NEWSLETTER

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REPORT ON AAPT WINTER MEETING, SAN DIEGO CALIFORNIA

by Bill Konrad, Section Representative, OAPT

With its average year round temperature of about 21° C San Diego is a pleasant place to visit at any time. However, with this years' cold January temperatures across virtually all of North America, San Diego was especially inviting as a site for the winter meeting of AAPT, January 3 to 8. The first two days of the conference were devoted to half and full day workshops and the remaining four days to regular conference sessions. A feature of this years' conference that I found particularly attractive was the opportunity to participate in some very interesting field trips. Three possibilities were offered. They were a visit to the Mount Palomar Observatory, home of the 200-inch reflecting telescope; a tour of the $100 million San Diego Supercomputer Center, one of four such centres in the U.S.; and a tour of General Atomics, an international leader in fusion energy research and development. Selecting a particular tour means missing all of the workshops and presentations that have been slated for the conference during that time so I decided to make the Mount Palomar tour and miss the other two. For the remainder of this report I would like to share some of the insights I gained as I joined a bus load of other conference delegates for a behind-the-scenes tour of the Mount Palomar facility.

The observatory is located 5500 ft above sea level. The funding for the construction of the telescope was secured by a $6 million donation from the Rockefellers. This donation was made a year before the depression hit. A great deal of planning and some preliminary construction such as the construction of roads leading to the top of the mountain preceded the actual construction of the telescope. The telescope itself was constructed in the early 1940's and it was formally dedicated in 1948. It is estimated that today such a project would have a price tag of about $100 million. The glass blank from which the 200 inch mirror was ground had a mass of 20 tons. As you may be aware the first blank, poured by Corning Glass in Corning New York, cracked on cooling and may still be viewed in the Corning Glass museum. The second attempt was successful because the blank was cooled more slowly. It was then shipped to California, where the laborious process of grinding away about 5.5 tons of glass to form the parabolic reflecting surface took place. The final adjustments in the parabolic shape were made when the glass was already in place on the telescope. Current astronomers and physicists have great respect for the individuals who designed and built the telescope. We must remember that they carried out all of the required calculations with slide rules and logarithms rather than with calculators and computers. Great care is taken when working near the glass surface. Accidentally dropping something which could chip or crack the surface would constitute a major catastrophe. A third glass mirror blank (for backup) was never poured.

The mirror itself is washed twice a year and resurfaced every three to four years. When it is to be resurfaced the existing reflective aluminum coating is dissolved with a mixture of nitric acid and copper sulphate. A large cylinder is then placed over the

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OAPT Technology Conference

23 June, Thursday, 19:00 to 21:00	Workshops
24 June, Friday, 08:30 to 15:00	Tour of Bell Northern Research, with complementary lunch
24 June, Friday, 15:30	Visit to David Florida Labs (CRC)
24 June , Friday, 18: 00	Supper with Speaker to Follow
24 June, Friday, 21: 00	Reception and Cash Bar
25 June, Saturday, 08:30 to 12:30	Workshops and Lectures
25 June, Saturday, 12:30 to 14:00	Lunch
25 June, Saturday, 14:00 to 16:00	Workshops and Lectures
25 June, Saturday, 16:00	Speaker and Conference Closing

Workshops/Lectures confirmed or to date include
Teaching Electronics; Chaos and Fractals;
Internet, Schoolnet, Freenet and the Information Superhighway;
Using multimedia to teach physics; Physics and Medicine; Particle Physics;
High Tc Superconductor Research; Radon Surveying by High-school students

Major speakers have not yet confirmed, but we will do our best to get the info to you as it accumulates. Thanks for your patience.

Costs
Registration: $80 for members
$90 for non-members
(This includes bus transportation, lunch Friday and Saturday, and supper on Friday night)
Accomodation: $70
(Thursday and Friday night in Carleton University dorms, includes breakfast both mornings)

THE ANNULAR SOLAR ECLIPSE OF MAY 10, 1994

by J.L. Hunt
Department of Physics
University of Guelph

The phenomenon of a solar eclipse is such a rare occurrence in a given geographical location that, when one occurs, it affords an opportunity to science teachers that should not be missed. Unfortunately, there will not be a total solar eclipse whose path of totality falls on North America until Aug. 1, 2008, and that one only in the high arctic. Aug. 24, 2017, will see a beautiful one whose path crosses the central United States, and not until Aug. 23, 2044, will a path of totality traverse central Canada. In the interim, we must be satisfied with partial eclipses and one spectacular annular eclipse.

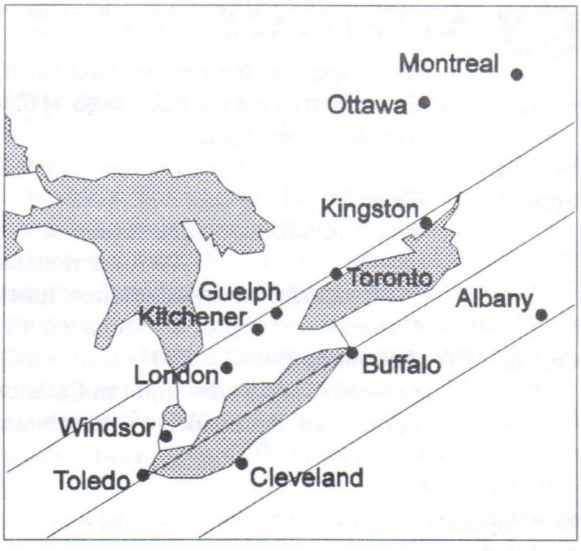
The annular eclipse occurs on May 10 of this year and Southern Ontario is the ideal region from which to witness it. An annular eclipse occurs when the Moon is somewhat further than the average distance away and its apparent size in the sky is slightly less than the apparent size of the Sun. As a result, the Moon cannot, at any time, completely cover the Sun. Instead of a narrow path of totality across the surface of the Earth, there is a narrow path where the Moon will be seen to be completely surrounded by a ring (annulus) of light for a short period.

On May 10, this path originates in the Pacific Ocean at longitude 150° W and enters the continent in California. It crosses the U.S. and enters Canada at Windsor. The path of annularity is shown in the Figure. The northern limit of the path is just to the north of Kitchener, Guelph, Toronto and Kingston. To the north of this line, some portion of the Moon will be seen to pass south of the Sun's lower limb and a complete annulus will not be seen. All of the rest of Ontario will witness a partial eclipse. For those within the path, the coverage of the Sun will be 89%.

At Guelph, the first contact of the Moon will be at 11:40 EDT; centrality will be at 13:22 and final contact at 15:06 EDT. Across Southern Ontario, the times will vary by about 20 minutes with Guelph being about midway.

Observing an eclipse safely is quite possible and relatively easy but must be done properly to avoid damage to the eyes. Without proper filters, direct observation is not advised. Exposed negatives and crossed polaroids are **NOT** safe as they transmit infrared radiation. Indirect (or projection) techniques are the preferred method.

A package of materials about eclipses in general, this eclipse in particular, and suggestions for safe observation and topics for discussion are available free of charge to teachers by writing to the author c/o Dept. of Physics, University of Guelph, GUELPH, ON, N1G 2W1.



PARAMOUNT CANADA'S WONDERLAND

SCIENCE AND PHYSICS DAY FRIDAY MAY 6, 1994

On Friday, May 8, 1994, thousands of students will attend the 5th annual Science and Physics Day at the biggest and most exciting physics laboratory available anywhere. This year's event promises to be the biggest and best ever at Paramount Canada's Wonderland.

The park will be open exclusively for science and physics students. The rides will be operating from 9:30 a.m. to 4:00 p.m.

Physics students may enter a contest in which they will be required to solve three or four Fermi estimation questions showing their solutions in detail. Prizes will be awarded to students as well as schools. There will also be prizes for nonphysics students entering other contests.

Student ticket prices will be approximately $16.00 (pricing to be confirmed). Teachers who bring a minimum number of students will be admitted free.

The student activity workbook and teacher's guideline have been updated. A copy of each will be available free to each participating school.

A free teacher information meeting will be hold for high school teachers at Paramount Canada's Wonderland on Thursday, April 7, 1994, to discuss details of the contest and many other aspects of Science/ Physics Day. Refreshments will be served at 3:45 p.m., and the meeting will begin at 4:00 p.m.

Physics teachers who have not included amusement park physics in their curriculum are urged to try doing so. Students learn to apply numerous physics principles in a real-life situation, some of the many concepts related to experiments on the rides include: displacement, velocity, and acceleration; Newton's laws of motion; Work, energy, and power; the law of conservation of energy; electrical energy and power; free-body diagrams; vectors; centripetal acceleration and force; inertial and non-inertial frames of reference; Fermi (estimation) questions.

Furthermore, students can build vertical and horizontal accelerometers (using commercially available kits) and learn how to use them to perform measurements on and off rides.

Teachers who have not received the information package from Wonderland by April 1 should contact the Group Sales Department at 905-832-7400 (phone), or 905-832-7499 (FAX), or write to:

Paramount Canada's Wonderland
Group Sales Department
P. 0. Box 624, 9580 Jane St.
Vaughn, ON, L6A 1S6

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mirror. This cylinder is evacuated to a very high level (about 10^{-6} torr). Located within the cylinder are 360 filaments of aluminum. These are vaporized using electrical current. The aluminum vapour then condenses on the glass surface and the mirror is once again ready to go to work. An interesting bit of folklore surfaced while we were told about the cleaning and resurfacing project. Technicians in charge of this process at observatories throughout the world believed that Wildroot Cream Oil Hair Tonic was especially effective in the cleaning process. A number of years ago the company producing this hair product panicked these technicians by announcing that it was planning to change the formulation of Wildroot Cream Oil Hair Tonic. Astronomy technicians at a number of observatories rushed out and purchased as much of the existing stock of this hair tonic as they could find. To emphasize this point our tour guide leaned over and pulled a full bottle out of the cupboard, a bottle that had been purchased many years ago when extra bottles of hair tonic had been purchased and stored for future use.

The astronomers and technicians currently in charge of the observatory are quick to point out that the telescope has some remarkable design features. For example the 530 ton telescope is so well balanced and lubricated that it can be moved by a 1/12 horse power tracking motor. The three pillars that support the telescope go down to bedrock and are designed to withstand an earthquake. Little did we realize that a test of this hypothesis was only about a week away. The telescope was also designed in a manner that has made the introduction of new technology fairly easy to accomplish. When the telescope first went into operation photographic plates were used to record observations. Today charge coupled devices (TV cameras) carry out this function. The telescope has also been equipped with a Norris spectrograph. This is a large steel plate with 176 tubes. Each tube is equipped with a mirror and fibre optics. Suppose an astronomer wishes to observe a cluster of galaxies. The location of 176 galaxies within this cluster are determined and the information is stored in a computer. On a particular night the computer provides the robot arm on the Norris spectrograph with sufficient information to enable it to position the 176 tubes so that each one is aimed at a different galaxy within the cluster being observed. The spectrum collected by each of these tubes is then conducted by fibre optics cable to a large analyzer somewhere within the observatory. Rather than recording the spectrum a galaxy at a time 176 readings can be taken in a relatively short time.

The 200 inch reflector is one of four telescopes located on the mountain. It has a very narrow field of view. If aimed at a full moon the moon will more than fill the field of view. An 18 inch telescope is devoted to the study of comets and earth crossing asteroids. Within the recent past an asteroid was observed crossing the space between the earth and the moon. Apparently it was only detected as it was leaving. A 48 inch spherical mirror telescope, which has a wide field of view, has been used to conduct the Palomar sky survey. This survey was a painstaking effort carried out in the 1940's to map the entire sky as viewed from Mount Palomar. The results of this survey were distributed to observatories around the world. A repeat of this survey was again started in 1985. Exposures in blue, red, and infrared are to be taken by 1997. When completed a collection of between 3000 to 4000 plates will be available. Better photographic materials and a new corrective lens for the telescope are resulting in better resolution. Also, it can be seen that nearby stars have shifted slightly in their position relative to more distant stars since the last survey was taken. This results of this massive project will again be shared with observatories around the world. The fourth telescope on the mountain is a 60 inch reflector. It is used when possible to free up the 200 inch reflector for more pressing work.

Suppose you are an astronomer and wish to use the 200 in reflector. How do you gain access? You submit your project to a committee. This committee reviews all requests. Requests out number available nights by a factor of 2 or 3. If you are successful you are assigned a specific night or nights for your project. If that night happens to be cloudy (only about 15% are unsuitable for viewing) that's tough! You must go through the whole application procedure again.

One of the main problems faced by the observatory is the increase in population density in the surrounding communities and the increased threat of light pollution. The population has increased by a factor of ten since the telescope was built. Communities are requested to use low pressure sodium vapour lights in their municipal lighting, a request with which most but not all comply.

Although larger telescopes have been built and are under construction there seems to be no shortage of work for the majestic telescope on top of Mount Palomar. As new technology is installed this instrument continues to evolve in its ability to gather data for fundamental research on what is found in the heavens.

E-Mail Us!

I'm on the Electronic Village. Drop me a line through Internet. Your comments, criticisms, observations are welcome.

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1994 OAPT Physics Contest

The OAPT contest for grade 12 physics students will be held this year on Tuesday, May 17. The format of the test will be similar to last year with about 30 questions based on the content of the grade 12 physics course, the physical science portions of the grade 9 and 10 science coourses, the history of physics, current events and general knowledge. The test will last one hour and the questions will range from easy to fairly challenging. The answers will be sent out shortly after the test enabling schools to determine local winners at an early date. Prizes will be awarded to provincial winners. The committee members are:

Malcolm Coutts	City Adult Learning Centre, Toronto
Fred Hainsworth	Ryerson Polytechnic University, Toronto (administration)
Dianne Ness	Humberside C.I., Toronto
Pauline Plooard	Fenlon Falls S.S.
Bill Prior	Malvern C.I., Toronto (test paper): 416-393-0765
Peter Spencer	Stephen Leacock C.I., Scarborough
Ron Taylor	Woburn C.I., Scarborough

PENDULUM, CENTRE OF MASS, AND MAGNETIC FORCE

by

John Earnshaw

Trent University
Peterborough, Ontario

A HUGE PENDULUM

When studying the physics of a pendulum, we have used a long (4-m) wire in a lecture room with a high ceiling in two effective ways.

First, using a very heavy iron ball (mass > 10 kg) as the bob, the pendulum is swung right to the edge of the room where the instructor puts the ball next to his/her nose while resting his/her head against the wall. (This is a real test of your confidence in the laws of physics!) If the bob is released WITHOUT ANY PUSH, it returns exactly to the starting point, neither crushing the instructor's nose, nor falling short. Students are asked to time the period using their own watches (there's always someone with a stopwatch who is proud to show it off), and then determine either the acceleration of gravity or the length of the pendulum. The period is sufficiently long for quite accurate values of "g" to be obtained from 10 oscillations.

Second, the bob is replaced with a short length of pipe on which the instructor sits. IT IS IMPORTANT TO BE SURE THAT THE ANCHOR SUPPORTING THE PENDULUM IS SUFFICIENTLY STRONG TO DO THIS. The instructor is left swinging long enough in front of the class for the period to be measured. Since your centre of mass is close to your buttocks, the period is almost identical to the one obtained before, in spite of the fact that the mass is much greater. Class discussions can expand to cover air resistance; it leads to the instructor's amplitude getting smaller, but not to a significantly different period of oscillation. This demonstration always leads to an interesting discussion of simple physics, and will be long remembered by students.

CENTRE OF MASS

Where is the centre of mass of a person? Most of us know that it is between the knees and the shoulders, but where? To determine this, and to do a class experiment using simple lever principles, we use a standard 2" × 12" piece of lumber, balanced over a simple fulcrum (a short piece of angle iron with its right angle up) at its centre. A student (whose mass is known) is asked to lie down on the previously balanced "plank" which is set in front of the class on the work bench, while other students locate a known mass (cement block, brick, etc.) along the other end of the plank to re-establish the balanced condition. Appropriate distances are recorded on the chalk-board. The class is then asked to draw a force diagram, to determine the location of the student's centre of mass on the plank, and then to determine the location of his/her centre of mass relative to the student's feet, and as a percentage of the student's height. If you use a 10'-long plank, part of the student's body will be "across the other side of the fulcrum." Good discussion will take place if you ask if this has been omitted (or even subtracted) in the experiment. Also, why can the mass of the plank be ignored? I am told that the results of this experiment taken from large samples of students show conclusively that the centre of gravity of females is significantly lower in the body than for males, when the results are presented as a percentage of overall height.

MAGNETIC FORCE

The influence of a magnetic field on a beam of electrons can easily be seen by bringing a magnet up to the screen of a black and white TV picture tube, a monochrome computer monitor, or an oscilloscope screen. (DO NOT DO THIS WITH A COLOUR TV or a COLOUR COMPUTER MONITOR; it will damage the screen.) A horseshoe magnet has the strongest lateral field (perpendicular to the beam), and produces a deflection according to the appropriate right or left hand rule. A bar magnet, while weaker, will show some evidence of rotation of a recognisable image on the screen, and this rotation depends on the direction of the magnet.

Column Editor: Ernie McFarland, Physics Dept., University of Guelph, Guelph, Ontario, N1G 2W1

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