NEWSLETTER
ONTARIO ASSOCIATION OF PHYSICS TEACHERS
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A Course for Science Teachers

The Canadian Nuclear Society has developed a four-day course on the science of nuclear energy and radiation for elementary and high school science teachers geared to enabling them to provide factual information (and explain how to use facts) to all their students. The course is modeled on the successful course developed by Professor Albert Reynolds at the University of Virginia, and is based on his book, "Bluebells and Nuclear Energy" (Reynolds, 1996). For the past 14 years, he and his colleagues have given it in Virginia each summer to a new group of ~30 teachers. One thing he discovered quite early is that most science teachers are aware that they do not know enough about the subject to do it justice. A second thing he discovered is that the teachers who take the course are extremely eager to learn about nuclear energy and radiation. And learn they do. Their understanding and enthusiasm go a long way toward dispelling fear of the unknown among their students. Reynolds states, "There is no better way to appreciate our public school science teachers than to observe them learning new material and sense their eagerness to introduce it into their curricula."

Science teachers attempting to teach these topics have a problem. They can devote only a few weeks of their course to nuclear energy and there is a limit to the amount of time they can spend learning about and preparing the material. This problem has guided the design of the textbook. It covers the most pertinent material that is needed for the various levels and branches of science offered in middle and high schools. Since students are informed through TV and newspapers and ask questions about nuclear topics, the book covers controversial issues related to nuclear energy and radiation in addition to basic technical information. A teacher will not know all of the answers after reading this book. Science teachers who take this course are aware of this, however, they gain confidence. The course is intended to be the beginning of a rewarding ongoing relationship for everyone. Teachers will have contacts to get answers to new questions and to guide interested students towards future careers in science and engineering.

The lecturers are highly qualified and experienced scientists, engineers and educators. Many are CNS members who have volunteered their time to give this course. The course (contents in Table 1) will be presented next June 22-25 by McMaster University and the Canadian Nuclear Society, in cooperation with AECL, Ontario Hydro and Oakville Trafalgar High School. McMaster University has a 5 MW pool-type reactor, and is located near AECL and several nuclear power stations. It has been giving courses in nuclear science and engineering for more than 50 years. It also has a nuclear medicine department in its hospital and medical sciences centre.

The course material avoids technical jargon and mathematics, so as not to be a burden. The concepts are simple, practical, interesting and relevant to current issues in Canadian society. Teaching aids and materials will be provided that can be readily used in the classroom. The lecturers have excellent credentials and will provide rational presentations on the science and technology. The teachers will have heard and will hear different messages from the anti-nuclear groups, and the course will help them make informed decisions.

The teachers will be encouraged and given opportunities to ask critical questions - to challenge the lecturers with information and ideas that they have acquired from other sources.

The tuition fee is $200 and includes a copy of the textbook: Bluebells and Nuclear Energy by Albert B. Reynolds. On-campus accommodation at the university student residence and a daily breakfast are included in the registration fee. Enrollment in the course is limited to 30 teachers.

The course brochure and registration form can be found at the CNS web site under the "Education" Section:

http://www.cns-snc.ca.

Persons wishing to apply for registration should contact:

Jan Nurnberg
Faculty of Engineering, location JHE 201
McMaster University
1280 Main Street West
Hamilton, Ontario, L8S 4M1
Tel: (905) 525-9140 ext. 24910
Fax: (905) 577-9099
E-mail: nurnberg@mcmaster.ca

(see "Nuclear" on page 2)

Physics News Update

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

MOVING FORWARD INTO THE PAST. Many novelists and not a few scientists have pondered the possibility of returning to a point in one's past. In principle physics does allow time travel via closed timelike curves (CTCs). Along such a warped spacetime trajectory the traveler is always moving into the future (locally) but eventually finds himself back where he started from. (Think of sailing around the world; heading west you return from the east.) J. Richard Gott and Li-Xin Li at Princeton have speculated on whether spacetime could both allow travel into the past and insure a consistent chronology (the traveler must remember shaking hands with his older self as he sets off). They have determined that in part of space no time travel would be allowable, but in another part (separated from the first by a surface called a Cauchy horizon) a time machine could be built, subject to this restraint: if you build a time machine in the year 3000, you might be able to use it to go from 3002 to the year 3000, but not back to the year 1998 because that would have been before the machine was built. Of course even this limited sort of time travel would be very difficult because you would need a lot spacetime warp for it to work, and this could only be provided through the agency of a black hole or a decaying cosmic string loop. For example, to move even one microsecond back into the past would require the presence of a space-warping mass equal to one tenth the mass of the sun! And then there's no guarantee the black hole wouldn't swallow you and the space around you. Then, as Gott says, you'd be able to circle around and meet your earlier self, but you wouldn't be able to escape to boast about it. (Physical Review Letters, 6 April)

NANO-ELECTROMECHANICAL SYSTEMS (NEMS) will be faster, smaller, and more energy efficient than the present day micro-electromechanical systems (MEMS), an example of which is the accelerometer that triggers airbags in cars. At last week's American Physical Society meeting in Los Angeles, Michael Roukes of Caltech (626-395-2916) described the leading edge of NEMS research. Using lithography and etching techniques, he has fabricated a 10x10x100-nm suspended beam of silicon which oscillates at an estimated frequency of 7 GHz (although no detector can yet "hear" the vibrations). Such a resonator will eventually be used in microwave signal processing (for modulating or filtering signals). The speed and stability of nanoscopic silicon arms might even facilitate the advent of some new kind of Babbage-type computer in which mechanical levers once again serve as processing or memory elements.(In other words, a machine with "moving parts" may not be so bad.) Silicon structures in this size regime will also be used as cantilever probes in magnetic resonance force microscopy (the goal being atomic-resolution NMR imaging; see Update 313) and as calorimeters for the study of quantized heat pulses (Update 320). Roukes' colleague, Andrew Cleland of UC Santa Barbara, described a paddle-shaped silicon structure (whose smallest lateral feature was 200 nm) for detecting very small amounts of electrical charge, with a potential application in highsensitivity photodetection (see also Nature, 12 March 1998). At the same APS session, Rex Beck of Harvard reported a NEMS force sensor which integrates a field effect transistor into a scanned probe microscope. The present sensitivities are about 10 angstroms for displacement and 5 pico-Newtons for force (per square root of the frequency), but Beck expects improvements as the size of the device shrinks. The smallest transistor-probe structure Beck reported had dimensions of 3x2 microns x 140 nm.

Nuclear(continued from page 1)

For further course information, contact:

Bill Garland
Department of Engineering Physics, location NRB 117
McMaster University
1280 Main Street West
Hamilton, Ontario, L8S 4L7
Tel: (905) 525-9140 ext. 24925
Fax: (905) 528-4339
E-mail: garlandw@mcmaster.ca

List of Course Contents:

- Introduction to the Course
- Introduction to Development of Teaching Unit
- Nuclear Energy Concepts
- Introduction to Radiation
- Health Physics Orientation
- Security Orientation
- Tour of McMaster Reactor
- Laboratory: Radiation Detection
- Biological Effects of Radiation
- Nuclear Reactor Concepts
- Nuclear Fuel Cycle
- Laboratory: Startup of McMaster Reactor
- Laboratory: Neutron Activation Analysis
- Workshop: Develop Teaching Unit
- Nuclear Reactor Safety
- Risk Analysis and Relative Risks
- Nuclear Energy and the Environment
- Introduction to Nuclear Medicine
- Tour of the Nuclear Medicine Facilities
- Course Evaluation and Wrap Up
- Day Trip to AECL and to Pickering NGS

Prices at Wonderland: One teacher's complaint

A few weeks ago, I booked my annual physics trip to Canada's Wonderland. And once again the price has increased!!! When we started attending this event the cost was $13.00 per student !! Now it is $19.00 per student!!!

As a teacher in an inner city Toronto school, I know that many students find this cost a hardship. However, they want to go and do the assignment and as well to share the experience with their friends. I feel that the park should give the students more of a break.

I would like to suggest that the OAPT members write to Maxine Terrier at Canada's Wonderland (FAX number 905 832 7419) to protest the constant increase in price - If a sizeable number of students did not attend the park from across the province then the park would have very poor attendance on those days. Perhaps a 1 year boycott would get their attention.

What do other OAPT members think?? Let the editor know or email me at dianness@sympatico.ca. If members are planning to attend the June conference may be we can discuss this issue further.

Too Many Physics Contests - one teacher's opinion

I would like to appeal to the universities to keep the number of contests, for the OAC level only, in check!! The Grade 12 OAPT contest is in my view terrific - not too hard - a balanced view of physics - emphasis on the real world - and good prizes too !!.

At my school for many years, the only senior level contest written was the Waterloo SIN contest. This was fine - challenging but fun - although I have heard complaints from some teachers that it was biased in favour of mechanics. SIN prizes only apply if a student intends to study physics at Waterloo - somewhat limiting the appeal. A few years ago when the format of the CAP contest changed we started writing the CAP. The "new" format is very good some multiple choice questions and usually 3 written problems. I like the contest but it is 3 hours long and most students are deterred by that fact. CAP prizes apply across the country at many universities but only to the top students. And now there is the University of Toronto daVinci contest. It encompasses Math, Chemistry and Physics and entrance scholarships to U of T's engineering faculty are based on the results of this contest. Last year it was a 2 hour exam of 24 questions that were very unreadable and I think would take at least 1 hour just to read the questions - they promise an improved paper this year.

In addition there are Chemistry contests, myriads of math contests!! The poor OAC student is being swamped with contests all occurring in April or May !! Lets get together and run one contest - perhaps from the OAPT - or from one university but supported by all!! Let's have prizes like the Grade 12 contest to recognize outstanding ability of more than the top student. Let's discuss this openly at the June conference.

Apparatus Competition

Open to all AAPT members
Cash Awards up to $1000
For more information visit the Apparatus Competition web site:

http://www.dean.usma.edu/physics/aapt/contest.htm

or contact the competition directors:

Bob Dorner
(973) 655-7349
dornerr@saturn.montclair.edu

Tom Lainis
(914) 938-3014
ht8134@usma6.usma.edu

Competition Address:
AAPT Apparatus Competition
Department of Physics
US Military Academy
West Point, New York 10996
FAX (914) 938-5803
Apply by e-mail: ht8134@usma6.usma.edu

Anybody Out There?

Don't forget that I'm always interested in hearing your comments, criticisms, etc.

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

pdlaxon@julian.uwo.ca

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

OAPT Newsletter
c/o Paul Laxon
201 Chestnut St.
St. Thomas, ON
N5R 2B5

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

THE DEMONSTRATION CORNER

A Multi-Purpose Instrument

by

Tomasz Dindorf and Wojciech Dindorf

Donaufelderstr. 252/24, 1220 Wien, Austria

(Editor's note: This article is reproduced, with permission, from a delightful little book, "The Sun on the Floor -- Physics experiments that can be performed at home." This 68-page book describes 58 experiments that can be accomplished with simple apparatus. There are many drawings and photographs to illustrate the experiments. A single copy of the book can be ordered for only $10 U.S. from the authors at the address above, and 20 copies can be obtained for $100 U.S.)

A table tennis ball bearing is an interesting and easy-to-make physical instrument that can be used for demonstrations as well as for measurements. Take a bicycle spoke or a similar straight steel wire and sharpen it at one end. Take a table tennis ball and pass the spoke through its centre. Bring the spoke into contact with a magnet for a while in order to magnetise it. Find a container (like an egg-cup) that has only a slightly larger diameter than the ball. Fill it up with water and place the ball in it. Balance the wire by sliding it delicately through the ball one way or the other. Enjoy playing with it to check how sensitive a magnetic needle it is. It points toward North and reacts to distant magnets.

(A special note: Have you noticed that hydrometers tend to stick to the side of a dish? This disturbs the measurement a lot. If you fill a container up to the very top, a convex meniscus will assure a central position of the hydrometer. This "discovery" helped in inventing the "bearing" described above.)

Experiment with the magnetic field of a current-carrying wire

You will need a 4.5-V or 9-V battery and a lead of about 1 m to demonstrate and study the effects of interaction between the compass needle and the electric current. Check the "right hand rule," and see that the best effect is achieved when the wire is above the needle and initially parallel to it.

Polarisation of a solenoid

The same wire, but this time coiled, can be used to show the similarity between a current-carrying solenoid and a bar magnet. The role of a magnetic material inside a coil can be easily checked by placing different materials inside the solenoid.

Reaction to static electricity

Would you expect steel wire to interact with a rubbed plexiglass ruler or a comb? It certainly does. A piece of styrofoam fastened at the end of the pin (with correction for balance) was found to be an interesting tool for the investigation of electrostatic effects.

This instrument can be made out of materials other than steel wire: a drinking straw or a wooden stick, aluminum or copper wire. If, instead of steel wire, a wooden stick or a drinking straw is used, samples of various materials can be stuck at the end, and having a strong magnet, one can find out whether the material is diamagnetic or paramagnetic.

PHYSICS WEB SITE FOCUS

BERKLEY PHYSICS DEMONSTRATIONS

http://www.mip.berkeley.edu/physics/physics.html

This physics WWW site is an effort to make available an on-line source of information and pictures used for preparing and performing undergraduate lecture demonstrations at the University of California Physics Department at Berkeley. This site deals with demonstrations for the subjects of:

- Mechanics
- Waves
- The Properties of Heat and Matter
- Electricity and Magnetism
- Optics
- Modern and Contemporary Physics
- Astronomy and Perception

Column Editor: Ernie McFarland, Physics Dept., University of Guelph, Guelph, Ontario, N1G 2W1
Email: elm@physics.uoguelph.ca

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