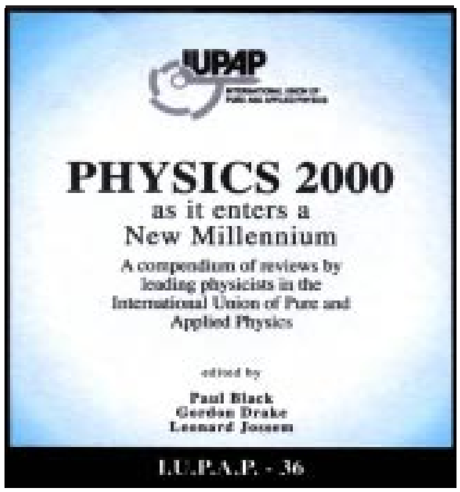
International Newsletter on Physics Education
International Commission on Physics Education • International Union of Pure and Applied Physics
Number 39 April 2000

Physics 2000: A Book for the Millennium

The Council of the International Union of Pure and Applied Physics (IUPAP) recently published a compendium of reviews by leading physicists as a way of celebrating the new millennium. The idea of collecting a summary of reviews, arose during a meeting of IUPAP in 1998.

The Commission of Physics Education, C14, had raised the question of whether to arrange any special activity to celebrate the millennium. Various big ideas, like a special millennium conference or a substantial book on the state of physics, were dismissed because these involve a great deal of effort in organizing such activity. They would only



add to the pressures on busy physicists who prefer to spend their time on moving ahead instead of a millennium celebration.

The group decided on a modest publication by asking the chair of each of the commissions to contribute an article of about 2000 words on their respective fields. One member – Paul Black – agreed to start the task of collection, and Gordon Drake and Len Jossem subsequently agreed to help.

The editorial invitation asked that a member of the commission should contribute a document "to explain the major advances in their field in the last part of the century, and to make predictions about how they expect it to develop, and what it might achieve in the next 10-20 years". The main purpose for the collection of such documents was

BOOK, 6

In this issue

Some Things to Watch in 2000-2001

ICPE-GIREP Conference in Barcelona, Spain Training Physics Teachers Beyond 2000

Various methods and tools in physics education have changed. It would be a huge gap if physics education will not do anything to be at the same tread with the advances in other discipline. That is why physics education demands improvement in physics teacher education and develops new methods and tools in physics. Basically, that is what

BARCELONA, 9

7th Inter-American Conference on Physics Education

Sometimes we have to make a choice. If we see a chance to a contemporary society, are we going to walk away? If we can do something and opt not to walk away, that is development. That is exactly the essence of the 7th Inter-American Conference on Physics Education (ICPE) theme – Preparation of Physics Majors and

7th, 10

International Conference on Computer and Information Technology in Physics Education

Added knowledge on computer and information technology in physics education is enough advantage. Getting it to work can be more beneficial. That is why the University of the Philippines Institute for Science and Mathematics Education Development (UP ISMED) in cooperation with Samahang Pisika ng Pilipinas, Philippine Association of Physics Institutions organize an International Conference on Computer and Information Technology in Physics Education this coming December 4-6, 2001 at the UP ISMED.

Various speakers from different countries will come and share their knowledge on the subject. The aim is to spread experiences and research outputs as well as linkages-building.

The activities are: plenary sessions, paper and poster presentations, workshops and public lectures. Topics include (1) the use and integration of computers and information technology (CIT) in physics teaching at different levels; (2) the teaching and learning of physics using computers, multimedia and information technology; (3) the use of CIT in industries; (4) electronic networking among schools, universities and industries; (5) multimedia software for physics instruction; (6) physics education resources and materials through internet and interface experiments.

icpit@ismed.upd.edu.ph
icpit@einstein.ismed.upd.edu.ph
http://www.ismed.upd.edu.ph/icpit/
Fax: (632) 928-1563
Telephone: (632) 928-2621 to 25

The most ordinary things are to philosophy a source of insoluble puzzles. With infinite ingenuity it constructs a concept of space or time and then finds it absolutely impossible that there be objects in this space or that processes occur during this time... the source of this kind of logic lies in excessive confidence in the so-called laws of thought.

Ludwig Bultzmann. *Populaere Schriften Essay 19, Ludwig Boltzmann, Theoretical Physics and Philosophical Problems*, **B. McGuinness (ed) Reidel, Dordrecht, 1974.**

5th Symposium of Research in Physics Education

The Grupo de Investigación y Desarrollo en la Enseñanza y Aprendizaje de la Fisica (GIDEAF) Departamento de Fisica – Facultad de Ingenieria Quimica – Universidad Nacional del Litoral, Asociación de Profesores de Fisica de Argentina (APFA): Secretaria Local Santa Fe y Proyecto 8 (Capacitación de Posgrado en Enseñanza de la Fisica) and Departamento de Ciencias Naturales – Facultad de Formación Docente en Ciencias – Universidad Nacional del Litoral will hold its 5th Symposium of Researchers in Physics Education on October 18 to 20, 2000 at Facultad de Formación Docente en Ciencias of the Universidad Nacional del Litoral in Santa Fe, Argentine.

The event aim: to offer a space where to reflect on; to discuss and share experiences among investigators on physics education; and to elaborate recommendations on issues of common interest to the research community in the science education field.

Invited to present papers are recognized specialists from Argentina and from different parts of the world. Lecturers will talk on theoretical and methodological aspects relevant to research in science education.

Interested parties may fill the registration form and send it through the following:
ccamara@figus.unl.edu.ar
http://www.unl.edu.ar/sief5

An Intervention in Physics Teacher Education in the Philippines

by Ed van den Berg

The Philippine high school covers grades 7-10. Physics is taught under General Science in grade 7 and in Physics in grade 10. College/University starts in Grade 11. Nationwide only 8% of the Physics teachers majored in Physics and about 20% of the Chemistry teachers majored in Chemistry. The other Physics and Chemistry teachers come from other subjects such as Mathematics, English, and Physical Education, and were forced to teach Physics or Chemistry. Even General Science teachers are often poorly prepared to teach Physics or Chemistry. As also at the college level there is a shortage of qualified Physics instructors. As a result high school physics teaching is superficial and memory-oriented, frequently erroneous, ineffective and boring.

Few universities offer a major in Physics or Chemistry teacher education as they lack laboratory facilities and qualified faculty. Most universities have enrollments in the single digits. Thus Physics pre-service students take teaching methods courses together with students of other subjects such as English, Filipino, History, and Mathematics.

Through a cooperation program with the Free University (Amsterdam) financed by the Netherlands' Government, USC could invest in science teacher education. A deliberate choice was made to focus on *pre-service* teacher education. Worldwide experience shows that several weeks of *in-service* teacher education does not lead to major improvements in teaching, particularly if the main problem of teachers is foundation on the subject matter. Science concepts take years to develop. The key issues identified in developing viable pre-service programs were: a) promotion and recruitment of students; b) the development of special science courses for prospective teachers; c) the development of science education courses which are really subject specific (e.g. how to teach about forces, what conceptual problems do students have with regard to electric circuits, how to evaluate laboratory work of high school students, etc.); and, d) how to make sure that graduates would become high school teachers.

Promotion and Recruitment

The first step in producing better teachers is to select top students for pre-service. Every year we run a massive promotion campaign. Faculty visits high schools which present an exhibition of Physics and Chemistry experiments. Philippine students take great interest in the shows and it is easy to maintain attention of 100-300 students. Schools near the university are invited to semiannual science exhibitions put on by the Physics teacher education students. The school shows exhibitions do stimulate students interest and many take the selection test (500-800 annually). Only 10% pass and are interviewed. Of these less than half enroll making for an annual admission of about 30 students. Many students initially want to become engineers, lawyers or accountants, not teachers. They enter the program because of the scholarships. Through the block sections in Physics and Physics Education courses, the group atmosphere that builds, and through the attitude and dedication of faculty, most students eventually commit themselves to a teaching career.

Science and Science Education Courses

Double Major: Of the Physics and Chemistry teachers in our region 70%, are teaching more than one subject, so

next page

we opted for a Physics-Chemistry and a Physics-Mathematics program. The Physics is offered in a block section for the two programs, while Chemistry and Mathematics are taken together with the BS majors in these subjects so that class size is still about 30. An added advantage of a double major is that the final science level remains below a pure BS single major degree, so prospective teachers cannot apply for industry jobs. Science teacher education students will teach the way they were taught in *science* courses, *not* how they were told to teach in science *methods* courses. *That is why the science courses are even more crucial as teacher preparation than the methods courses: the science courses should be exemplary for the future teachers.* All science courses try to model teaching methods that are applicable in Philippine high schools. This has necessitated extensive redesigning of existing courses and in-class coaching of faculty through team teaching with the consultants.

In a series of four courses taught by Physics and Chemistry faculty, students get a subject-specific introduction to teaching science. A first course emphasizes interactive presentations and demonstrations and culminates in an exhibition of science experiments for visiting high schools. A second course leads to the first school teaching. A third course is on alternative conceptions and the fourth is on assessment. The emphasis is on teaching methods, which are realistic in Philippine high schools: 50-70 students per class, together with underlying problems like heat, noise and lack of textbooks and lab equipment. This means interactive demonstrations and getting students to study during the lessons rather than lecturing the whole period.

Faculty development is done not only through formal Masters and Ph.D. programs at UP, but also through team teaching and joint course development with long-and short-term consultants. Masters and Ph.D. projects focus on development of science and science education courses. The project has funded some faculty internships at other institutions in the Philippines and abroad.

Placement

All students are required to teach for at least 4 years in Philippine schools. During that time they cannot obtain a passport. Our dean works closely with the Regional Education Office and with private schools in order to place students in high schools and if possible in pairs so they can assist each other during the difficult first years of teaching.

Support

The following forms of outside support have been received during the development of the program: The Department of Science and Technology (DOST) has donated science equipment and student/faculty scholarships for Masters and Ph.D. studies. The Commission on Higher Education has provided student scholarships. The University of San Carlos provided a new building, half of which is being used by the science/mathematics teacher education programs. The Free University and the Dutch Government have provided funds and expertise for equipment, part of the building, modest AV facilities, a long-term consultant for 4 years for physics education, short-term consultants and short courses for faculty.

Copying the Experience

Could other institutions copy the intervention described in this paper? The answer is both yes and no. Institutions can copy the selection promotion campaign through access to government scholarships and faculty talented at running science shows to inspire kids. The Physics-Chemistry programs are not easy to copy as probably much less than 20 universities have the necessary infrastructure. But even institutions with facilities would need faculty with deep commitments and willingness to spend much extra time during a 6-year experimental stage. Long-term expatriate support is also important. This is expensive but crucial. As to other countries, the promotion and recruitment campaigns would do well in low-income countries, as scholarship is the only way for most students to continue their studies. The goal for a critical number of students and focus of physics teacher education at few universities per country is important. An alternative could be the cooperation between different institutions with small number of physics teacher education students, and brought together for an intensive summer program that emphasizes physics pedagogy. A large investment in one program is better than spreading it over several programs with subcritical mass.

Ed van den Berg
Science and Mathematics Education Institute
University of San Carlos (USC), Talamban Campus
Cebu City, Philippines 6000
edberg@cnms.net

... man will occasionally stumble over the truth, but usually manages to pick himself up, walk over or around it, and carry on.

Churchill, W. S. In Irving, K. (1996). *Bending perception*. A book review. Nature, 379: 412.

Trends in Physics Education in French Upper Secondary Schools

by Marie Geneviève Sèrè & Daniel Beaufils

The Ministry of Education (MENRT standing for Ministère del l'Èducation Nationale, de la Recherche et de la Technologie) of France continuously monitors the curriculum in physics education through a committee of experts. This committee may be influenced by different trends originating not only from teachers' associations, trade unions, researchers in science education and recognized scientists, but also sociologists, economists and public opinion possibly determined by wide-scale surveys.

Recently, various original trends have been noticed in physics education these include the following:

The promotion of multidisciplinary education

As in various countries, pupils' and students' interest in physics is decreasing in France. To a lesser extent, the interest in other sciences like biology and chemistry is also decreasing. On the contrary the need to promote written and oral expression, general culture, foreign languages, etc., is increasingly emphasized. As a result, it has been suggested that a new type of activity should be organized, namely Travaux Personnels Encadrès (TPE: directed personal work). Next year, each pupil in the three years of upper secondary school will have to choose a subject chosen from a list, to prepare a report on their TPE, supervised and helped by two teachers from different scientific disciplines. The pupils will work from time to time in groups with a teacher, but they will also work by themselves in libraries, on the Internet, at home or even in the laboratory. This is how TPE differs from tutorials. Once the information has been presented in the report, the report should depend on both bibliographic searches and experiments.

The setting up of TPE in schools will take into account this four-year experience. The first trials seem to indicate that students will enjoy this sort of activity and it will encourage them to accomplish worthwhile study.

New shapes of assessments in the baccalaureate (final secondary school examination) to encourage effective labwork

The way in which any academic activity is assessed influences greatly both students' and teachers' practice. If it is not graded, students neglect the activity and spend little time on it. Teachers are tempted to do the same–to neglect the activity. One of the best ways to ensure that students take labwork seriously is to assess it. Like any assessment, this poses numerous problems, such as: which type of knowledge should be assessed; how to obtain fairness and equality of grading throughout France; how to organize practical activities for examination purposes; and how to provide enough teachers to observe and grade student.

To answer these questions, different pilot studies have been organized since 1993. The main one was carried out by the national association 'Union des Physiciens' who asked selected teachers across the country to undertake assessments. The first trial was inspired by similar assessments in technical education, where experience has been gained over several years. The trial lasted two years and all the observation reports and results, supplemented by teachers' comments, were centralized and summarized. The conclusions were reshaping existing school experiments to facilitate assessment of teachers on how to organize such sessions in terms of apparatus and hardware, and training teachers on how to intervene, to avoid unfair help and ensure students to have the same chance whatever happens during the work. For example, in a given laboratory, on a given examination day, all the experiments are different and allocated to candidates at random. Two teachers are present, one observing and grading, and the other being a 'resource teacher' coping with unforeseen problems. Developing grids to undertake standard assessments does not help students get distracted when at work. As a result, the assessment was gradually restricted to familiarity with standard apparatus and experimental skills. This is felt to be a drawback by some teachers who regret that it is not possible to assess initiative and personal commitment. However it is generally recognized that this constitutes a step which encourages teachers not only to consider conceptual objectives, but also to pay attention to non-conceptual ones during labwork, and to promote teaching of skills and experimental procedures.

Promoting use of computers in physics education

The French Government has agreed to an important financial effort to equip each secondary school with computers. Two types of support will complement the financial effort. Firstly, it is necessary to offer in-service training to teachers especially interested by this type of

next page

teaching, and encourage them to disseminate their skills in this domain by accepting the role of instructor in their school. Secondly, it is necessary to provide teachers with software that is both useful and adapted to the curriculum. During the seventies, any teacher could offer the CNDP (Central National de Documentation Pédagogique) software based on personal ideas, with a view to disseminating it. Nowadays, techniques are too sophisticated, and fewer teachers are able to develop individual software. Specialists working in the INRP (Institut National de Recherches Pédagogiques) and private companies are now responsible for the development of scientific software. Theses in physics education also contribute to the development of software. The inspectors from the Ministry of Education pay attention to current developments in this sector, to monitor what is actually used in schools.

Schools are now well-equipped in computers, not only in physics but also in biology. In biology, software, originating from industry (pharmacy), is commonly used. In physics, the most frequently used software occurs during labwork: most upper secondary schools acquire modeling software, data processing software, simulation software for electricity, optics, etc., and chart recorders. Conversely CIAL is seldom used. A paradox is that most schools are very well-equipped and better equipped than laboratories during the first years of university. Generally students are puzzled by the change between upper secondary school and university in this sector. The situation in universities is now changing with the rapid development of a university self-training network (RUCA) offering students more and more on-line courses whose development is coordinated by the Minister of Education. This tool, available on the Internet, is called *'Premier cycle sur mesure'* (undergraduate level). Access to part of this tool is free, while the remainder has to be paid for.

The above describes certain aspects of current changes in physics education at upper secondary school. Another change is likely due to an important decision taken recently on undergraduate studies in natural sciences (whatever the science studied). It has been decided that lectures on the philosophy of science will be provided and will become compulsory in every scientific discipline. Given the fact that in France, philosophy is part of the curriculum during the last year of the baccalaureate, this will without doubt can influence education at the upper secondary school level. Teaching strategies may be diversified and lead to specific comments and guidance during labwork, to ensure coherence with what is taught in the philosophy of science. Research in science education should play a prominent role in future decisions in this domain, making use of the results acquired on the link, more and more strong, between epistemology and science education.

Marie Geneviève Sèrè & Daniel Beaufils
DidaScO Universitè Paris Sud XI. Bat. 333
F-91405 ORSAY Cedex

The following websites provide further information on innovations in France:

Institut National de Recherches Pedagogique:
http://www.inrp.fr

Resources from the Ministry for Education:
http://www.educnet.education.fr/phys

French education system:
http://www.education.gouv.fr

Union des Physiciens:
http://www.cnam.fr/udp/

RUCA:
http://www.univ-lille1.fr/lemm/ruca

BOOK, from 1

that they would serve as background briefing for any physicist who might be presenting a lecture during the year 2000 on the state of, and prospects for, physics in the new millennium.

Some authors acted as proxies for physicists who are not specialists in their commission's field. Suggestions were also made for high school teachers to be included in the category. The results form this volume. They have been lightly edited, and it is clear that they vary in the demands that they make on the reader's knowledge of physics. But the strength of this collection is that, each piece is authoritative – written by recognized international experts.

The pieces are presented in the order in which the IUPAP commissions happen to be ordered. It would be possible to reorder them so that related fields are grouped together. The cross-links are multiple, so no one sequence could be ideal. There is overlap between them, and in some cases, notably between Commission 17 on Quantum Electronics and Affiliated Commission 1 on Optics, the overlap is considerable. Such features might be a stimulus for IUPAP to look again at the structure of its commissions. It should be noted that Commission 1 deals with Finances of the Union and so does not feature here.

All three of us have enjoyed these pieces. Whilst none of us would claim to have understood all parts of all of them, they have expanded our vision and given us a lively picture of physics. They show that the subject is very much alive, and still full of intriguing surprises and fascinating promise. We hope that other readers will share this experience.

Leonard Jossem
Jossem@mps.ohio-state.edu

For information on how to obtain a copy of the book, write or e-mail to the IUPAP Secretary General:
Dr. R. Turlay
DPNIA/DIR – C. E. N.
Saclay, F – 91191
Gif – Sur – Yvette, France
e-mail: turlay@hep.saclay.cea.fr
or the book can be downloaded for free at:
http://www.iuap.org/reports.html

China Uses Interposed Video-tape and Multimedia CD-ROM in Physics Teaching

by Yun Ying, Zhang Binghua and Yang Honhua

Sixteen Physics teachers and staff of the audio visual education joined in the research project "Application of Modernized Teaching Method in University Physics, which was sponsored by the Ministry of Education in China, Jiangsu Education Commission, UNESCO and TWOWS.

More than 150 universities, colleges and high schools in 26 provinces like Beijing, Shanghai, Xian, Nanjing, Wulumuqi, etc. are using videotapes, and close to 40 universities and colleges are using text books.

This new teaching mode helped physics teachers to: (a) show vivid physics phenomena; (b) deepen students' understanding for concepts; (c) deepen the image information, stimulate image thinking, make a correct response and feedback with the abstract thinking; (d) remedy some effects of the demonstration experiments; and, (e) stimulate student's individual interest.

Cultivating Students' Abilities

Professor Huan Ying, with her group at the technology University of Tayuna have seen the implications of these, mode of teaching using textbooks with videos in class.

Teachers should use their talents to establish the context or environment in their lectures. For example, the teacher should ask the students to observe carefully on the tape "super position of motions," and ask the students to think of a problem according to this phenomenon by themselves. After students have discussed, the teacher formulates a physical question from the actual phenomena.

Teachers should further cultivate student's abstract thinking abilities: example "Standing Wave" is more or less difficult, the teacher uses the tape, and asks the students to think about the characteristics of amplitude, phase and energy of standing wave, and analyzes the right or wrong answers of her students. An example is letting the students do research works and write essay(s) on topics like "Application of static electricity," "Application of Electromagnetic Induction," etc.

Using Videos in a Tutorial Session

The other innovation of the use of interposed video was by Professor Zhang Binghua at Jiangsu Radio and Television University. He tried another way of using interposed video as a tool in a tutorial session. The innovation is mainly based on the work of McDermott's model of Tutorials in Introductory Physics. In the traditional tutorial session, some practical experiments are not so easy to prepare in a short time. But if we use well-prepared interposed video in the class, it can replace the experiment and play the same role as the real experiment does.

(1) The instructor assigned three or four students as a study group in an interposed-video tutorial session. Then instructor gave each student a work sheet on which there were several questions or quantitative problems related to the concepts they would investigate.

(2) Students made predictions by themselves on the worksheet. Some questions are qualitative and others are quantitative. After that, students in the group discussed their predictions with each other. Next step was for the students to report their results to the class and to discuss with the instructor.

(3) Then the students in the tutorial were assigned to watch the interposed video and to check their answers with the video.

These kinds of exercise help students understand the concepts better if their first predictions were wrong. This method helps students study individually at their own pace and more effectively. The instructor can ask questions more than that in the traditional tutorial session because the interposed video was well-designed to ask students more questions than the real experiment does.

Prof. Yun Ying
Department of Physics
Southeast University
Nanjing, Jiangsu 210018
PRC
huiming@seu.edu.cn

Mathematics is an elegant tool for bookkeeping in physics.

—Prof. Gerard 't Hooft
University of Utrecht
1999 Nobel Laureate in Physics

Science Education Through Physics Toys

by Yoshio Kamishina

Everywhere in the world not only children but also adults like toys everywhere in the world. The mechanism of toy's movements is, in many cases, explained by physics. These toys are called physics toys. There is no room for doubt in believing that physics toys are useful materials in teaching physics. Unfortunately, however, the mechanics of physics toys are often nonlinear phenomena, that is, the equation of motion that the toy's movement obeys is not a linear equation with respect to a variable. Hence, it is hard for students in elementary and secondary schools to understand strictly the mechanism of toy's movement in terms of mechanics. For an example, let us think of the swing, a device consisting of a seat hanging from two or more ropes or chains, on which one can sit and swing backward and forward as a form of recreation. It is very popular with children. Most children can learn to propel a swing in the proper way after a relatively short time even if it is their first time. Most of them have no idea about why that way of swinging is the proper one. Motion of a swing is known as a typical example of parametric excitation, which is quite different from a usual forced oscillation.

The use of toys in teaching physics, or in general science, to children, using a toy-frog swing and toy musical instruments - pipes, by way of examples is very effective.

A toy-frog swing

Using a rubber frog toy as a model to represent the movement of a swing is close as possible to a real swing. The legs of the frog are made of rubber and can fold to sit the frog down when the air pressure is low in the body of the frog. When the air is sent into the body from a pump through the plastic tube inside the hanging rope, the frog stands up on the seat due to the high pressure in the legs. In this way, one can propel a frog to swing by pushing a rubber pump.

This swing works as a simple pendulum, which consists of a bob suspended by an inextensible string. The length of a rope or a chain determines the period of the swing as far as the amplitude is not large, like a usual simple pendulum. The reciprocal of this period is its intrinsic frequency. To propel a usual pendulum, we push or pull a bob periodically. If the frequency of the external periodic force is equal to the intrinsic frequency of the pendulum, the amplitude of the bob gets larger and larger. Then resonance occurs. This type of oscillation is called a forced oscillation.

To propel a swing, on the other hand, a frog as a rider stands up on the seat and sits periodically. In this case, external force is created by muscular power of the rider, and lifts the center of mass of the rider against the weight of gravity. When the center of mass is lifted, the length of the rope gets shorter effectively and the period becomes smaller. The length of the rope is a parameter that determines the period. The oscillation where a system is energized by changing a parameter is called a parametric oscillation. In the parametric oscillation, when the frequency of external periodic force, that is standing up and sitting down, is not equal to the intrinsic frequency of the swing but to twice of it, resonance occurs.

Students can understand the phenomenon that when they push the pump twice in a period of swinging, the amplitude of the swing gets larger most effectively, and the timing of pushing is important through playing a swing.

Toy musical instruments

All musical instruments make use of RESONANCE phenomena.

A typical example of resonance of sound is explained using a tuning fork. If a tuning fork is made of metallic tube, resonance of sound can clearly be shown. When the length of tube is proper to the pitch that the tuning fork makes, the sound becomes louder. Furthermore, the condition that resonance occurs depends on whether the end of the tube is open or not, even if the length of the tube is the same.

Wind instruments are especially suitable for students to understand the resonance condition of sound, that is the relation between the length of the pipe and the pitch of a sound. Roughly speaking, pipes are divided into three groups, a flute family, a clarinet family, and a trumpet family. The first group contains a flute, a piccolo, a recorder (an English flute), a shakuhati (a Japanese flute), and so on. The second group has a clarinet, an oboe, a bassoon, a saxophone and so on. A trumpet, a trombone, a tuba, and a horn belong to the last group. This grouping is made in terms of the mechanism of generating sounds. In a flute family, a player blows toward an edge of the hole to make sounds, and tune by pressing a key to change the length of the pipe. In a clarinet family, a reed or double reeds are used to generate sounds. In a trumpet family, a player vibrates his or her lips instead of reeds to generate sounds. Although the mechanism of changing is different depending on instruments, in all wind instrument the length of the pipe is changed to tune.

next page

Stringed instruments are also simple and useful for teaching resonance phenomena of sound, mode of vibration and higher harmonics.

Other interesting phenomena related to vibration and resonance

One of them is coupled oscillation. A simple example of coupled oscillation can be shown by a pair of pendulums, which is coupled by a string or a soft coil spring. One pendulum starts swinging while the other set rests. As time passes the second pendulum that was at rest at first begins to swing gradually, while the first swinging pendulum is getting less active. When the amplitude of the second pendulum reaches the maximum, the first pendulum stops. As time passes further, the first pendulum begins swinging again and the second one loses energy. These movements repeat again and again. The energy of swinging transfers alternatively.

Another different type of coupled oscillation is a combination of coil spring and disk.

A simple harmonic oscillator consists of coil spring and bob. When you pull down bob hanging from coil spring and release it softly, the bob goes up and down periodically showing a simple harmonic oscillation according to Hook's law. If you exchange the bob by the disk with a small dumb bell on it, what will happen? The energy of the coil spring is transferred to the disk to make it twist clockwise and counterclockwise alternatively around the vertical axis along the direction of a coil spring. When the disk twists most intensely, a coil spring stops moving. As time passes further, the coil spring starts going up and down again and the disk twists less. The movement repeats just like a coupled pendulum.

This type of energy transfer also occurs when two systems, which are loosely coupled, have the same intrinsic frequency of oscillation or higher harmonics. Thus, it is also a kind of resonance phenomena.

Merits and demerits of using physics toys

Physics toys are very popular among children. In this respect, physics toys are powerful teaching materials as a driving force for students to learn science. As mentioned above, the mechanics of physics toys is not so easy for children to understand. It is noteworthy that teachers must not expect that students understand the whole concept. A physics toy shows, but makes them feel that science is fun and daily life phenomena are full of physics.

Prof. Yoshio Kamishina
Shimane University, Faculty of Education,
1060 Nishikawatsu-cho, Matsue City
Shimane 690-8504 Japan
kamisina@edu.shimane-u.ac.jp

BARCELONA, from 1

the Physics Teachers Beyond 2000 conference is all about.

The 18th edition of the GIREP International Conference on Physics Teachers Beyond 2000 will be held in Barcelona, Spain on August 27 to September 1, 2000.

The objectives of the conference are as follows: to bring together professionals from the fields of physics education (at all levels) and physics teacher education; discuss the present state of teacher physics education; discuss the research in science education; and provide new ideas and resources to update physics teaching.

The conference is divided into three main topics. Among the topics to be presented in plenary lectures and roundtables are:

Physics Beyond 2000: New Contents for a New Conception of Physics Teaching

- What Physics Should be Taught
- Basic Concepts and Structure of Physics
- Relationship Between Current Physics in Research and Physics in School
- Science Contents in Physics Education
- Scientific Contents in Physics Teacher Education School-University Interaction
- Teacher Education Beyond 2000: Improving Physics Teacher Education

Guidelines and Approaches: How Should Physics Teachers be Trained?

- Professional Contents for Physics Teachers
- Strategies to Improve Teachers Education
- In-service Teacher Training
- Collaborative Work
- Physics Education Beyond 2000: New Methods and Tools in Physics Education

How Should Physics be Taught? Innovative Methods Strategies and Contents

- Computer Based/Aided Learning
- The Impact of Other New Technologies in Physics Teaching
- Approaches to Laboratory Work
- Assessment Procedures

Registration is ongoing. Interested parties may register:

mail
Fill in registration form and mail to Conference contact persons:

Roser Pinto
Department de Didactica de les Ciencies
Universitat Autonoma de Barcelona

Santi Surinach
Department de Fisica
Universitat Autonoma de Barcelona

e-mail
PHYTEP@blues.uab.es

Maxwell on Experiments and Words of Power

Nowadays we have too much to teach and too little time to teach it.

There are, as I have said, some minds that can go on completing with satisfaction pure quantities presented to the eye by symbols, and to the mind in a form which none but mathematicians can conceive. There are others who feel more enjoyment in following geometrical forms, which they draw on paper, or build up in the empty space before them. Others, against, are not content unless they can project their whole physical energies into the scene that they conjure up. They learn at what at rate the planets rush through space and they experience a delightful feeling of exhilaration. They calculate the forces with which the heavenly bodies pull at one another, and they fell their own muscles straining with the effort. To such men momentum, energy, and mass are not mere abstract expressions of the results of scientific inquiry. They are words of power, which stir their souls like the memories of childhood. For the sake of persons of these different types, scientific truth should be presented in different forms, and should be regarded as equally scientific, whether it appears in the robust form and the vivid coloring of a physical illustration, or in the tenuity and paleness of a symbolic expression.

When we shall be able to employ in scientific education, not only the trained attention of the student, and his familiarity with symbols, but the keenness of his eye, the quickness of his ear, the delicacy of his touch, and the adroitness of his fingers, we shall not only extend our influence over a class of men who are not fond of cold abstractions, but by opening at once all the gateways of knowledge, we shall insure the association of the doctrines of science with those elementary sensations which form the obscure background of all our conscious thoughts, and which lend a vividness and relief to ideas, which, when presented in mere abstract terms, are apt to fade entirely from the memory.

To exhibit illustrative experiments, to encourage others to make them, and to cultivate in every way the ideas on which the throw light, form an important part of our duty. The simpler the materials of an illustrative experiment, and the more familiar they are to the student, the more thoroughly is he likely to acquire the idea which it is meant to illustrate. The educational value of such experiments is often inversely proportional to the complexity of the apparatus. The student who uses homemade apparatus, which is always going wrong, often learns more than one who has the use of carefully adjusted instruments, which he is apt to trust, and which he dares not take to pieces.

It is very necessary that those who are trying to learn from books the facts of physical science should be enabled by the help of a few illustrative experiments to recognize these facts when they meet them out of doors.

A few experiments performed by himself will give the student a more intelligent interest in the subject, and will give him a lively faith in the exactness and uniformity of nature, and in the inaccuracy and uncertainty of our observations, than any reading of books, or even witnessing elaborate experiments performed by professed men of science.

Quotations from physicist, James Clerk Maxwell 1831-1879

7th, from 1

Physics Teachers in Contemporary Society. The ICPE, which was organized by the inter-American Council for Conferences on Physics Education, will be held on July 3-7, 2000 at Porto Alegre (Canela), Brazil.

The topics include the following: The use of new technology in the preparation of physics major and physics teachers; research on physics education and the preparation of physics teachers; history and philosophy of science in the preparation of physics teachers; and new curricula for the preparation of physics majors and physics teachers.

Conference activities will include plenary sessions, paper and poster presentations, workshops and lectures.

For inquiries, write to the following:
iacpe7@if.ufrgs.br or
secteor@if.ufrgs.br
IACPE7/SECTOR/Instituto de Fisica, UFRGS
C. O. Adriana Marques Toigo
Caixa Postal 15051, Campus
CEP 91501-970 Porto Alegre, RS, Brazil

... I suffered exactly the same treatment at the hands of my teachers who disliked me for my independence and passed over me when they wanted assistants ... Keep your manuscript for your sons and daughters, in order that they may derive consolation from it and not give a damn for what their teachers tell them or think of them ... There is too much education altogether.

Albert Einstein, *The World as I See It*, The Wisdom Library, New York, 1949.

The ICPE Commission

OFFICERS (1999-2002)

Jürgen Sahm (Chair)
Technische Universität Berlin
Fachbereich 4 Physik
Sekr. PN 1-1, Hardenbergstr. 36
D-10623 Berlin
GERMANY
Fax: + (49-30) 314-23057
sahm@physik.tu-berlin.de

Sergei S. Krotov (Vice Chair)
Physical Department
Moscow State University
The Student Magazine of Mathematics and Science "Quantum"
64A Leninsky Prospect
Moscow 117296
RUSSIA
Fax: + (7-095) 938-2140
bquantum@sovam.com

E. F. Redish (Secretary)
Department of Physics
University of Maryland
College Park, MD 20742-4111
USA
Fax: + (1-301) 314-9531

redish@physics.umd.edu

MEMBERS (1999-2002)

Ernesto W. Hamburger
Instituto de Fisca-USP
Caixa Postal 66138
05315-970 São Paulo SP
BRAZIL
Fax: + (55-11) 818-6832
ewhamburger@if.usp.br

T. Hyodo
Department of Basic Sciences
Graduate School of Arts & Sciences
The University of Tokyo
Tokyo, JAPAN
Fax: + (81-3) 5454-6519
hyodo@phys3.c.u-tokyo.ac.jp

Ernie W. McFarland
Department of Physics
University of Guelph
Guelph, Ontario N1G 2W1
CANADA
Fax: + (1-519) 836-9967
elm@physics.uoguelph.ca

J. M. Ogborn
The Institute of Physics
76 Portland Place
London WIN 3DH
UK
Fax: + (44-171) 470-4848
jon.ogborn@iop.org

Sung-Jae Pak
Physics Education Department
Seoul National University
Seoul 151-742
KOREA
Fax: + (82-2) 880-7754
paksj@snu.ac.kr

Marie Geneviève Séré
DidaScO
Université Paris XI
Bâtiment 333
F-91405 Orsay
FRANCE
Fax: + (33-1) 6915-5454
Marie-Genevieve.Sere@didasco.upsud.fr

J. R. Seretlo
University of Fort Hare
Faculty of Science
P.O. Box 21
Fort Hare 5701
SOUTH AFRICA
Fax: + (27-4065) 31-669
seretlo@phys.ufh.ac.za

Gunnar Tibell
Department of Radiation Sciences
Box 535
S-751 21 Uppsala
SWEDEN
Fax: + (46-18) 471-3833
gtibell@tsl.uu.se

Matilde Vincentini
Laboatorio di Didattica delle Scienze
Deipartimento di Fisica "E. Fermi"
P. le Aldo Moro 2
I00185 Roma
ITALY
Fax: + (39-6) 446-3158
vicentini@romal.infn.it

Kai-Hua Zhao
Department of Physics
Peking University
Beijing 100871
PEOPLE'S REPUBLIC OF CHINA
Fax: + (86-10) 6275-1615
khzhao@ibm320h.phy.pku.edu.cn

ASSOCIATE MEMBERS (1997-2000)

Endre Lillethun
Department of Physics
University of Bergen
Allegaten 55
N-5007 Bergen
NORWAY
Fax: + (47-5) 558-9440
endre.lillethun@fi.uib.no

S. W. Raither
UNESCO Division of Research and Higher Education
1, rue Miollis
F-75015 Paris
FRANCE
Fax: + (33-1) 4567-2639
rather@ext.jussieu.fr

Vivien M. Talisayon
Institute for Science and Mathematics Education Development
University of the Philippines
Diliman, Quezon City 3004
PHILIPPINES
Fax: + (632) 928-1563; 928-2625
director@ismed.upd.edu.ph

IUPAP · ICPE

International Commission on Physics Education
International Union of Pure & Applied Physics

For comments, questions, or to be added to or deleted from the mailing list, please contact the editor:

Editor:
Dr. Vivien M. Talisayon
University of the Philippines
Institute for Science and Mathematics
Education Development
E. Quirino Avenue, UP Diliman 1101
Quezon City, Philippines
Fax: (632) 928-1563
E-mail: vmt@ismed.upd.edu.ph

Editorial Adviser: **Prof. Dr. Jürgen Sahm**
Editorial Assistant: **Ginette Cecilia Nolasco-Almaden**
Design & Layout: **John Jerry A. Maramag**

The International Newsletter on Physics Education
is a publication of the International Commission on Physics Education and is produced twice a year.

Visit our Webpage at :

http://www.physics.umd.edu/ripe/icpe

Visit the following web addresses for problems and solutions given at the IPhO in Padua. The organization to acknowledge when visiting is + ACI – Italian Physics Olympiads Group of Association for Physics Teaching + ACI and the Scientific Committee of the IPhO.

Web addresses:

http://www.pd.infn.it/Olifis/welcome.htm
http://www.cadnet.marche.it/olifis

ICPE Newsletter Editor
University of the Philippines
Institute for Science and Mathematics
Education Development
E. Quirino Avenue, UP Diliman 1101
Quezon City, Philippines
Fax: (632) 928-1563

Stamp