NEWSLETTER

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REPORT ON THE OAPT CONFERENCE

Brock University June 19-21, 1997

by Peter Scovil, Section Representative
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The theme of this year's conference was "Expanding the Boundaries of Physics". Dr. F.S. Razavi (saar@newton.physics.brocku.ca), our conference coordinator, welcomed us, stating that this is how we can renew our excitement for our subject. The boundaries were expanded into technology, computer applications, chemistry, biology, environmental science and beyond. We also crossed the international boundary with several speakers coming from New York State.

Dr. R.A. Hinrichs (SUNY, Oswego) spoke on "Energy, a Vehicle for Change". With the recent concern about nuclear fission energy, he talked about the increased use of natural gas, especially as more resources are being discovered. It is much more efficient than coal and less polluting, although it still contributes to global warming. There is increased use of photovoltaics, mostly in developing countries. Wind generation is increasing by 20% a year worldwide, mostly outside the U.S. and Canada. Developing countries are increasing their energy use as they try to catch up. Unfortunately, they can't afford to be as environmentally friendly. As energy is an important topic in the N.Y. State school system, Dr. Hinrichs holds an award-winning Institute in Energy Education at SUNY Oswego and runs workshops for N.Y. high school teachers.

Dr. Edwin Goldin, manager of the American Institute of Physics' Career Services Division looked at areas where physics graduates are being employed. More and more are going into industry in areas such as radio communications, computers, graphical technology (HDTV, etc.), petrochemicals, food/drugs/medical, materials industry, energy. Often they are involved in small businesses, sometimes in very creative ways.

The closest we got to an actual boundary was when we visited the Sir Adam Beck Generating Station. Along with the tour we were treated to a look at the history of this site. There are still three generating units operating at 25 Hz feeding Dofasco and Stelco.

Crossing discipline boundaries, Dr. E. Lemon gave us a real look at using physics in the natural treatment of waste water with cattails and bulrushes. These plants can transport oxygen to their roots. The oxygen-rich areas near their roots help aerobic bacteria oxidize the waste organic matter, while further from the plants' roots, anaerobic bacteria reduce excess nitrogen compounds. Contact The Friends of Fort George, Box 1283, Niagara-on-the-Lake, ON, L0S 1J0 for more information. Dr. Ira Blevis (Sunnybrook Health Sciences Centre, Toronto) gave us an historical look at x-rays, describing the latest improvements using digital radiography. This allows radiologists to tailor the x-ray dose for the picture required, reducing doses by a factor of 100. It also permits computer enhancement to improve contrast, and the storage and retrieval of images with computers. The new devices are much more compact and easy to work with.

Going further afield was John Caranci (j_caranci@NYNET.nybe.north_york.ca). He has some very interesting ideas for physics ISU's that are truly creative such as drama, a children's story book, a radio mystery and many more. John Blair extends the time boundary for the school term by giving students summer reading assignments. He recommended books such as Nobel Prize Women in Science by Sharon McGayne, and The Physicists by C.B. Snow. The boundary that Roland Meisel (rollym@vaxxine.com) dealt with was the one at the end of an open air column as he talked about impedance matching in wind instruments and how flaring the ends decreased the reflection from the ends. He has students make musical instruments from household materials. Daniel Peat (neufpeat@iaw.on.ca) demonstrated his flaming tube to demonstrate pressure variations due to standing waves.

(... **Conference** continued on page 3)

Plan to attend the 1998 OAPT Conference

University of Waterloo

June 18-20, 1998

Physics News Update

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

TRAPPING A SINGLE NANOPARTICLE BETWEEN TWO ELECTRODES has been controllably achieved for the first time, enabling researchers to deposit individual nanoparticles onto surfaces and offering possibilities such as single-nanoparticle switches. Researchers (Cees Dekker, Delft University of Technology, dekker@qt.tn.tudelft.nl) construct a circuit containing two platinum electrodes separated by as little as 4 nm--a gap that the researchers believe to be a world record. To trap nm-scale molecules or clusters, they immerse the electrodes in a solution containing the nanoparticles. Applying a voltage to the electrodes polarizes each particle and attracts a particle to the gap between the electrodes. Once a particle bridges the gap, current flows through the circuit, and a resistor then sharply reduces the electric field, discouraging any additional nanoparticles from entering the gap. In principle, this electrostatic-trapping technique can work for any polarizable nanoparticle; it has been demonstrated for nanometer-scale clusters of palladium (Pd) atoms, carbon nanotubes, and a 5 nm-long chain of thiophene (a conducting polymer). The researchers have also studied the properties of single electrons as they cross a Pd nanocluster between the electrodes. (A. Bezryadin et al., Applied Physics Letters, 1 September; images at www.aip.org/physnews/graphics)

QUARK STARS represent one segment on the sliding scale of collapsed stars stretching from white dwarfs to black holes. In between lie neutron stars, in which self-gravitation has forced electrons to merge with protons to form neutrons. At higher density, some of the nuclear matter may exist in the form of hyperons, heavy versions of neutrons which can be made artificially at accelerators on Earth. Hyperons are normally unstable and quickly decay, but would survive indefinitely inside neutron stars. Up to this point, the nucleons inside a neutron star are still baryons; that is, they each consist primarily of three quarks. But at higher density still, the baryons can melt, creating the quark-gluon plasma state being sought at the CERN collider in Geneva and (in the next few years) at the RHIC collider on Long Island. However, if physicists don't hurry, astrophysicists might spot evidence for the quark matter first. Rapidly spinning neutron stars (pulsars) gradually shed energy and angular momentum in the form of radio emissions and an electron-positron stellar wind. This causes the star to contract, jacking up the pressure a bit, making conditions more favorable for the creation of hyperons and quark matter. According to Norman Glendenning of LBL (nkg@csa.lbl.gov) and his colleagues S. Pei (Beijing Normal University) and F. Weber (Ludwig-Maximilians University of Munich) one in a hundred pulsars is undergoing the baryon-melting phase transition. They suggest ways in which this transition could be detected, "quark astronomy."(Norman Glendenning et al., 1 September Physical Review Letters.)

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Anybody Out There?

Don't forget that I'm always interested in hearing your comments, criticisms, etc. (besides, it lets me know that someone is reading this thing).

You can reach me—the editor—by e-mail:

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or, if the mood strikes you, by mailing a letter to:

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OAPT Web Site

Guleph 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

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NEEDED: Volunteers for the Executive

The OAPT needs you! In order to keep the association vibrant we encourage you to volunteer for service on the executive committee.

If you have a special expertise you may wish to apply for a particular position but if you are like most of us, (no expertise but a willingness to do a little work) then just submit your name and we can discuss the various options open to you. Hopefully we will reach the stage where we have enough volunteers so that we can hold elections. The time commitment is small enough to fit into your busy schedule. So apply! It's a good thing!

Send your name to John Pitre, Dept. of Physics, University of Toronto, 60 St. George Street, Toronto, Ontario M5S 1A7.
Email: pitre@physics.utoronto.ca
Telephone (416)-978-8803

Conference continued from page 1...

Crossing the boundary into cyberspace, Bill Konrad (willkonr@wincom.net) described two projects he is working on. One is a CD ROM for electromagnetic radiation and wave-particle duality using computer simulations, videosnippets and animation. This should be available in Ontario schools through the Ministry of Education. The second project is the OAIP Test Bank in electronic form. He intends to include the Force Concept Inventory, the past OAPT contest questions (by topic) and OAIP questions for both OA and 4A physics (by topic). The questions can be organized into a test using a test engine such as "Testmaster" by Keith Young (ygk@ebtech.net, www.sarnia.com\testmaster\). Bill also demonstrated a program called Vidshell that allows digital analysis of videos.

Anthony Pignatelli and Elizabeth Dunning (St. Joseph's College School, Toronto) encouraged us to use data analysis programs in grade 12 physics. Students see their graphs immediately after they have completed their experiments. Elio Covello (eliocove@enoreo.on.ca) has an Einstein screensaver ($3) and a CD ROM with photos of 150 Nobel physicists. He is working on physics 4A using computer-aided instruction. If you are interested in purchasing the programs, helping with the 4A course, or in making your own programs, contact him.

There were a number of interesting workshops on Thursday evening on materials physics, making web pages, using CBL interfaces, energy and the environment, searching strategies for the internet, and a digital electronics project. Contact me or Dr Razavi for more details on these or other conference items. Dr. Razavi and the Brock University physics department did a great job in organizing the conference, getting good speakers, feeding us and housing us. Thanks for a great time! Next year, the conference is to be held at the University of Waterloo. Dates are June 18-20, 1998.

THE DEMONSTRATION CORNER

Dumb Tricks with Metre Sticks

by

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Here are two tricks, sorry, demonstrations that you can store away for when you have a few minutes to kill and all you have available is a metre stick, or when you just feel the need to show off in front of impressionable young students. They both are opportunities to prove that a knowledge of physics is better than being young and co-ordinated.

Trick 1: Challenge a student to balance the metre stick vertically on his/her open flat palm. Even a co-ordinated young athlete will be doing very well to manage 5 seconds or so. In the end, they are dancing back and forth wildly trying to keep the thing from toppling over. Now it's your turn, and being a physicist and understanding the nuances of nature, you will not only beat 5 seconds, but you will do it the hard way. You will do it while at the same time balancing on the end of the stick the massive physics text book that you make your students carry around with them. Of course you have actually given yourself an advantage in disguise.

The period of oscillation of a simple pendulum (whether hanging from a fixed pivot or balanced vertically above a fixed point as in our case) is given by T = 2ð(/g)$^{1/2}$, where g is the acceleration due to gravity and is the radial distance from the pivot to the centre of mass of the pendulum. Really we should be worrying about the moment of inertia of a rigid body here, but this simple analysis will suffice to get the point across. For the unencumbered meter stick, is about half the length of the stick. By putting a very heavy object on the top of the stick, you have effectively doubled the length and increased the period of oscillation. The stick will not only wobble more slowly, but you will have more time to react and keep your hand under the centre of mass of the system. With only a small amount of practice, you can easily beat 5 seconds.

Of course, circus performers and jugglers exploit this principle when they balance plates on the end of a stick. The longer the stick, and the closer to the top of the stick the centre of mass is, the easier the trick is to perform. For more examples of this, think of tight rope walkers and their balance poles and ballet dancers who invariably do their hardest *en-point* manoeuvres with their arms above their heads.

Trick 2: Begin by placing your metre stick horizontally on your two outstretched index fingers, one at each end. You should wonder out loud how hard it would be to slide your fingers toward each other and keep the stick in balance at all times, finally ending up with your fingers touching each other at the centre of the stick (and then you could remove one finger and end up balancing the stick on the other). But wait, this is too easy. Confidently, you ask a student to place their "door stop of a physics text book" anywhere upon the length of the stick. You begin sliding your fingers toward each other, and you will find automatically that first one finger will slide, then the other, and so, until your fingers are touching one another and the book has remained in balance at all times.

The catch is that the force of friction opposing the motion of each finger is proportional to the normal force acting on the finger. The one closer to the book will not slide initially because of the larger normal force and, hence, larger friction force. The other finger will slide until the dynamic force of friction opposing its motion becomes greater than the static friction opposing the other. When this happens, the other finger (now farther from the book) will begin sliding and the finger that was originally sliding will cease to slide. Only one finger will slide at a time. It will appear that you are concentrating very hard on which finger to slide and on how far to slide it when, in fact, the laws of physics are taking care of all of this for you.

It is possible, in this way, to devise a simple experiment to measure the ratio of the static and dynamic coefficients of friction between wood and flesh. Or, if you outfit each student with a metre stick and two pencils (to replace your fingers), it makes a very inexpensive experiment to study frictional forces.

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