance with their intuitive notions of "average", and "average difference from the average".(Note that the σ_{n-1} button gives a result not in accordance with the intuitive notion of what standard deviation should be.)

In short then, if you are using a microcomputer to help your students do graphing, curve fitting, or data reduction, please reconsider - your students may already be better equipped to do these things than you thought.

BOOK REVIEW: : by Doug Cunningham

Why Experiments ?
Why Statistics ?

by W Hines, H. Lachmansingh, D. Miller
available from
U of Guelph Bookstore cost $4.50

Perhaps the best vehicle for realizing the aims of any science program is the "science project". Students are encouraged to work on a problem in an area of science that interests them... problems usually requiring both library and laboratory research. In my own experience the essential ingredient for a successful project is the interest and enthusiasm of the student. Another ingredient of importance is the interested attention of the teacher... to provide encouragement when the difficulties seem overwhelming and, equally important, to serve as a sounding board as the student plans his (her) research. Typical problems encountered during the planning and execution of the experimental work involve knowing what to measure and how to measure it, distinguishing between comtrols and controlled variables, coping with differences in ages or environmental conditions, and learning from experiments that fail. In this area of experimental design good resource material has been hard to find....that is, until this book "Why Experiments? Why Statistics?" was written by Hines, Lachmansingh, and Miller. Although the purpose of the book is to serve as a guide for students embarking on the adventure of a science project, many educators will also find the information helpful.

In spite of the title the authors have chosen to emphasize good experimental design and sound experimental practises and deliberately refrained from an advanced treatment of statistics. Their concerns center around experimental variability, the importance of planning in experiments, the need for controls, and the role of the blind experiment.

It is not surprising then to find the main body of the book organized into chapters with headings which reflect the experimental process....ie designing experiments, performing experiments, summarizing observations, writing reports, and reaching a conclusion. Each of these chapters follows a question and answer format that is effective in conveying the main ideas. In the section on summarizing observations, the authors have used 5 examples from the life sciences to illustrate the basic organizing of data, the tabulating and graphing of experimental results, and the descriptive statistical summary. They indicate that other statistical summaries are possible but beyond the scope of their book.

The authors have added three appendices -: appendix A is a summary of steps to be followed in experiments; appendix B contains a list of 26 biological topics for science fair experiments; and most important, appendix C contains reports of two experiments along with valuable criticisms. These comments and criticisms are quite instructive.

In summary this softcover book is very readable, well organized, amply supplied with examples and would be a valuable addition to the science library of any school.. I would recommend this book as required reading for any students and their teachers involved in science project work.

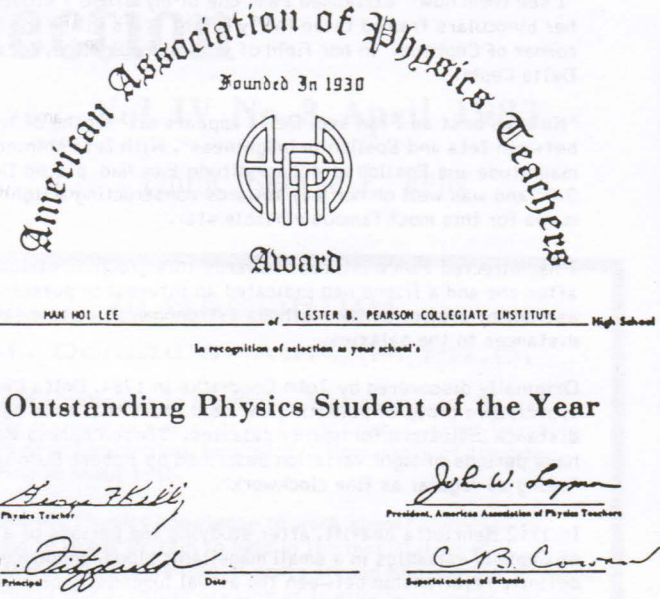
AAPT Ontario members author Articles for "PHYSICS TEACHER"

by George Kelly

The April edition of "The Physics Teacher" contains articles by three members of AAPT Ontario. Congratulations are extended to Doug Cunningham and John Hlynialuk for their lead article on "Grazing Occultations". It is really a great article. I'm glad that the fine talent we have in AAPT Ontario can be shared with other Physics teachers.

Doug Fox also has a good article (page 251) on "Teacher's Pets: Programmed experiences in classical mechanics". We again commend these members on this recognition.

AAPT AWARD CERTIFICATES free!



HONOUR YOUR OUTSTANDING PHYSICS STUDENT with a professionally printed certificate signed by the President of the National AAPT!

PROVIDE VISIBILITY for physics and the physics teacher by having the Superintendent and Principal signatures on this certificate!

PROMOTE YOUR PHYSICS PROGRAM - by presenting this at Commencement or Awards Assemby!

AVAILABLE FREE. Order yours today!:

NOTE: One per school only!
Teachers
Name.....

School
Name.....

School
Address.....

City.....Prov.....

Postal Code .....

The following questions are asked to help the Committee collect data on the physics programs in the schools giving these awards. We will be pleased to send you the certificate upon receipt of this completed form.

Number of General Grade 11 Physics classes.....

Number of Advanced Grade 11 Physics classes
.....

Number of Physics teachers. .....

Av. No. students per class .....

Number of grade 13 Physics graduates .....

Are you a member of (national) AAPT?(Y/N).....
(NOT NECESSARY for requesting certificates.)

Send your request to:

HIGH SCHOOL CERTIFICATES,
American Association of Physics Teachers,
Graduate Physics Building,
SUNY at Stony Brook,
NY 11794, U.S.A.

STAR GAZING

by Doug Cunningham

"I see them now!" exclaimed Pam, one of my Grade 9 students, as her binoculars framed three fairly bright stars in the lower left corner of Cepheus. In her field of view were Epsilon, Zeta, and Delta Cephi.

"Now, as best as I can see, Delta appears six-tenths of the way between Zeta and Epsilon in brightness". With Zeta shining at 3.3 magnitude and Epsilon at 4.2 magnitude Pam had placed Delta at 3.8^m and was well on her way towards constructing a light curve for this most famous variable star.

I had directed Pam's interest towards this group of variable stars after she and a friend had indicated an interest in pursuing an astronomy project on the methods astronomers use to measure distances to the galaxies.

Originally discovered by John Goodricke in 1784, Delta Cephei is typical of a group of pulsating variable stars that have served as distance indicators for nearby galaxies. These Cepheid variables have periods of light variation described by Robert Burnham as "being as regular as fine clockwork".

In 1912 Henrietta Leavitt, after studying the periods of a number of Cepheid variables in a small magellanic cloud, announced a definite relationship between the actual luminosity of a Cepheid and its period of light variation. In particular, the longer the period, the larger the time-average lunimosity. After Harlow Shapley stated, in 1917, the relationship in terms of a useful law, a relatively simple distance determination method was made available to astronomers.

In actual fact, two period luminosity laws were discovered because the Cepheids could be members of the arms of spiral galaxies, called Population I types, or they could be the Population II types, 1.5 magnitudes fainter, found in galactic halos, global star clusters, and elliptical galaxies.

The mechanism responsible for the pulsations is not completely understood but apparently the outer envelopes of the Cepheid stars are involved wherein the opacity of the Hydrogen and Helium ionization zones acts as a reverse valve to orchestrate the pulsations.

The use of Cepheid variables as "standard candles" to determine distances opened the door for Edwin Hubble's discovery of the expanding Universe. This use of the Cepheids was elegant- wherever a Cepheid was found, its period indicated the absolute luminosity and then its apparent faintness was a measure of the distance.

The observation of variable stars, of which the Cepheid forms only a small class, is a productive and valuable enterprise for the amateur astronomer. Anyone interested in this branch of amateur astronomy should contact

American Association of Variable Star Observers,
187 Concord Avenue,
Cambridge, Massachusetts
02138 U.S.A.

CELESTIAL EVENTS CALENDAR

MAY

Sun May 1 Neptune 1.5° N of moon
Thurs May 5 Eta Aquarid Meteor Shower (20 high speed meteors per hour)
- best observed during the early morning hours on May 5th
Thur May 12 New moon
Mon May 16 Venus 1.5° N of the moon
Jupiter 0.8° N of Uranus
Thur May 19 First Quarter moon
Mon May 23 Saturn 1.8° S of the moon
Thur May 26 Full moon

IMPORTANT DATES COMING UP!

Grade 11 Prize Contest
Tuesday May 3rd, 1983
For info contact Doug Fox, Belle River District High School,
Belle River, Ontario N0R 1A0.

F.O.S.T.E.R. Guelph Chapter
Wednesday May 4th, at 7.30 p.m.
Room 113 Physical Science Bldg.
University of Guelph, Guelph, Ont.
Topic: "Astronomy in your own back yard"
Doug Cunningham, Science Head at Bruce Peninsula D.H.S.

Sir Isaac Newton (SIN) Test
Thursday May 5th, 1983
For info contact P.C.Eastman, Dept. of Physics,
Univ. of Waterloo, Waterloo, Ontario N2Z 3G1.

National AAPT SUMMER MEETING
June 15-17, 1983.
Memphis Tennessee
Abstract deadline: March 20, 1983.

AAPT ONTARIO Section meeting
June 17-18, 1983, at Univ. of Waterloo,Waterloo, Ontario N2Z 3G1.
Convenor : Dean Gaily, Physics Dept. Univ. of Western Ontario,
London, Ont. N6A 3K7.

COMPUTERS IN EDUCATION
Conference & Summer Institute
June 20-July15th
Rutgers the State Univ. of New Jersey
Contact Dr. Michell E Batoff
245 Nassau St. Suite D
Princeton, New Jersey 08450

PHYSICS for TEACHERS
June 27th to July 8th
Short course on Physics Demonstrations and outdoor activities.
at the Royal Military College in Kingston, Ontario
for info contact Geo. Vanderkuur at
The Ontario Science Centre 770 Don Mills Rd.,
Don Mills,Ontario M3C 1T3

S.T.A.O.Region 7 & 8 (Toronto and Area)
Computer Conference
November 5, 1983
At Upper Canada College.

Event of the decade!!

National AAPT WINTER CONFERENCE
JANUARY 1985 AT
ROYAL YORK HOTEL, TORONTO!

CONGRATULATIONS

A.A.P.T.Ontario takes pride in congratulating Doug Fox, a former President of A.A.P.T. Ontario and Newsletter editor, on his appointment to the Editorial Board of the National A.A.P.T. Publication "THE PHYSICS TEACHER". No doubt the experience gained as editor of this newsletter will make him a valuable member of that organization. - Geo Kelly

JUNE

Fri June 3 Last Quarter moon
Wed June 8 Mercury greatest western elongation
Thur June 9 Mercury 0.8° S of the moon
Sat June 11 New moon
Solar Eclipse visible from New Guinea
Tues June 14 Venus 1.5° S of moon
Thur June 16 Venus greatest Eastern elongation
Fri June 17 First Quarter moon
Mon June 20 Saturn 2° S of the moon
Tues June 21 Summer Solstice
Wed June 22 Jupiter 1.2° S of the moon
Sat June 25 Full moon
Partial Lunar Eclipse- moon enters umbra 3:14 DLS