



NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS
(an affiliate of the American Association of Physics Teachers)
Volume XXI, Number 4 Summer 1999

AAPT Winter Meeting

Anaheim, California January 8-14, 1999

by Diana Hall, Section Representative

Heading out on the first day of this year's major winter storm I was fortunate to get to Anaheim with a delay of only 5 hours. Many travellers were delayed up to a day. From the start of the first workshop to the end of the last session I felt continually re-energized and remotivated by this conference. The calibre of teachers there was such that everyone had something to share, no matter who you spoke to.

I was very glad not to have missed the workshop which I attended on Saturday on "Video Capture" given by Priscilla Laws, featuring the Videopoint program produced by Lenox Softworks (www.isw.com). This technology allows students to make their own motion movies, digitize them using capture cards and load them into the Videopoint program (many premade movies are included in the program). From there the program allows you to obtain data from the movie. The capabilities are extensive, including position, velocity, acceleration, momentum, kinetic energy and lots more. Incidentally this software appeared on the recent government issued shopping the list so hopefully many of you knew enough to purchase it. It was unfortunate that no information was given out with the list. I found the process very easy to learn and it seems to be very versatile. I recommend it and others at the workshop recommended it over other similar programs like "Motion Graph". Priscilla Laws (lawsp@dickinson.edu) gives many workshops and mini courses and has written books on Real Time Physics.

I also attended the PRISMS workshop given by Roy Unruh (unruh@uni.edu) which is an activity based program and includes lots of neat demos, labs and discussion activities to encourage thinking using low budget materials. He sells this in the form of a big binder. There were other workshops involving CBL's and interfaces, Amusement Park Physics.. and on..so many to chose from so few choices.

Wolfgang Christian ([wchristian@davidson.edu](mailto:wchristian@ davidson.edu)) was there with his Physlets. I notice Peter mentioned these last year. He presented his CIPE (Committee on Computers in Physics Education) grand prize winning physlet, a cool one

on electric fields "EField and Poisson". It allowsthe student to visualize the fields around charge configurations, to determine current from an inside view of charge flow or to determine charge size based on forces. All windows are interactive and all pages can be adapted to reflect the emphasis desired. He has 25 applets now downloadable at no charge. They will run in standard html page. I'm having trouble accessing them but I emailed him and he replied promptly. It may be a Mac/PC thing. I haven't tried a PC yet. Look for them on webphysics.davidson.edu/applets/applets.html.

Another CIPE winner was Michael Lee who's "Optics Bench" appears on Wolfgang's website. This is a very practical program which allows you to create images from lens or mirror systems, change parameters etc. Check it out! Others to investigate are "Atom in a Box" by Dean Dager, UCLA (dauger@physics.ucla.edu) or do a Yahoo search on "dauger" for the program. This program shows atomic orbitals in 3D and more.

Highlights of the conference were the two lectures given by David Goodstein, Oersted Medal Recipient. The Oersted Lecture was entitled "Now Boarding: The Flight from Physics" where he discussed the declining enrolment in Physics programs and the reasons for it and the use of physics to weed out students from other science areas. An interesting and controversial topic.

If you have read "Surely You're Joking Mr. Feynman" or any of Feynman's other books you will know what a brilliant, captivating and funny man he was. David Goodstein was lucky enough to be both a colleague and a good friend of Feynman's. In his second talk he shared some of his experiences with this great man. It was a thrill to be there.

I didn't attend it but there was a very popular session on the "Physics of Magic". Check "DJ1-The Physics of Magic and Vice-Versa" AAPT Announcer, 28 p.107, (July 1998). Also check <http://members.aol.com/sciencetrix/index/html>.

There were lots of demo session and I learned many neat tricks that I will share with you through demo corner and at the June Meeting. It was a privilege to be able to represent OAPT at such a fulfilling conference. Thank You OAPT!

Ontario Association of Physics Teachers

21st Annual Conference

May 25, 26, 27 2000

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Hamilton, Ontario**

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Physics News *continued from p. 3*

each other at higher velocities, such as those associated with friction between tectonic plates during earthquakes. Observing the jerky "stick-slip" motion of a steel block riding on a rotating steel table, the researchers carefully measured the friction forces for relative velocities up to 0.35 m/s, by monitoring the expansion and compression in a spring attached to the steel block. At these high velocities, they noted that the significantly increased production of sound waves (largely neglected in past analyses) dissipates a large amount of energy, stealing away some of the energy of motion required for two surfaces to slide past each other and thereby amounting to an increase in friction. This suggests that the generation of sound waves between two sliding fault surfaces during an earthquake may provide a significant feedback mechanism that mitigates a quake's effects, by converting energy of motion (friction which might otherwise have caused fracturing in the Earth) into sound energy. (Johansen and Sornette, Physical Review Letters, 21 June 1999.)

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:

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WHY WAIT UNTIL IT'S TOO LATE?

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Physics News Update

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

PERCEIVING MUSICAL PITCHES may require much less neural processing and occur at a lower level of the nervous system than previously thought, according to a new explanation, offering possible insights into designing better hearing aids. A musical note is defined mainly by its lowest pitch, known as its "fundamental frequency," but a note also typically contains higher-pitched "overtones" with frequencies that are some multiple of the fundamental. Even when the fundamental frequency is completely removed from a note, the overtones often allow listeners to perceive the missing fundamental anyway. Being able to perceive missing frequencies may explain why hearing a classical symphony through a tiny radio, which cannot satisfactorily reproduce the lowest-frequency pitches, sounds reasonably faithful to a live version heard in a concert hall. Recent explanations of how we perceive "residue tones" require extensive amounts of neural processing, which can only take place in the cerebral cortex. However, researchers in Spain and Italy (Julyan Cartwright, Higher Council for Scientific Research, Spain, 011-34-958-243360, julyan@galiota.uib.es) propose that residue perception may result from a "nonlinear" process, involving the generation of frequencies that are not multiples of the original signal. Much more efficient than previous linear models, their proposed mechanism can take place at neural centers much earlier than the cerebral cortex. Specifically, they propose a "three-frequency resonance" that takes place in some neural processing center before the cerebral cortex, in which the electrical signals generated by two overtones stimulate a population of nerve cells to fire electrical signals at a third frequency different from those of the two overtones. Better understanding of pitch perception may lead to applications in medicine; it is already known, for example, that hearing aids which concentrate on making the fundamental frequencies more intelligible produce better results than simple amplification alone. (Cartwright et al., *Physical Review Letters*, 28 June; sound samples at <http://www.imedeia.uib.es/~piro/PitchPage/>)

LONG BASELINE NEUTRINO OSCILLATION EXPERIMENTS have now gotten underway with the announcement that the Super-Kamiokande detector (near Tokyo) has recorded the arrival of a neutrino launched in its direction from the KEK proton accelerator 250 km away (near Tsukuba). Last year Super-Kamiokande established the important fact that neutrinos (made by cosmic rays striking the atmosphere) transform, or oscillate, from one type to another on their way through the Earth (see last week's Update 436 for more recent results). In

the new experiment (dubbed "K2K") physicists attempt to confirm the oscillation phenomenon by allowing neutrinos made artificially at an accelerator to pass through a nearby detector and also the much more distant Super-Kamiokande detector, aligned so as to receive the same neutrino beam. If, for example, muon neutrinos oscillate into another type of neutrino, adjusted event rates would be different for the two detectors. (K2K website: <http://neutrino.kek.jp>; for background see *Physics Today*, February 1996.) HOW DO COMPLEX ORGANISMS FORM? A Darwinian mechanism of natural selection plus random mutation is not quite enough to explain the complex features of life on earth. For example, it does not predict or anticipate the fact that an ecosystem or a global community has a hierarchical structure, with interactions that take place at several size scales. For example, people communicate with each other in an organization; and organizations communicate with each other in a larger community. Barbara Drossel of the University of Manchester in England (011-44-161-275-4201, barbara.drossel@man.ac.uk) has introduced a simple mathematical model for describing how originally independent units may develop into a complex organism with a hierarchical structure. In her model hierarchy comes about because of the increase of a quantity she calls "productivity" (similar to "fitness" in biology and "utility" in economics). Individual units communicate with each other to increase productivity which leads, at the very least, to larger groups. Drossel's model incorporates the additional idea that the size of a group is restricted by the limited capacity of individuals to communicate and to travel. Therefore, she introduces a "communication cost" per partner and per unit distance to the partner. This encourages the formation of groups and ultimately the formation of supergroups and groups of supergroups which interact with each other. (Drossel, *Physical Review Letters*, 21 June 1999.)

ACOUSTIC-DEPENDENT FRICTION. Studies of friction are often carried out at modest relative speeds: the two moving surfaces in question typically slide past each other at 1 cm/s. However, researchers at UCLA (Anders Johansen, 310-825-2863) wondered if new mechanisms might appear when surfaces slide against

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Two Sound Demonstrations

by

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The following two sound demonstrations have the virtue of being inexpensive; in fact the first one costs the teacher nothing. Although I have seen the first referred to somewhere, I do not recall seeing the second. Both demonstrations rely on the human ear's remarkable ability to distinguish changes in pitch.

DEPENDENCE OF RESONANCE FREQUENCY ON COLUMN LENGTH.

Have the student roll two pieces of $8\frac{1}{2} \times 11$ inch notepaper into cylindrical tubes: one the long way and the other short. Hold both tubes up to the ear and gently scratch them alternately; first one and then the other. The enhancement of the sound at the resonant frequency of the tube produces a distinct difference in pitch (higher for the shorter tube).

The resonant frequencies are 608 Hz (a very sharp D') and 791 Hz (a slightly sharp G'). Only the rare musical student with perfect pitch will be able to come close to the absolute pitch; however, the interval is almost a perfect 4th (slightly flat) which is easy to distinguish. If a chromatic instrument is available (piano, flute, etc.), playing a 4th starting on D' (D' - G' in the second octave above middle C) will match closely the interval heard in the paper tubes.

For the non-musical teacher:

A semitone frequency ratio is given by the 12th root of 2 which is 1.059463. Therefore, any frequency f multiplied by $(1.059463)^n$ is n semitones higher. A perfect 4th is an interval of 5 semitones so $608(1.059463)^5 = 812$ Hz. As stated above, the interval from the tubes is flat from this.

DEPENDENCE OF SOUND SPEED ON MEDIUM DENSITY.

Take an 8 oz tumbler and put a heaping teaspoonful of a fine wettable powder in the bottom. I have used cement and, separately, psyllium (Metamucil, a common laxative); the latter works better. Carefully fill the tumbler with water and start stirring vigorously, including striking the glass. The sounds of the stirring action will rise in pitch as the

powder is mixed. As the powder is mixed into the water, the mean density of the medium increases and so the sound speed increases. Since the resonant length is unchanged, the pitch (frequency) rises. The Metamucil can then be drunk in safety.

The Exam

Instead of studying for the last exam of their college careers, the four seniors spent the night partying in the house they had rented off-campus. The next morning they waited until the test was almost finished, and then they made their way to class. Along the way they all put grease on their hands to support the story they were going to tell their professor.

The class was almost done with the exam when all four seniors burst into class. They told the professor that they had had a flat tire along the way, and could they please retake the test? The professor said that he was a reasonable man, so he scheduled a testing date the following week.

Their plan had worked! They studied diligently for the next week, making the most of their time. The day of the make-up came, and they were ready for anything.

The first question, worth 5 points, was easy. The second question was worth 95 points. It simply read, "Which tire?"

from <http://www.physics.unlv.edu/~farley/humor/>

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