NEWSLETTER

ONTARIO ASSOCIATION OF PHYSICS TEACHERS
(an affiliate of the American Association of Physics Teachers)
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A Brief History of OAPT

MOVING TOWARDS AN ELECTED EXECUTIVE

Bill Konrad—Archivist

OAPT traces its origin back to 1978. It owes its existence to some enthusiastic Ontario Physics Teachers which include the following: Ernie McFarland, Jim Stevens, and Doug Fox. It was started as a section of the American Association of Physics Teachers. You may find it of interest that in 1931 the American Association of Physics Teachers (AAPT) approved a policy that *a regional chapter of AAPT may be established, upon approval of the AAPT Executive Committee, by ten AAPT members in a suitable geographic area. Whenever the membership exceeds 24 the chapter shall be entitled to be represented by one member on the national Executive Committee.* In 1947 the word *chapter* was changed to *section.*

According to the AAPT membership directory, *from the beginning the rationale for local sections was primarily to provide meetings accessible to AAPT members and others interested in physics teaching. Each section must have well-defined geographical boundaries, devise its own constitution (which must be compatible with that of AAPT), and set its own dues. Individuals may be members of the section without being AAPT members, but they may not represent the section on the Council.*

The decision in the late 1970's to establish an Ontario section has certainly benefited Ontario Physics Teachers. OAPT tries to promote physics education through three main initiatives. It plans an annual conference, it conducts a physics contest and it publishes a Newsletter four to five times a year. In order to get the program going the group that founded the organization divided up the tasks. In time other interested physics teachers were identified and were invited to take on certain tasks on the Executive. Early in its existence it was agreed that the annual conference should be held on a university campus during a time of the school year when teachers would find it relatively easy to get away. There are several reasons for this. Generally room rates are much lower than in a large city hotel. It gives the university a chance to showcase its physics education and research programs. Reasonable conference costs make it easier to get significant numbers of teachers out. In order to be fair to the universities and to make it easier for teachers from various sections of the province to attend it was also agreed that the conference should be moved around the province. To facilitate conference preparation someone at the university that was planning to host the next conference or someone in the adjacent educational community was asked to take on the position of vice-president. This person would then move on to the position of president the following year, thus providing continuity. Periodically, however, individuals would wish to be involved in conference planning but did not wish to take on other OAPT Executive responsibilities.

OAPT is approaching its twentieth birthday. It has stood the test of time and has become an important organization for physics teachers in the province. We would like to move from appointing new Executive members to electing them. This is easier said than done. We are able to maintain our low membership fee by keeping bureaucracy to a minimum. The executive meets at the conference and at one other time in the year. To make the transition from appointment to elections it feels that, initially at least, it should invite the membership to express their availability for various executive positions. When two or more members show interest in a specific position the executive can conduct an election for that position.

In addition to the initiatives described above OAPT also maintains a page on the "net". Its address is http:/www.physics.uoguelph.ca/OAPT/index.html. Among other items of interest the executive positions are listed. Why not take a look and see if you want to become more directly involved in this organization?

1997 OAPT Conference

Brock University

June 19-21, 1997

Expanding the Boundaries of Physics

Physics Dept, 500 Glenridge Avenue, St.Catharines, Ontario L2S 3A1

voice: (905) 688-5550 ext. 3412
fax: (905) 682-9020
email: oapt97@physics.brocku.ca

See the conference website for more details
http://www.physics.brocku.ca/oapt97/

Physics News Update

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

THE EARLY FAINT SUN PARADOX goes as follows: 4 billion years ago the sun (its fusion fire not yet having worked up to present levels) was 25-30% cooler than now. Terrestrial temperatures would have been sub-freezing, precluding liquid water. How then did life form in these early eras? Carl Sagan, in a posthumous paper co-authored by Chris Chyba (Science, 22 May) suggests a possible scenario. Ultraviolet radiation from the sun, they argue, would combine with existing methane to form solid hydrocarbons in the upper atmosphere. This in turn would shield ammonia (otherwise broken up by the UV) long enough for the ammonia to produce a greenhouse warming adequate for liquid water. Sagan and his interest in life in extreme environments was the subject of a session at the meeting of the American Geophysical Union in Baltimore. According to David Morrison of NASA Ames, there are only two places on Earth where life has not been found—on the Antarctic ice sheet and in the upper atmosphere. Everywhere else, whether in hot springs (even above boiling temperatures) or a kilometer below the surface, life seems to thrive. One speaker, Todd Stevens of the Pacific Northwest Lab, asserted that some subsurface "rock-eating" microbes constituted an ecosystem independent of photosynthesis and that their metabolism (in some cases amounting to a biomass doubling time of millennia) was perhaps the slowest of all life forms.

AN EXCITED ATOMIC STATE WITH A 10-YEAR LIFETIME has been discovered in the ytterbium atom, raising hopes for atomic clocks 1000 times more accurate than now possible. The Heisenberg uncertainty principle states that the longer a system can be observed, the smaller the uncertainty in its energy can be; therefore, it is extremely desirable to tune an atomic clock to a long-lived high-energy (excited) state.

Researchers at the National Physical Laboratory in the UK laser cool and trap a single ytterbium ion. They then use a laser photon to boost the atom's outermost electron to the long-lived state. With additional laser light, the researchers subsequently induce the electron to return to its lowest-energy (ground) state. By noting the characteristics of the laser light interacting with the electron, the researchers determine a 3700-day lifetime for the state. In addition to being the longest living excited energy state yet detected in an atom, it is the first observed "octupole" transition, a very rare transition in which the electron changes its angular momentum by a relatively large amount of three units. Once in this state, the electron (in the absence of external perturbations) can only decay via the octupole transition, which is why the state lasts so long. An atomic clock based on the transition would be very precise but requires much additional development. (M. Roberts et al., Physical Review Letters, 10 March 1997; see also Nature, 20 March 1997.)

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 r **Change of Address r**

Name _____

Address _____

_____

$8.00 / year x _____ years = $ _____ , payable to the OAPT

Send to: Ernie McFarland, Department of Physics, University of Guelph, Guelph, Ontario N1G2W1; Email: elm@physics.uoguelph.ca

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:

plaxon@edu.uwo.ca

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

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c/o Paul Laxon
201 Chestnut St.
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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

(...**Demo** continued from page 4)

ENHANCING YOUR DEMONSTRATION

While you are demonstrating this amazing toy to your class, pose the questions listed below as well as others you may think of:

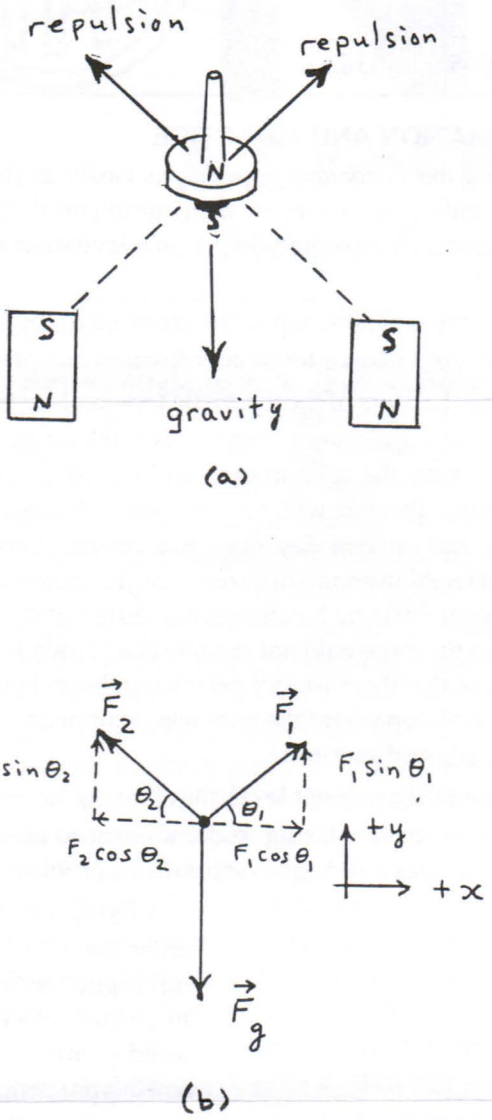

Figure 2 Forces acting on the top during levitation.

(a) Sketch of the situation (showing two of the four base magnets).
(b) A free-body diagram of the top.

- What is the shape of the magnet in the top? What are the possible arrangements of its poles? (The magnet is disc-shaped, with N on the top and S on the bottom, or *vice-versa*.)
- How can we discover the number and arrangement of the magnets in the wooden base? (This question confuses me because when I test the box with a magnetic compass or magnetic filings, I find that there are four separate permanent magnets in the base, whereas some references suggest there is one large disc magnet in the base.)
- When the magnetic top is spinning, what would happen if we were to try to pass our fingers (or a pen, or a ruler, or an aluminum bar, or a copper bar, or an iron bar, etc., etc.) between the magnet and the wooden base? (Try it and see!)
- Would the *Levitron* operate whether the base contained a single ring magnet or four smaller disc magnets arranged in a square?
- Can you draw a two-dimensional, free-body diagram of the levitating magnet to explain the forces acting on the spinning magnet during levitation? (Refer to Figure 2.)

AVAILABILITY

The *Levitron* is sold at The Nature Company, which has numerous stores in the USA and the following two outlets in Canada:

- The Eaton Centre on Yonge Street in Toronto, First Level: Phone 416-971-5858
- Sherway Gardens at the intersection of Highway 427 and the QEW in Etobicoke: Phone 416-621-2700

The price of the *Levitron* is $ 57.95, although The Nature Company offers a 15% discount on all items to teachers.

REFERENCES

Besides the instructions that accompany the *Levitron*, there are various resources in magazines and on the Internet that you may find interesting and useful. For example, if you use the Internet search engine called *Metacrawler* and enter the key search words "Levitron magnetic levitation," you will discover about one dozen articles, some of which are pertinent to the toy. It is interesting to find that some other purchasers of the toy discovered that the top would levitate only if the base was turned over! One serious article describes the physics of the top's motion, including the precession, and even describes how to set up a synchronous drive using Helmholtz-like drive coils to cause the top to remain perpetually levitated. The address for this site is:

http://www.physics.ucla.edu:80/marty/levitron/node8.html

A highly-recommended magazine article that mentions the *Levitron* as well as several other interesting demonstrations is called "Playthings of Science" by Fred Guterl, in the December, 1996, edition of *Discover*.

There have been at least three articles in *The Physics Teacher* that relate to magnetic levitation. These are:

Edge, Ron. "Levitation Using Only Permanent Magnets," *Phys. Teach.* Vol. 33, 252 (1995).

Kagan, D. "Building a magnetic levitation toy," *Phys. Teach.* Vol. 31, 432 (1993).

Rossing, T. and Hull, J. "Magnetic levitation," *Phys. Teach.* Vol. 29, 552 (1991).

The Levitron

by

Alan Hirsch

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What physics toy have you seen that can attract the attention of every passerby in a mall during the December shopping rush? And what toy can you expect your physics students to exclaim "hey, cool" when they see it? The answer to each of these questions is the same: The *Levitron*: The Amazing Antigravity Top.

Design and Operation

The *Levitron* consists of a magnetic top, a clear plastic lifter plate, and a wooden base in which are embedded some permanent magnets. Accessories include some wooden wedges to help keep the base level, and several washers to vary the mass of the magnetic top.

To operate the *Levitron*, the physics genius places the plastic lifter plate squarely on the wooden base, and twirls the magnetic top above the circle painted on the lifter plate (Figure 1). Once the top is spinning, the user gently raises the lifter plate about 2 cm until the top levitates and the lifter plate can be slipped away from under the top. The top will levitate in mid-air for two to three minutes, until the rotation rate is too low to maintain stability.

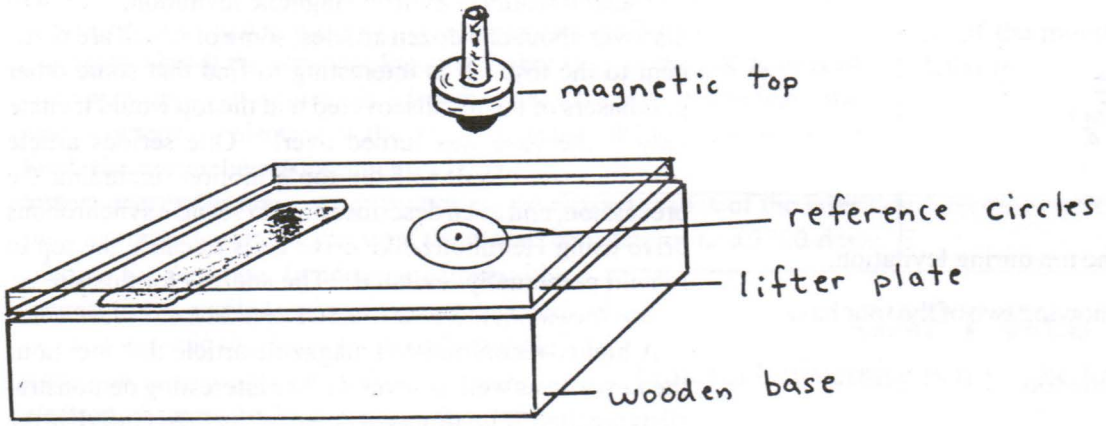

Figure 1 The arrangement of the *Levitron* components.

Co-ordination and Practice

Don't expect the *Levitron* to operate as easily as the above description indicates. There are many problems that must be avoided or overcome before you put on a levitation show for your students.

- Spinning the magnetic top in the presence of the repelling magnetic field takes a lot of coordination and practice.
- Adjusting the mass of the magnetic top involves trial-and-error by varying the number and sizes of the washers. With too little mass, the spinning top will fly away; with too much mass, the top will not levitate. Success at one location and on one day does not ensure success at a different location or on a different day. Fine tuning may be necessary at different locations or on different days. (One day when the top would not levitate at a certain location, I discovered that there was a steel support beam beneath the wooden tabletop where the base was positioned. Moving the base allowed success!)
- If the wooden base is not level, the spinning top will move to one side easily. Using trial-and-error to position the wooden wedges will help overcome this problem.
- A flying top can easily strike the floor, becoming chipped and reducing the chances of a well-balanced rotation. To prevent this problem, arrange a barrier on the desktop to prevent the top from falling to the floor.
- A major problem is buying a *Levitron* that never has worked properly. I recommend that you have the store salesperson prove that the device works before you pay for it. I had to exchange the first *Levitron* I bought because the top didn't levitate!

(**Demo** continued on page 3)

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