NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS (An Affiliate of the A.A.P.T., and a charitable organization) September, 2006

Digital Physics

Exploring Relative Velocity Using the Web

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Hello fellow fizzies and welcome back from what I hope has been a wonderfully relaxing and rejuvenating summer! As we ease our way into September, I thought I'd touch on a subject of immediate relevancy to the first unit of the 4U program. The topic: Relative Motion.

This topic is fraught with challenges for our students – challenges that sometimes lead to misconceptions, and these misconceptions are remarkably transferable to other areas within the course. So, we try to avoid these misconceptions by paying special attention to clarity and detail in our lessons. Sometimes, however, this is not enough, and we are forced to rethink our mechanism of delivery. In this article, I describe a different approach – a web-based approach, that I found quite effective last year. My hope is that you, too, will find it so. So, let's get at it!

This activity, called a Peer Learning Session, is performed by the students following a variety of instruction and problem solving in relative motion. It is meant to augment learning toward the end of the topic's discussion. The first part of the activity addresses the idea that velocity is a relative, not an absolute, concept. Working in groups of two, students access the following web-site: www.phy.ntnu.edu.tw/ntnujava/viewtopic.php?t=227 depicting a river (with boats moving on it), and a bystander walking along the shore. This applet allows students to modify object velocities and the frame from which these velocities are observed. I have the students predict, and then verify velocities from various perspectives to really solidify the concept being addressed. Casual assessment of the students at work can be surprising! While most seem to understand the idea, it is clear that some have

The second part of this investigation has the student address the problem of the path of least time when a boat crosses a river. Initial assessment sees the students almost unanimously choose the incorrect answer. This applet (in conjunction with a well-planned worksheet), however, allows the student to correct this misunderstanding.

Students can adjust the heading of the boat (while keeping its speed constant), and 'see' first-hand that the path of least time across a river is the one that is straight across it. What's more, is that they have a chance to see why that is the case. Sometimes no amount of verbal explanation and diagrams can do the trick. Some kids just don't seem to be able to get this idea. This applet, though, animates your language and diagrams – which for some is all they need.

Again, the results of this portion of the investigation are remarkable. I have given test questions on the least time idea in the past, and found the results to be marginal at best. Following this approach, however, the same question sees nearly the entire class get a correct answer. No kidding!

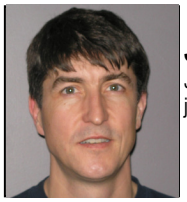
For me, the success this little experiment in peer learning speaks volumes. It's an approach to teaching that can make the lives of both student and teacher easier. In short, it works. And my hope is that it will work for you, too.

Until next time, happy teaching!

Visit us on the web at www.oapt.ca

Highschool Teaching Strategies

Learning Modern Physics at the Perimeter Institute



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The Perimeter Institute for Theoretical Physics has two primary mandates. First it provides a state of the art facility for theoretical physicists to do what they do best; think. Secondly it does community outreach to help the general public better understand the world of modern physics. As part of this outreach the institute offers one week institutes for high school physics teachers. The aim of the institutes (called Einstein Plus) is to deepen the high school teacher's understanding of modern physics and to encourage them to increase its presence in the high school curriculum. Perimeter Institute (PI) offers two of these one week sessions during the first two weeks of the summer. Teachers from across the country (and around the world as we had an Australian and a US attendee in the first session) apply to participate. PI pays for the teacher's travel, food and accommodation .

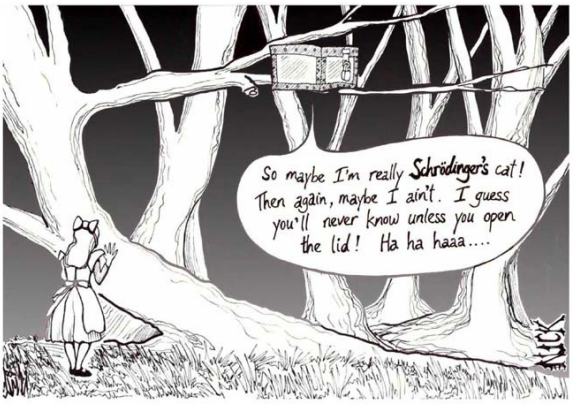
The days are full. In the morning Damian Pope the director of community outreach introduces a core concept in modern physics (for example special relativity or superposition). These sessions are interactive and involve a lot of useful discussions. The afternoons are more varied consisting of talks by experts on topics like Dark Matter or Different Interpretations of Quantum Mechanics followed by workshops or field trips to the nearby institute for Quantum Computing. The workshops were moderated by an excellent group of high school teachers who have been past participants at Einstein Plus.

PI has many visiting scientists. We were fortunate enough to be able to listen to a talk by Nobel Laureate Tony Leggett on his work with superfluids.

The first evening involved a number of activities that helped the group get to know each other. Future participants are forewarned that you need to know your physics and math trivia! Other evening sessions were either less formal or social. The entire group was taken to a performance at Stratford. By the end of the session the entire group had enjoyed a challenging, stimulating and very worthwhile session. If you are interested in more information got to

http://www.perimeterinstitute.ca/activities/community/teachers/index.php

PERIMETER PI INSTITUTE FOR THEORETICAL PHYSICS



Alice's Adventures in Wonderland, Chapter VI:
The Cheshire Cat gets Weirder.

At a resolution of 10^{-24} metres, isolated clumps of Strange Matter pop briefly out of the quantum foam to debate the possible existence of Particle Physicists.

cartoons from
http://www.nearingzero.net/sci_physics.html

The Demonstration Corner

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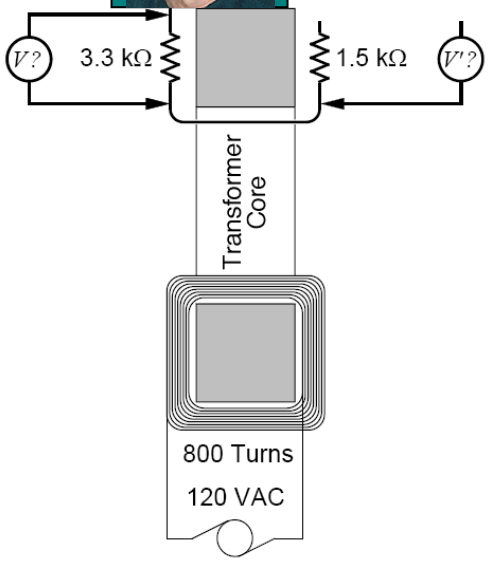
Induction Puzzle

by Leigh Palmer
Simon Fraser University

Here's a demonstration that will make your students think more carefully about the meanings of the terms voltage, electromotive force, and potential difference. A transformer is necessary for the demonstration. Any discarded transformer with 120-volt primary winding is suitable. If the secondary can be stripped and the core left bare it will greatly improve the clarity of the apparatus. At SFU we use a dissectible transformer.[1]



Two resistors with different resistances are soldered together as a one-loop secondary as shown in the diagram. Two digital AC voltmeters are connected across the resistors as shown. The primary is then connected to the mains, and *the voltmeters read different values*! The calculation (shown below) is straightforward, but the student must think long and hard to understand why two voltmeters connected to the same terminals in a circuit should exhibit different readings. The student who does so will learn much about the difference between "emf" or "voltage," and the concept of "potential difference" which is inapplicable in this time-dependent case.

$$\text{emf} = \frac{120\ \text{V}}{800} = 150\ \text{mV}$$

$$I = \frac{150\ \text{mV}}{3.3\ \text{k}\Omega + 1.5\ \text{k}\Omega} = 31.3\ \mu\text{A}$$

$$V = 31.3\ \mu\text{A} \times 3.3\ \text{k}\Omega = 103\ \text{mV}$$

$$V' = 31.3\ \mu\text{A} \times 1.5\ \text{k}\Omega = 47\ \text{mV}$$

[1] A similar apparatus is listed by Sergeant-Welch. See http://www.sargentwelch.com and search for "Dissectible Transformer."

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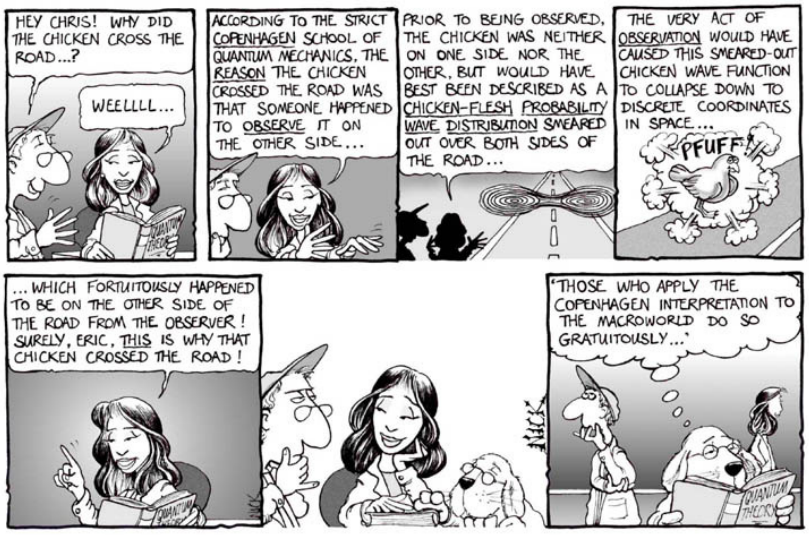
Submissions describing demonstrations will be gladly received by the column editor.



Do you have physics questions that you'd like answered. Do you have some great demos or labs that you'd like to share? Then join the OAPT group by sending a message to the moderator at

oapt-subscribe@yahoogroups.ca.

Note you will need a free yahoo ID to subscribe. Join the discussion!

OAPT Photo Contest

Sponsored by Alan J. Hirsch

As another school year begins don't forget to incorporate the OAPT Photo Contest into your SPH4U program.

Controlling Photographic Variables

polarization – interference – diffraction - depth of field – shutter/film speed

… connected to Wave Nature of Light Ontario Curriculum topic

Great Prizes - $200, $100, $50 plus several honourable mentions

Quick Tips for successful participation.

- Hold an in-school contest and make participation a mandatory part of the course. Evaluate under either "Making Connections" or "Communications".
- Have students vote for favourite entries to send in to the provincial contest.
- Run a separate contest in each semester and compile entries in January and April.
- Set a deadline that is well in advance of April 1 in order to leave time to compile materials and meet the deadline of May 1, 2007.Don't hesitate to contact me *(Diana Hall, Contest Coordinator)* with questions or ideas.*Please visit* ***www.OAPT.ca*** *and read complete contest details, see past winners and sample photos diana.hall@ocdsb.ca*