



NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS

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AAPT Winter Meeting

PHOENIX JANUARY 3 - 8, 1997

Reported by Peter Scovil, Section Representative

Phoenix is a very clean city, whose modern downtown area belies its two million population. Palm trees line the streets, and cacti are everywhere. But physics dominated for six busy days. Good, sound physics. In fact Brian Holmes (San Jose State U) gave us a fascinating presentation of the physics of brass instruments, starting with the concept of an open ended tube and explaining the effects of the flared end and the mouthpiece. Because the flared end is essential to the sound, a trumpet must use valves to change the sound. Keys like in woodwind instruments would not work. He demonstrated how French horn players got different sounds before valves were invented by using their right hand inside the bell to affect which part of a standing wave occurs there. As an accomplished musician, he gave a very entertaining performance. We hope we can get Dr. Holmes to come to an OAPT meeting as a banquet speaker in the near future. I'm sure his talk would have wide appeal to anyone interested in music, regardless of their physics background.

Keeping with the topic of sound, I attended a workshop on that topic by Clarence Bakken. He had suggestions, like assigning homework on waves to be done in the bathtub. Rows of students can participate in transverse or longitudinal waves. A copy of the Tacoma Narrows video can be purchased from AAPT for \$US 35.00. Chladni plates work very nicely without bowing if they are mounted at the centre to a wave driver such as Pasco has. I have plans for home-made tuning forks from extruded aluminum tubing. I also have plans for a speaker-driver which is very useful for standing waves. Contact me for details. I will publish or present some of them in the near future.

The other workshop I attended was on Interactive Physics 3.0. As opposed to 2.5, it allows curved shapes and force fields. Cindy Schwarz has a good Players Workbook through Prentice-Hall for \$US 25. (schwarz@vassar.edu) She has also developed a CD-ROM using simulations, animations, videos and problems. It's called Interactive Journey through Physics, and includes mechanics, electricity and magnetism, thermodynamics, and light and optics. It would be useful in secondary or university physics, and is expected to sell for around \$US 25.

Dr. E.D. Dahlberg (dand@physics.spa.umn.edu) talked about magnetic force microscopy, including some videos of magnetotactic bacteria in action looking for their food which is magnetic. To show your students magnetic domains, take a refrigerator magnet, and cut a narrow strip off one end. Drag one end of this strip across the refrigerator magnet, and you

will feel vibrations as it encounters the differently-oriented domains.

Dr. Edward Redesh (redesh@quark.umd.edu) talked about the Maryland Physics Expectations Survey of over 2000 students in a dozen institutions, revealing that less than 3% will ever take another physics course. What does this mean in terms of first year physics? There has been a lot on Force Concept Inventory, but gains in this area do not necessarily imply improvement in other areas.

There were a lot of other very interesting talks, but I have touched on a few that I felt I could share most easily. Future AAPT conferences are April 18-21 in Washington, D.C., August 11-16 in Denver, and Jan. 3-8 in New Orleans...and maybe Guelph in 2000!

1997 OAPT Conference

Brock University

June 19-21, 1997

**Expanding the Boundaries
of Physics**

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See the conference website for more details
<http://www.physics.brocku.ca/oapt97/>

Physics News Update

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

A BLACK HOLE'S EVENT HORIZON HAS BEEN DETECTED. Ramesh Naryan and his colleagues at the Harvard-Smithsonian Center for Astrophysics have used the orbiting ASCA x-ray telescope to study x-ray novae, binary systems in which gas from one star is pulled toward an accretion disk and the spherical region surrounding a compact companion. These systems occasionally flash prominently at x-ray wavelengths (hence the name x-ray nova), but Naryan is more interested in what happens during the quiescent intervals between upheavals.

His recent theory, called the advection-dominated accretion flow (ADAF) model, suggests that if the accretion rate is slow enough the inspiraling gas will refrain from radiating away its accumulating energy. Instead the gas continues to get ever hotter, reaching temperatures as high as 10^{12} K. Eventually this enormous energy buildup is dealt with in one of two ways: if the compact object is a neutron star, the gas will fall onto its surface, where it heats the star, causing it to radiate. In contrast, if the object is a black hole, there is no surface for the gas to fall upon; instead, like a prisoner being led to execution, the gas crosses the black hole's event horizon, never to be seen again. In effect, 99% of the gas energy disappears from the universe. Because of this, x-ray binaries containing a black hole should be dimmer than those with neutron stars. Naryan, speaking at this week's meeting of the American Astronomical Society in Toronto, reported on 9 binaries which fit the ADAF pattern of behavior. Four of these were thought to harbor black holes (because of their higher masses), and indeed these are all dimmer than the five neutron-star binaries. Naryan judges this dimness, and the binaries' x-ray spectra, to be the sign that an event horizon is at work, and that this in turn constitutes the most direct evidence yet for the existence of black holes.

IMPORTANT PROCESSES IN SINGLE DNA MOLECULES have been observed for the first time by using the atomic force microscope (AFM), in which the deflections of a tiny stylus over the contours of a surface can be turned into molecular-scale images. At the APS Meeting this week in Kansas City, Carlos Bustamante of the University of Oregon (541-346-1537) and his colleagues presented movies showing the first stages of DNA replication, in which a protein is seen to slide on DNA like a bead on a string to find the exact site where it could attach and start the replication process.

Binding DNA and RNA polymerase (the protein that mediates the

transcription of DNA into RNA) to a mica surface, Neil Thomson of UC-Santa Barbara (805-893-4544) and his colleagues produced 5-nm-resolution movies of the transcription process, in which RNA polymerase pins down the middle of a single DNA strand and then pulls the strand through as it starts transcribing the DNA into RNA using RNA-building-blocks called NTPs (Biochemistry, 21 Jan. 1997).

Using an AFM, Gil Lee of the Naval Research Laboratory (202-763-5383) found that a force of about 600 piconewtons was required to tear apart two complementary strands of DNA, namely a 20-base-pair-long strand of polycytosine (a form of single-strand DNA) from single strands of polyinosine averaging 160 base-pairs long.

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.

Membership Application

Renewal Change of Address

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\$8.00 / year x _____ years = \$ _____, payable to the OAPT

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

OAPT EXECUTIVE ADDRESS CORRECTION:

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OAPT WEB SITE

Guelph University is now the host of an OAPT web 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:

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

SCIENCE ON THE INTERNET:

Here are a couple of interesting internet sites you might want to check out.

Astronomy Picture of the Day

<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

A different picture posted daily, with a short explanation included, and an index of archived pictures.



A COMET IN THE SKY

Credit: Alessandro Dimai (Col Druscie Obs.)
It has been suggested that Comet Hale-Bopp will become the most viewed comet in Human history. Presently, for denizens of the Earth's northern hemisphere, this bright comet is certainly a lovely and inspiring sight — visible here crowning the sky above Cortina d'Ampezzo, Italy on March 20. Based on orbital calculations, this comet's last passage through the inner Solar System was approximately 4,200 years ago. Principally because of changes caused by the gravitational influence of Jupiter, Hale-Bopp should pass this way again in a mere 2,380 years. Comets come from the outer reaches of the Solar System where they reside, frozen and preserved. Astronomers analyzing their structure and composition as comets swing near the Sun seek a glimpse of the conditions during the Solar System's formative years.

Science Teachers Lounge

<http://www.deepwell.com/~ccimino/index.html>

RESOURCES FOR SECONDARY SCIENCE TEACHERS

The Science Teachers Lounge has been recognized by the Eisenhower National Clearinghouse for Science and Mathematics as one of the top Internet sites for science education and resources and has listed the STL in it's "Digital Dozen" for February 1997.

This site is a resource for secondary science instructors but will contain info useful to all teachers (after all we can't all be science teachers). The STL includes teacher tools and educational software, classroom demonstrations, lessons, labs, Internet utilities, childrens software, links to other cool science and education sites, and a message board. Feel free to send your favorite lessons, labs, demos, links, etc for inclusion in this site via email at the address listed below. I hope you enjoy the site and find it useful.

MENU

- Teacher Tools - Software (Win/DOS): Grade and classroom management software.
- Message Board: Announcements concerning education and educational events on the Internet.
- Cool Classroom Demos: Science demos that motivate students (and teachers)
- TOPS Learning Systems: Check out a FREE TOPS Activity!
- Chemistry Labs: New labs added periodically (get it?)
- Educational Software: Contains FREE educational software, tutorial programs, and teacher utilities.
- Internet Utilities: Utility programs that will enhance your use of the Science Teachers Lounge and many other cool sites on the Internet
- Popular Search Tools: A collection of some of the most popular search engines on the Internet.

The STL would like to encourage you to submit lessons or recommend software that would be beneficial to other science teachers.

1997 Grade 12 Contest!

Contest Date: Thursday May 8
Registration Deadline: April 11
Cost: \$3.00 per student

Packages were sent out to all high schools on March 1, addressed to "Grade 12 Physics Teacher". If you do not receive yours, email me at diana_hall@ocebe.edu.on.ca.

Two Kinds of Polaroid Glasses

by

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When polarized light is discussed, polarizing plastic sheet filters are always mentioned. During manufacture, this material which contains long chain molecules is mechanically stretched into sheets resulting in the alignment of the molecules. Electrons can travel along the axis of the molecules but cannot jump from molecule to molecule. When light is incident on a polaroid sheet, the component of the electric field which is parallel to the axis of the long chain molecules causes the electrons to move, and that component is absorbed; the component which is perpendicular to the axis of the molecules is unaffected. Thus, polaroid sheets have a preferred direction, or transmission axis, which is perpendicular to the axis of the long chain molecules.

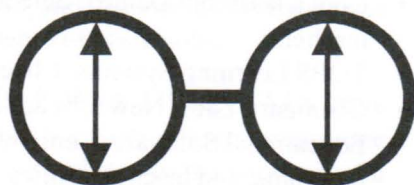
When light reflects from a non metallic surface, components of the electric field parallel and perpendicular to the plane of incidence, called parallel and perpendicular components, are reflected differently and the amount of reflection depends on the angle of incidence (the plane of incidence is the plane containing the incident ray and a normal to the reflecting surface). For the perpendicular component, the amount of reflected light increases with the angle of incidence but for the parallel component, at any given angle, the amount of reflected light is less than for the perpendicular component. In particular, there is one angle of incidence called Brewster's angle (53° for water) for which none of the parallel component is reflected. Note that the vibrations of the electric field of the perpendicular component are in the plane of the reflecting surface, so at Brewster's angle, reflected light is completely polarized

and the vibrations of the electric field are in the plane of the reflecting surface. By wearing polaroid sun glasses with the transmission axis of both "lenses" vertical as in the diagram, the majority of the reflected light from surfaces which we experience as glare can be eliminated.

On a recent scientific expedition I discovered another kind of polaroid glasses while viewing "Terminator-3D", a 3D film starring Arnold Swartzenegger at Universal Studios in Orlando, Florida. Depth perception is a result of binocular vision since objects subtend slightly different angles at either eye. Older 3D glasses were fitted with coloured filters, red for one eye and green for the other. Two slightly displaced pictures, one red and the other green were projected and each eye saw its appropriate picture although the composite colour was completely unrealistic.



Polaroid 3D Glasses



Polaroid Sun Glasses

The new 3D glasses have polaroid filters in place of the lenses with the transmission axes perpendicular to each other as shown in the diagram. Two pictures are transmitted with mutually perpendicular polarizations rather than different colours, but the principle is the same. Because both my wife and I saved our glasses as souvenirs I have two pairs to demonstrate in class. When two pairs of glasses with the same orientation are placed on an overhead the image is bright, and colour is rendered faithfully when a coloured transparency is used underneath the glasses. If one of the pairs of glasses is rotated 180° the lens areas become black.

I don't know if glasses of this sort can be purchased but since this is the 25th anniversary of Disneyland I'm sure that someone in your school will be in Orlando this year. Why not encourage some scientific collecting to increase your repertoire of demonstrations!

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