NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS
(An Affiliate of the American Association of Physics Teachers)
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2001 - A Physics Odyssey
The Annual Conference of the Ontario Association of Physics Teachers
by Terry Price

Another year and another very successful OAPT conference. Approximately 80 physics teachers, many of who were attending for the first time, spend three enjoyable and productive days Trent University in late May. David Marshall our host from Trent, Dianna Hall, the conference coordinator and the OAPT executive once again put on an excellent conference program. Some of the highlights of the program were:

- Four - two hour evening workshops on Thursday night including the Grade 10 motion unit (Kevin Soltes, OAPT president for 2001 - 2002; Scanning Electron Microscope (Alan Slavin of Trent University); Astronomy for the Grade 9 Curriculum (John Earnshaw of Trent University); and Weather Station Science (John Palcik of Boreal). These Thursday workshops have become a very popular beginning to our conference, perhaps partly because of the wine and cheese social that follows them.
- A keynote lecture by Dr. Ralph Chou of the School of Optometry, University of Waterloo on Protecting the Eyes from the Sun. Dr. Chou very effectively showed us how important it is to protect the eyes from the UV spectrum.
- A short session by a second year teacher from York Region, Steve Auger, on using video clips from popular television shows to grab your students interest
- Glen Wagner from Centre Wellington DHS shared some ideas on the effectiveness of exposing students to modeling instruction in the classroom
- Delegates attended one of four tours in the afternoon and then combined for an interesting boat cruise from downtown Peterborough to the University campus.

Our Friday night banquet began with a delicious meal prepared by the University Chef and ended with a very enjoyable after dinner talk by Dr. Michael DiRobertis of York University. Michael shared some ideas on how science teachers could use the topic of pseudoscience (ever popular with our students) to teach real physics topics and the scientific process.

Although I couldn't attend the sessions on Saturday due to a family commitment I'm told that the day was just as successful as Friday. The sessions were:

- A keynote lecture by Jim Jury of Trent, "From Landmine Detection to Human Diagnostic Radiography"
- A keynote lecture by Johann Beda of Physiciens Sans Frontieres, "Photonic Programs at Ontario Colleges – the PET Project"
- A short session by Diana Hall OAPT Conference Coordinator, "Crackerbarrel on Grade 10 Motion"
- A short session by Professor Tony Key of the University of Toronto, "Transforming the Traditional Laboratory"
- A short session by Doug Hayhoe of the Toronto District School Board, "Mapping Misconceptions Before Writing Textbooks"
- A keynote lecture by Dr. Uwe Erb of the University of Toronto, "Nanoworld 2001"
- A keynote lecture by Elliot Coleshill, of M.D. Robotics, "Canada's Contribution to the International Space Station"

After lunch the conference concluded with the ever popular "My Favourite Demos" (Alan Slavin from Trent with his 'Human Oscillator'; Rolly Meisel from Crystal Beach HS with 'Three Fun 'must do' demos', Dave Barrowclough and Chris Howes showing their 'Wine Cork Motors'; Kevin Soltes of Scarlet Heights SS discussing' 'Friction Experiments on the computer' and Johanne Christensen of Glenforest HS discussing 'The Internet Science and Technology Fair'.

Another highlight of the afternoon was the awarding of a Life-time Membership Award to Dianna Hall of Bell High School in Ottawa. Dianna, an active member of the executive for many years, has taken a leave of absence from her school board to take a position at a new school in Illinois.

I know that all delegates appreciated the efforts of Dave and Dianna and the rest of the committee in the planning this conference.

SEE YOU NEXT YEAR AT ERINDALE CAMPUS OF THE UNIVERSITY OF TORONTO

Addressing Student Misconceptions
in Sound
with Refutational Text

Douglas Hayhoe, Ph.D.,
Instructional Leader,
Toronto District School Board

Refutational text is one way to address student misconceptions in physics.[1] Write a scenario where a student expresses a misconception, while another student refutes this 'faulty' idea and presents a scientific viewpoint. The students argue back and forth. The story can end with the students actually doing the experiment. When other students read this refutational text, they see their own misconception clearly explained, not by the teacher, but by one of their "peers," and immediately identify with it ("that's just what I think!"). But they are then confronted with another viewpoint, again by one of their 'peers," the alternative 'scientific' viewpoint. The following example of refutational text is based on research conducted by Michael Wittmann at the University of Maryland regarding students' misconceptions of sound as a longitudinal wave.[2]

Anita and Juan are sitting in front of a speaker pondering the physics of life! They turn on the speaker and listen to the burst of sound coming out. They know that sound travels from the speaker to their ears by means of the air molecules, because they have seen the Bell Jar demonstration showing that air is the medium for sound.

They try to analyze the minute details of the situation, taking advantage of a ray of light shining into the dusty room through a window. They focus their attention on a single dust particle sitting at rest in the air in front of the speaker (Figure 1 – redrawn from slide 22 a of Wittmann.). Anita challenges Juan to predict the motion of the dust particle, when the speaker is first turned on and the sound travels out from the speaker. To make the problem simpler, they assume that the speaker plays a single note with a fixed loudness and pitch.

At first, Juan replies that the dust particle will be pushed away from the speaker, as the sound moves across the room. He illustrates his answer by sketching the dust particle being hit by the force of a sound wave (Figure 2 – redrawn from slide 23 of Wittmann). Juan also says that if the speaker is turned up to a louder volume, or to a higher frequency, the dust particle will be kicked further out.

Anita isn't entirely happy with this analysis. She replies, "But isn't sound a wave? What did we learn about waves in physics class? What happens to a single particle of a medium when a wave passes through it? Doesn't it vibrate back and forth? And after the wave has passed through it, doesn't it return, again, to its initial rest position?"

Juan thinks for a minute and then replies, "Yes, sound waves **are** longitudinal. Therefore, each particle of the medium including this dust particle should vibrate out and back, in the same direction as the direction of movement of the sound wave."

Both students finally agree that when the speaker is first turned on to a single note, the dust particle should move out and back horizontally, as the wave passes through it, returning to its initial rest position. Two years later, when Juan is studying high-speed videography at college, he places a burning candle in front of a speaker and films the movement of the candle flame when the speaker is turned on (Figure 3 – redrawn from slide 22 b or 26 of Wittmann). Sure enough, when he plays the film back at normal speed, he sees the candle flame vibrating out and back in a horizontal direction, parallel to the direction of the sound wave, and always returning to its initial position.

[1] Galileo employed refutational text in his *Dialogues*, over three hundred years ago.
[2] See Wittmann's slide presentation at www2.physics.umd.edu/~wittmann/research/9806_tyc/sld001.htm.

THE DEMONSTRATION CORNER

"Cheap and Easy Sound Demos with Rods and Tubes"

by
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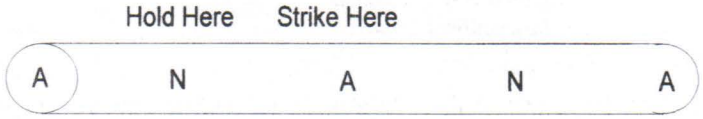
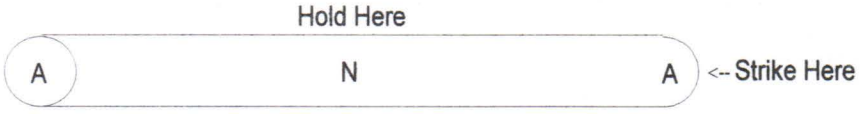
Visible standing waves with a node at each end are fairly easy to demonstrate. You can use a long spring such as a slinky (cheap way), or even order a nice transducer-based demo from one of the scientific supply companies (expensive way). However, I also wanted to demonstrate antinodes at both ends, or even one node and one antinode.

To get antinodes at both ends, I use an aluminum rod about two metres long. I was able to obtain this at no cost to the science department by a begging campaign aimed at the machine shop teacher. I learned this technique while watching PBS. It can also be done using the rod from a retort stand. You can create transverse standing waves in the rod by holding it at a point ¼ of its length from one end and hitting it in the middle. Another node appears at the ¾ point, with antinodes at the end. These are all easily visible **in the** two-metre rod, and can even be seen as "blurs" in the retort stand. I usually do the big rod as a demo and then let the students **do it with** the retort stand.



Transverse Standing Waves



Longitudinal Standing Waves

The same rod can be used for longitudinal standing waves. Hold the rod in the middle, and tap one end against the floor or other hard surface. Although the standing waves aren't visible, they are very audible. I then push one end slowly against a chalkboard to show that the vibrations are indeed longitudinal, and produce an irritating, spine-tingling noise as a bonus. You can extend this by holding the rod at the ¼ point, and generating a note one octave above the first. I am also usually able to get one more octave by holding it at the 1/8 point, although it is very sensitive to any error in the holding point.

Another bonus with the longitudinal vibrations is a Doppler Effect demo. Tap the end against the floor to excite the longitudinal standing waves. Then hold the rod horizontally over your head and start twirling it. You will get a beautiful vibrator effect from the shift in frequencies between the end moving away from the observer, and the end approaching the observer.

For a node at one end and an antinode at the other, I purchased a 12-ft length of rigid copper tubing from a hardware store. I brace one end against the floor (or a wall, if I'm in a room with low ceilings), and hold it at the closest antinode to the wall, which is 1/3 of its length from the forced node. Moving my hand back and forth at this antinode produces the desired pattern. One must be careful not to do it for too long or at too great an amplitude, since the copper will bend permanently. This demo would work better with a solid aluminum rod of similar length. I couldn't beg one using the above technique since I am now in a school without a machine shop, but I plan to buy such a rod with the greatly increased science budgets expected next September.

Column Editor: Ernie McFarland, Physics Department, University of Guelph, Guelph, Ontario, N1G 2W1
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Submissions describing demonstrations will be gladly received by the column editor

The Ontario Association of Physics Teachers needs you...

New people for this exceptional organization.

From:
The Executive to volunteers,
presenters and help at conferences,
organizers to writers,

and all aspects of the Association.

From Peter Scovil <petescov@enoreo.on.ca>

I found this website fascinating on the negative index of refraction. http://www-physics.ucsd.edu/lhmedia/

Membership

Join the Ontario Association of Physics Teachers
Members receive a Newsletter and **reduced registration rates at the annual conference**.

As well, from time to time, the Association makes available special resources; examples have included reprints of **"Demonstration Corner"** articles from the **Newsletter**, and the videotape, **"The Physics of Dance,"** from a presentation at one of the annual conferences.

To become a member of the OAPT, send a cheque for $8 (or a multiple thereof) payable to OAPT to:

Ernie McFarland
OAPT Membership Secretary
Department of Physics
University of Guelph
Guelph, Ontario
N1G 2W1

HIGH SCHOOL PHYSICS PHOTO CONTEST
There are two categories: Natural and Contrived. Vernier Software & Technology has contributed prizes for first, second, third places, and a certificate for honorable mention, as well as prizes for the teachers of winning students. Photo submissions should be sent to: Mary M. Winn, 2623 Watrous Ave., Tampa, FL 33629 no later than June 10, 2001. Entries will be displayed and judged at the 123rd AAPT National Meeting, July 21–25, 2001. For additional information and contest rules, visit the AAPT website at *http://www.aapt.org/programs/HSphoto.html*

AAPT NATIONAL MEETING
Will be held in Rochester from July 21-25

Find the Ontario Association Of Physics Teachers WEB SITE at:
http://www.physics.uoguelph.ca/OAPT

Copy, Copy, Copy

We are looking for articles and items for the newsletter – no matter how small or large. Have you got an interesting demo, a unique project development, a fascinating web site, an off the wall summative, or informative piece. Send them to: **Glenn Wagner or John Caranci** GWAGNER@cwdhs.ugdsb.on.ca, physix@iprimus.ca, or demos to **Ernie McFarland,** Physics Department, University of Guelph, Guelph, Ontario, N1G 2W1 Email: elm@physics.uoguelph.ca