NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS

(an affiliate of the American Association of Physics Teachers)

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Spacing Out with your Students

by Diana Hall

I recently took my OAC Physics Class to Cosmodome's Space Camp in Montreal. We had a Blast so I thought I'd share it with everyone.

The Space Camp has a life size model of the Endeavour complete with computer simulators. There are also 6 NASA type simulators which allow the students to experience some of what it might be like to live and work in space, weightlessness and disorientation. Although some of them were more realistic than others, and you really can't escape completely the effects of earth's gravity, the students found the simulators exciting and educational. The highlights were the zero gravity wall, which allowed them to float beside a wall and attempt to do various tasks while Newton constantly threw his third law at them. A similar feeling of frustration was obtained in the 5 Degrees of Freedom Chair which floats on a cushion of air. Students were put to work on the outside of the space shuttle while floating on a cushion of air. (Newton's 3rd once again). They had to manoeuvre themselves upside down in order to maintain their position next to the wall while having hands free to complete a task. In the MMU's they had to manoeuvre using joy sticks to accurately position themselves next to a satellite (again, no friction).

While strapped into the multi axis giro, the animators asked questions which required them to focus on a calculator to solve a problem or read a sign while moving with 6 degrees of freedom. (They made me try that one. It rattled my brains and left my legs very shaky for a long time after.)

There was a tour of ground control and two workshops on Space Suits and Launch and Reentry. My students were divided into groups of 12 each with their own animator (group coordinator). The students thoroughly enjoyed the day. They found the animators, knowledgeable as well as entertaining. Cosmodome runs a number of programs at Space Camp ranging from a half day to a six day sleep over camp. During the longer programs, the students actually plan and execute a complete mission. I strongly recommend the Space Camp, especially for students in Eastern Ontario, although they say that they get groups coming from Canada's West and the States as well. For one day, the cost was $32 per student. My students each paid $42 including the bus and reported that the price was about right!

For information call 1-800-565-2267 or check out their web site at http://www.sim.qc.ca/Cosmodome

Internet Interest: http://bonsai.physics.perdue.edu/getdb.html
This web site allows you to search for any articles from the *American Journal of Physics* and *The Physics Teacher*.

Why AAPT?

by Peter Scovil, Section Representative

OAPT is a great organization - and at a great price! For that you get a newsletter, and an opportunity to share in an organization that gives you the OAPT Physics Contest and the annual conference. So why would you want more? Why would you want to join the AAPT which costs quite a bit more money? (No, your OAPT membership does not make you an automatic member of AAPT.)

The biggest reason is "The Physics Teacher". It is a magazine devoted to our favourite subject, with articles for all levels from elementary teaching to university. The November issue contains articles such as "Chair Lift Physics" to get you in the mood for ski season. There are also ones on automatic night lights, the Coriolis effect, "What is a Photon?", using a computer mouse as a motion interface, electrostatic motors, superluminal velocities, teaching in Russia, and air bag sensors. Our new vice-president, John Petre has an article on Chladni Plates, picking up on an idea that George Vanderkur demonstrated at our Guelph conference. Two pages later, we have a picture of Ernie McFarland (our membership person) in an article describing "The Fantastic Physics Fun Show" which he and Tom Kehn take to elementary schools. These articles are designed to inform you, delight you, challenge you, and impress you with the ideas and concepts that attracted you to physics in the first place. There are more good ideas in each issue than you can possible implement. You need "The Physics Teacher".

You also receive "Physics Today", a magazine that brings you up to date on some of the more recent research. It can provide useful research material for your OAC independent study units. You are also kept up to date on conferences for AAPT and the various sections.

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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

Physics News Update

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

Laser manipulations of artificial cell membranes: An Israel-U.S. research team has discovered that lasers can cause artificial versions of cell membranes to expel inner objects as large as 3/4 their diameter. A cell membrane is made of lipid molecules that arrange themselves into a closed, sac-like structure (a vesicle) to prevent energetically unfavorable contact between water and the water-repelling lipid tails. For this reason, it's difficult to rip open a vesicle, let alone expel interior objects. In the experiment, researchers focus a laser spot onto an artificial vesicle. The light's electric field pulls lipid into the spot. The light also causes some of the lipid inside the vesicle to break off into a suspension of smaller objects which escape the laser spot. To increase the entropy (amount of disorder) in the system, water rushes into the vesicle to disperse the smaller structures, driving out an inner object through a reclosable pore in the vesicle. Manipulating membranes with lasers may someday allow researchers to transform living cell membranes in desired ways. (J.D. Moroz et al., upcoming article in Phys. Rev. Lett.; Figure and movie to appear at www.aip.org/physnews/graphics)

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 ❒**

Name _____

Address _____

_____

$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

Demo Corner...continued from p. 4

2) ***Discharges***: The radio waves can also be used to light up a fluorescent tube without a discharge. Just holding it near the tube produces noticeable light in a semi-darkened room. Of course, following this with an arc discharge to the light increases the light output considerably. Since we have a high-frequency AC output, no damage occurs to the person holding the light. Just to be safe, I usually pick someone with rubber soles, and caution him/her to stand away from desks, blackboards and especially water taps.

Different coloured discharges can be produced using the standard helium, hydrogen, mercury and other discharge tubes used in spectroscopy. I also like to use a neon lamp due to its bright colour. This leads to the "Uncle Fester" demonstration. A student is invited to hold the lamp in his/her mouth, and it is lit using the coil.

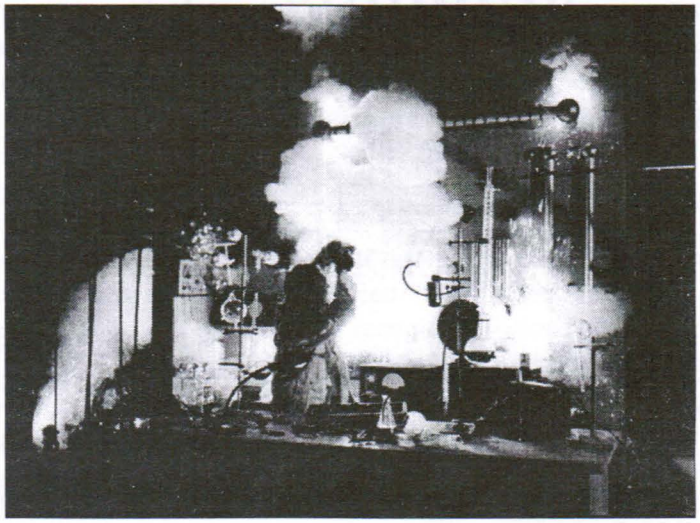
3) ***Potential Difference***: The Tesla coil can be used to place a potential on the filament of a lamp. This will cause arcing inside the bulb, and since most bulbs are filled with argon, beautiful streamers are produced. Placing fingers at ground potential on the glass will attract stronger streamers which will follow the fingers around. I like to use one of the "Fat Albert" bulbs available at lighting stores.

Cautionary Notes:

1) Since we are using high-frequency AC, current does not flow through the subject, but mainly back and forth in the arc. Arcing should always be done to metal or another conductor, rather than bare skin. Arcing to bare skin may cause radio-frequency burns. Most receivers of the arc report a mild tingling, indicating that a surface current is penetrating a little way away from the point of arc.

2) The B-10 coil is isolated from the 60 Hz AC line with a teflon spacer, so there is no danger of direct electrical shock. Without this spacer, danger of shock exists. It is best to insulate the subject anyway.

3) Like most electrical demonstrations, an untrained demonstrator can find ways to make it dangerous. It is not recommended for those without some background in electricity and electronics.



Demonstrations with a Tesla Coil

by

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Theory in a Nutshell: A Tesla coil circuit generally consists of some sort of step-up transformer along with a tuned oscillator. The B-10 coil sold by Cenco Scientific is a compact device which produces 40-50 kV at frequencies of 3-4 MHz. The schematic diagram shows an inductance connected to an AC circuit. As the AC goes through its cycle, the inductance builds up a high reverse potential (similar to the arcing at the commutator of an electric motor) which can exceed the breakdown resistance of the spark gap in the oscillator circuit. When this happens, the resistance across the gap drops effectively to zero, and causes the tuned circuit to "ring" electrically, much like hitting a tuning fork. A high-voltage high-frequency AC potential is induced at the tip. This is the "simple" explanation which high school students can usually follow. For those who wish to see the differential equations describing what is going on, may I suggest an advanced book on electrical physics!

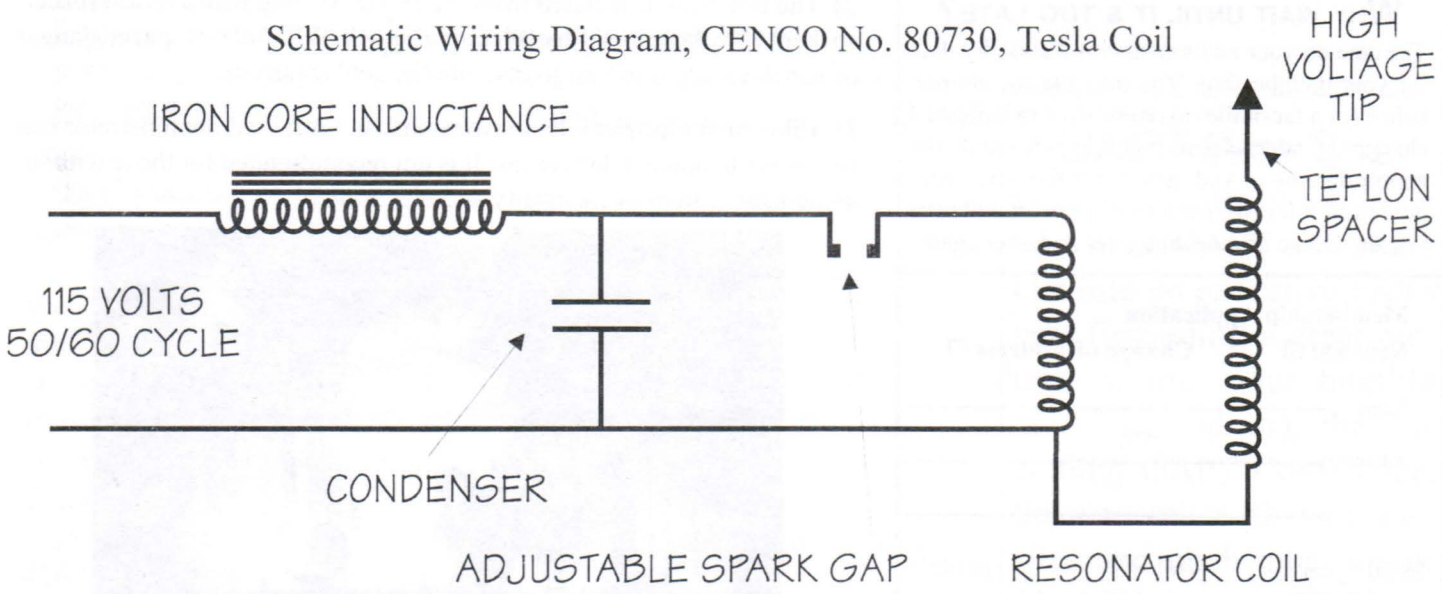
Demonstrations:

This Tesla coil is generally intended to be used to test for leaks in vacuum systems by causing a "glow" which can be seen by the naked eye. I use it in several places in the Grade 12 and OAC physics curricula. I have chosen three particular demonstrations to describe:

1) ***Radio Waves***: The tip of the Tesla coil acts as a radio transmitter even if no spark discharge is being produced. To demonstrate this, I use an AM or a SW radio, and am able to show that there is radio frequency radiation coming from the coil. I then create a spark discharge, and demonstrate the large increase in signal. Morse code can be sent this way. With a portable radio, students can check on the range of the signal. If you do it outside, and a car is available, the range can be checked using the car radio and the odometer. I've gotten up to half a kilometre under good conditions.

Demo Corner continued on p. 3

Schematic Wiring Diagram, CENCO No. 80730, Tesla Coil



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