International Newsletter On Physics Education

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

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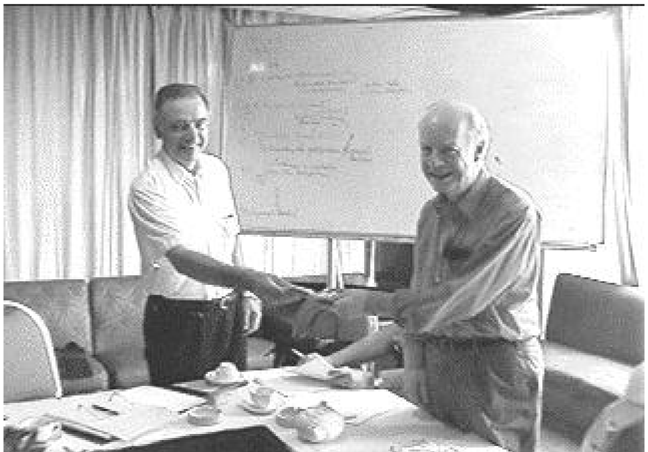
New ICPE Membership



Incoming ICPE chairman Jürgen Sahm receiving the baton from outgoing chairman Paul Black

Successful elections for the 1999-2001 ICPE membership were held during the IUPAP meeting in Atlanta, Georgia, USA in March 1999.

The new officers and members of the ICPE are:
Chairman: J. Sahm (Germany)
Vice-Chairman: S.S. Krotov (Russia)
Secretary: E.F. Redish (U.S.A.)
Members: E.W. Hamburger (Brazil), T. Hyodo (Japan), E. McFarland (Canada), J. M. Ogborn (U.K.) S-J Pak (Korea), M.G. Séré (France), J.R. Seretlo (South Africa), G. Tibell (Sweden), M. Vincentini (Italy) and K-H Zhao (China).

The term of the associate members , which includes E. Lillethun (Norway), M.A. Moreira (Brazil), S. W. Raither (UNESCO) and V. M. Talisayon (Philippines) ends in year 2000.

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ICPE Chair Reports on Activities and Trends on Physics Education

Professor Paul J. Black
Chairman, International Commission on Physics Education (1996-1999)

The ICPE's main aim is to promote the exchange of information and views amongst members of the international community of physicists in the general field of physics education. To pursue this aim, it tries to assist the communication of information concerning education in the physical sciences at all levels. This information includes in its scope the assessment of the standards of physics teaching and learning, ways in which the facilities for the study of physics might be improved, and ways to help physics teachers incorporate current knowledge about physics, physics pedagogy, and results of research in physics education into their courses and curricula.

A.1 **Conferences**

The promotion and support of international conferences is one of the main ways in which the commission seeks to achieve its aims. The main meetings which it has helped sponsor during the 1997-1999 term are as follows:

1. Taller Iberoamericano de Enseñanza de al Fisica Universitaria. Havana, Cuba
   January 20-24, 1997
2. Sixth Inter-American Conference on Physics Education. La Falda, Argentina
   June 30-July 4, 1997
3. Creativity in Physics Education. Sopron, Hungary.
   August 16-22, 1997
   A published conference report is available from Professor Marx at the Eötvös University in Budapest. The 1997 ICPE meeting was held on the 24th and 25th of August in Budapest immediately after the meeting.
4. Hands-on Experiments in Physics Education. Duisburg, Germany.
   August 23-28, 1998
   This was a GIREP conference. A publication of the proceedings of this conference is being prepared. The 1998 ICPE meeting was held in Duisburg on the 22nd and 23rd of August, immediately after this meeting.

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Turning the Challenge into Opportunities: The Mission of Physics Teachers for the Next Millenium

(Conclusions from the International Conference of Physics Teachers and Educators, Guilin, People's Republic of China, August 19-23, 1999)

Conference Team led by Leonard Jossem, Professor of Physics Emeritus, Department of Physics, Ohio State University

The very rapid changes of knowledge and techniques in science and technology, and the changes they have caused and will continue to cause in our societies, define the challenge and the mission for us as teachers in the next millennium. It is the challenge of life-long learning and understanding for all.

This challenge has many parts.

For us as teachers, and as teachers of teachers, it is the challenge of personal professional development. The profession of teaching needs, now more than ever, to become one of life-long development. We need to keep up-to-date in developments in physics and related sciences, in developments in physics education research, in developments in curriculum reform and instructional methods and technologies, and in the theories and techniques of examination, evaluation, and assessment – including self-assessment.

In meeting these challenges, it is very important for teachers to have strong support for their work. It is not realistic to believe that they can do it all without support. They need support from their colleagues at work, and support from school and university administrators, and at the national level.

Money is an important aspect of support - in the form of better salaries and funds for travel to important educational conferences. But time is also a very important source of support: time to study and to discuss educational problems with colleagues, time to try educational experiments and to analyze the results, time to see where and how improvements might be made and to try the new ideas.

Teachers can help and support each other in local groups in which they discuss their problems and their research and analyze their results. The existence of high-speed connections to the Internet and the World Wide Web make it possible to have discussions and share ideas with teachers in other parts of the country and even with physics teachers anywhere in the world. The Web also opens up a tremendous source of information, ideas and instructional materials to the individual physics teacher. One of the things that needs to be explored is how best to use this resource. Standards of quality for judging materials are very much needed and should be shared widely among physics teachers.

A second challenge is the challenge of helping students – including prospective teachers – to learn and understand. It is the challenge of motivating them to see the value to themselves of becoming *actively* involved in the process of learning and of taking serious responsibility for their own learning. The conference has provided us with various examples of some ways to motivate students, for example, involving them in the solution of "real-life" problems, and in the design of practical projects. Another part of the challenge is recognizing the diversity of students and their different styles of learning, and adapting teaching methods to suit the individual student. Here, again, help for the teacher can come from the results of physics education research, from discussions with colleagues and with the students themselves, and from the many resources available on the Web.

A third challenge is the challenge of the relations of teachers with the rest of society. In times of rapid change such as we have now, people often become uncomfortable and look for quick and easy solutions to what they see as their problems. There is no doubt that there are problems in the educational systems in every country, but in some cases the cure proposed is worse for the country than the disease. In the long term interest of the health of their own countries, physics teachers need to help educate the people who determine the local, regional and national policies on education. This is especially true for science education. In many countries, the number of required hours for science education has recently been reduced. Where curricula are determined locally, individual teachers can do much to help the situation. Where there are national curricula that must be followed, the problem is much more difficult and requires much hard work on the part of the individuals and professional societies. It is often a very slow process to change people's minds, but it is important to keep trying. Here, again, the Internet can serve as an important way of keeping good contact and communication among groups of teachers.

Finally, the participants in the conference have some challenges for the organizers of future conferences.

Conference proceedings nowadays are usually prepared on a computer, so electronic files are available. Putting the proceedings on a website would make them available to a much larger group of teachers around little, if any, extra cost.

People from around the world are interested to learn about the educational systems of the countries they visit. Organizers may make provisions for optional visits to typical schools, colleges, and universities and institutes to see how physics education is done in the host country. Iin addition to the general sightseeing tours, organizers may take advantage of local places to visit on "science field trips" such as those in Workshop 3C in this conference. Organizers

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5. New Technologies in Physics Education. Hefei, PR China
   October 12-22, 1998
6. International Conference of Physics Teachers and Educators. Guilin, PR China
   August 19-23, 1999
   The 1999 ICPE meeting was held in Guilin on the 17th and 18th of August immediately before the international conference.

A.2 **The Medal of the International Commission on Physics Education**

This medal is awarded for contributions to physics education which are major in scope and impact and which have extended over a considerable period. In 1997, the medal was awarded to Professor George Marx (Budapest, Hungary). In 1998 it was awarded to Professor Dieter Nachtigall (Dortmund, Germany).

A.3 **The ICPE Newsletter**

This continues to be produced on a semi-annual basis and distributed free of charge to about 1000 persons and institutions worldwide. The newsletter has been edited since early 1995 by Professor Ed Redish (Maryland, USA). He also manages the Commission's website with address http://www.physics.umd.edu/icpe/.

A.4 **Other Activities**

In early 1998 the Commission published a book entitled *Connecting Research in Physics Education with Teacher Education* with chapters by over twenty authors who are authorities in their various fields. The book is not published in print – it is available on a website http://www.physics.ohiostate.edu/`jossem/ICPE/Books.html with no restriction on downloading. It is also available at nominal cost on diskette. Translations into French and Spanish are in preparation with a grant from the UNESCO. The Commission has also prepared a diskette about selected posters useful in physics education and in arousing interest in physics amongst students. The text of four books on undergraduate physics education produced in the 1970s and now out of print are being put on a website for free availability in collaboration with the USA project NOVA and with a grant from the UK Institute of Physics. Work is also in progress to select papers particularly useful to teachers from past conference proceedings and copy these also onto a website. Members have been maintaining links with several regional networks concerned with physics education, including the European Physical Society and GIREP, and with other international organizations, notably UNESCO.

B. **Developments in Physics Education**

Four main trends can be discerned in the recent development of physics education. One is the continuation and strengthening of the development impact of research into ways by which pupils learn new concepts and practices of pedagogy, including assessment. Research into human cognition is beginning to frame useful lessons about optimum routes for teaching and learning and to open up particularly challenging innovations in the use of computer based learning programmes so that participants can work at the problems of selecting, transforming and adapting new thinking into reformed classroom work. The Internet published book is an example of work to convey research lesson in a form useful to practitioners. Whilst in past years such activity has been directed mainly at school level, there is now a new focus also on teaching and learning at the undergraduate level. As the participation rate in higher education increases in all countries, professors can no longer assume that any subject expert can undertake teaching by merely 'talking the subject'. The ICPE sponsored conference in Maryland in 1996 was a milestone in this development, as is the two-volume report on this meeting published by the American Institute of Physics.

A second trend is marked by a variety of explorations in which physics educators are attempting to broaden the scope of physics as a component of education. The use of toys in physics education, the use of museums and other informal centres for learning, a new emphasis on physics in the environment and for environment protection, are all examples of moves which have two main motives. One is to make physics more attractive to young people by engaging their interest in it through themes and problems of relevance to their daily lives. Another is to develop a sense of social responsibility amongst future physicists, and to give them basis for making critical judgements about the impact of science and technology amongst all future citizens. Underlying such moves is a new realization that physics education at all but the most specialized level of tertiary education should not be directed primarily at the development of the future physics researcher, but at using the insights and skills that physics can provide to enrich and form the capable citizen. The implications of such a shift in aims are being thought through in various ways. One implication is that issues in the history, philosophy, and social context of the development of physics ought to feature more strongly in future curricula.

A third trend, related to the second, is continuing, and in some western countries particularly increasing, concern that students are not being attracted to the study of physics. So there are some renewed efforts to make physics more attractive to young people. Some of the

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ICPE Chair Reports *(continued from page 3)*

changes mentioned under the second trend above should also serve this purpose. However, there is also a need to convey in school and undergraduate study some of the sense of wonder and excitement that fundamental research in physics continues to engender in those working in it or close to it. Thus courses of study which concentrate on 'basics' and promise to come to the exciting frontiers in future years are no longer seen as acceptable. The challenge is to develop new curricula in which some authentic vision of work at the frontiers is communicated, and in such a way that some concepts and methods of working fundamental to the understanding of physics are developed through this communication.

A fourth trend is the rapidly expanding use of the Internet in education. As can be seen from the above report of activities, the Commission is trying to explore several ways of taking full advantage of the possibilities that the new technology can open up, and in so doing, it is hoped to learn lessons about future uses. The immediate prospect is that materials, many old and some new, can be made freely available so that any teacher in any school in the world can have access to them. The issues here are to develop a label that assures quality of such material, and to find or produce material for which copyright holders are willing to give rights with no financial return. The attraction is particularly strong in the case of developing countries that have neither the channels of communication nor the resources to obtain materials by normal commercial purchase. In many such countries however, teachers cannot take advantage of Internet availability because they lack the equipment to read and download. So a second strand of the Commission's work here must be to try to establish and disseminate information about centres in such countries, where such equipment exists and where there are physics educators who are willing to download and copy, at cost, for provision to others in their immediate region.

Physics Posters

To celebrate its centennial last March 1999, the American Physical Society has produced a timeline entitled 'A Century of Physics'. On eleven consecutive posters, which creates a 23-feet mural when mounted side by side, the milestones of the history of physics are exhibited in images and words.

The timeline functions at once a chronology, a work of art, a permanently open textbook, and a gigantic photo album covering a hundred years in the life of the community of physicists.

Access to the timeline and to the Wall Chart can be found at http://timeline.aps.org/APS/home_HighRes.html

Some Conclusions *(continued from page 2)*

may include sessions on the demographics of physics education in the host country and in other countries represented at the conference. What is happening in physics enrollments and required class hours in physics teaching at all levels is of interest to all teachers around the world.

Lectures and demonstration shows open to the public are important ways of connecting with the general public. In addition, organizers may wish to consider awarding prizes or other recognition to excellent students and to young teachers who are doing excellent work and show promise of becoming leaders in physics education in the future.

Conference organizers may also provide "pre-" and "post-" questionnaires to the participants. What do they expect to gain from the conference? What parts of the conference were not valuable to them? This feedback from the participants can be of help in evaluating the success of the conference and in planning future conferences.

Statement from the `99 International Conference of Physics Teachers and Educators

Why Teach Science

There are many good reasons. Science helps us find out about the structure of the universe, of ho things work and our place in it. It brings us new knowledge, and helps us understand. Science is one of the major achievements of the minds and imagination of the people in the world. It helps to prepare future generations for their place in an increasingly complex and technological society.

What to Teach in Science

In a rapidly changing world where new knowledge is being created at an astounding rate, learning has become a life-long process. Physics in particular is an important subject with which to teach students how to learn more about the world. We can not teach all of physics, but we can bring to all students a knowledge and understanding of parts of the subject, and show them how they are connected to the world.

How to Teach Science?

We learn in different ways, and although each of must learn for ourselves, we can all – teachers and students – also learn form each other. The important thing is that each of us take an active part in our owl learning process, and experience the satisfaction that comes form knowing that we can learn and understand new things for ourselves.

A Physics Education Project in Africa

Endre Lillethun
Department of Physics, University of Bergen, Bergen, Norway

The developing countries need a technological development not only to benefit from the discoveries of the last century but also *to develop their own technologies*, useful in their environment. Note that a *technological development* contrasts *a transfer of technology* from industrial countries. It is dependent on an infrastructure of a general understanding of the natural sciences among the inhabitants. The basic understanding should be obtained in primary and high school.

An educational growth in a poor country or region can be speeded up through collaborations with persons from richer countries. In such a collaboration, one of the most important “rules” to remember is that potential and intelligence of persons from both sides is the same quality. The poorer ones have a setback due only to fewer opportunities to make use of their gifts towards education and research in the way this is possible in richer countries. One should also remember that they have a solid knowledge and wisdom useful in their living situation. This is valid in all stages of education, and if this is made use of in the educational process, it will give self-reliance to the pupils/students and ease the absorption of new knowledge and show its relation to daily life.

During the 1980s, it was becoming very clear that research in physics and mathematics was losing ground in many developing countries and this occurrence was fairly evident in Africa, where, due to disastrous proceedings 15-20 years past, a slump in research and research methods has been experienced. Seeing the need for a revival of research and research methods for local use, and the possibility of a partnership with a richer country, the collaboration project “Basic Physics for Technological Development in Uganda” between Makarere University, Uganda and the University of Bergen, Norway was conceived, through the help of a four-year financing fund.

The aims of the project were: i) *to facilitate a technological development in the country*, in a build-up of possibilities for developing both education and research in the basic sciences, ii)*to take part in Competence and Capacity Building*, particularly on the experimental side, iii)*to make the research fields be selected by the Makarere staff, related to local needs,* iv)*to rehabilitate and modernize the teaching laboratories* including the production of proper manuals for the practicals, v) *to find Norwegian supervisors for graduate students and Ph.D. students*, giving the possibility for the students to visit their advisors, to use a good library, and to copy articles of use for their studies. Degree studies to be carried out as sandwich programs where the students spend most of their time at the Makarere University, adding to the local academic environment also during the study period, and vi)*to supply some of the essentials for infrastructure,* such as copying machines, computers and overhead projectors.

The above aims were followed up by: i) having persons in charge of the practicals visit similar laboratories in Norway, studying their methods and experiments, and starting the adaptation to and development of the Makarere facilities, ii) finding Norwegian researchers and Ugandan students for the different research topics selected, and procuring suitable equipment, iii) planning for the number of graduate students per year, and iv) planning an efficient use of the funds available.

The research was carried out in different fields of the sciences. Some of the fields focused on were the physics on studies of physical and chemical parameters of products made from clays in the abundant Uganda clay deposits, electronic devices, radiation physics and solar energy.

Under the project, about 35 Ugandans have completed M Sc studies in physics, chemistry and mathematics and 20 more are on their way. Two Ugandans have completed their Ph D studies and 8 more are on their way. A few Norwegians have also taken up degrees in the same subjects within the project.

Local workshops and seminars have been held for the academic and technical staff, with resource persons from Norway and from the region. International conferences in chemistry and in Mathematics and information seminars have been held for the public in Kampala and in other cities. In addition to a few publications in international journals, there have been international publications in proceedings from the conferences mentioned above and at conferences attended in the region.

As affirmed by the research fields covered and the particular studies pursued, the project has worked out in the way it was planned: to revive and develop ones’ research and research methods and to use this in locally based research, and not to feel compelled to copy the research trends in industrialized countries. The departments have made a leap forward and have thus made their initial contribution towards giving Makarere University once more (as in the fifties) the status of “Harvard of Africa”.

The about 25 Norwegian partners in the project have found it a rewarding activity, meeting hardworking and friendly persons who contributed to the research such that some of the joint research projects still continue, financed from normal university funding.

The apparently unique way of making the Ugandan University itself decide on the priorities of the projects wanted, and that the project would keep on for years, leading to continuous contact with scientists from abroad was strongly appreciated. The results of this project show that an expanded effort in enhancing science education in poorer countries is extremely rewarding, and hopefully, many others will follow suit.

A Physics Problem Based on an Actual Experiment

Yohtaro UENO and Toshiaki SHIBATA, Department of Physics Tokyo Institute of Technology, Oh-okayama, Meguro, Tokyo Japan

Most problems on physics of the university entrance examinations in Japan are certainly appropriate for evaluating calculating ability when only limited understanding of physics is needed. However, it is difficult to evaluate to what extent applicants understand basic physical ideas through these exams. We have confirmed this via the 1999 Spring entrance examination by including a problem that asks students to explain why a physical force they have calculated occurs.

In recent days most university teachers of natural sciences have seen a strong tendency of their students to show less academic improvement than in the past; students are deficient in the ability to think logically by themselves. In view of the strong influence of entrance examinations on high school and junior high school education in Japan, the fact that the conventional type of problems have persisted dominantly for a long time is without doubt a major factor that has brought about such serious matters.

In order to get over this difficulty we have also tried to pose problems based on or strongly related to experiments and observations. These kind of problems involve questions that require understanding of basic physical ideas and are favorable to those who have experimental and observational experience.

The problem given below is the only one that we made by doing an experiment. We hope that this type of problems will encourage high school teachers and students who have spent time in doing a lot of experiments. Finally, it is worth noting that one can complement to some extent the shortage of the conventional type of problems by adding questions that require reasoning and explanations.

Problem:

In order to study the force between two electric currents running in parallel lead wires, an experiment was performed using the apparatus as shown in Fig. 1. Although each of the lead wires 1 (abcdef) and 2 (gh) is a part of a different closed circuit, the remaining part of the circuit is abbreviated in Fig. 1. Lead wire 2 (hereafter abbreviated as LW2) is positioned horizontally, and its length is equal to segment cd of LW1. LW1 is attached to a Y-shaped insulator between a and b and between e and f. These connected parts are supported by two insulated fulcrums at the midpoint of segments ab and ef, so that the system is balanced. Segments ab and ef are collinear and serve as the axis of the balance. (Fig. 2 shows the apparatus viewed along the axis). When the balance is in balance, the plane of LW1 is horizontal and cd lies directly under gh. The force exerted on segment cd of LW1 can be measured by adjusting the weights on the fine-adjustment weight pan. The abbreviated parts of the circuits in Fig. 1 are designed so that their influence on measuring the force is negligible. The quadrilateral bcde is a rectangle where bc is 0.1[m] and cd is 0.3[m].

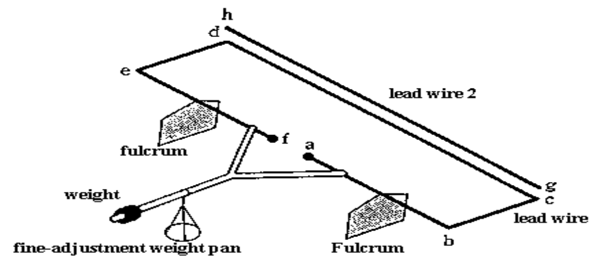


Figure 1

(a) We want to pass electric currents of up to 5[A] through LW1 and LW2. What is the most important thing we have to know for the purpose, in addition to the electromotive force V[V] of the battery and the electric resistance R[Ω] of the lead wire? Write also the equation that shows how it affects the electric currents.

(b) Firstly, we sent electric current I_1=5[A] in LW1 and no current in LW2, and balance the system by adjusting the weight. Next, keeping I_1=5[A], we sent electric current I_2[A] in the direction opposite to I_1. Varying the value of I_2[A], we measured the force exerted on segments cd and gh which was caused by the electric current I_2[A]. The distance between segments cd and gh was kept at 0.01[m] all the time. The force was repulsive and we obtained the result shown in Table 1. Plot this data on the graph on the examination answer sheet, choosing appropriate coordinates.

(c) Next, by moving LW2 upwards vertically while keeping it horizontal, we varied distance r[m] between segments cd and gh. Following the same steps as in (b), we measured the force exerted on segments cd due to electric current I_2[A], while keeping I_1=I_2=5[A]. The results are shown in Table 2. Plot this data on the graph on the examination answer sheet, choosing appropriate coordinates.

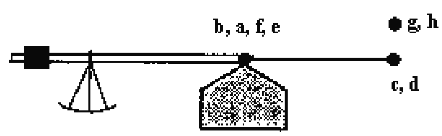


Figure 2

(d) Let us denote by F[N] the force which acts between segment cd in WL1 and segment gh in WL2. Taking

(Continued on page 7)

A Physics Problem *(Continued from page 6)*

into account the principle of action and reaction of a force and making use of plots obtained in (b) and (c), derive an equation which expresses F[N] in terms of electric currents I_1[A] I_2[A] and distance r[m]. Note that the derivation should be logically done step by step. What is the value of the proportionality constant in the equation?

(e) The proportionality constant obtained in (d) turned out to be smaller than the value obtained by the formula applicable to (d). Let us consider the qualitative influence of each one of the following items on the experiment. If it makes the constant smaller, write S on the answer sheet. If it makes the constant larger, write L. If it makes the constant smaller in some cases and larger in other cases, write SL. If it has no influence, write N.

i) The electric current is passing through segments ab and ef.
ii) Segments cd and gh are not sufficiently long.
iii) Geomagnetic fields are acting on segment cd and gh.
iv) Although segments cd and gh are parallel, they may not be completely in a vertical plane.

(f) The force acting between the lead wires, observed in (b) and (c), can be regarded as working via the magnetic flux density existing around one of the lead wires. In (d), the equation for the force that acts between the lead wires with r=0.3[m] was derived. Use that equation to derive an equation which expresses the magnitude of magnetic flux density B[T] at the position of LW2, generated by I_1[A] running in segment cd with r[m]. Using the derived equation, obtain the value of B[T] when I_1=5[A] and r=0.01[m].

Table 1

Electric current I_2[A]	Force [N]
0.0	0.0
0.5	1.2×10^{-5}
1.5	3.6×10^{-5}
2.0	3.8×10^{-5}
2.5	5.6×10^{-5}

Table 2

Distance *r* [m}	Force [N]
0.010	10.0×10^{-5}
0.015	7.0×10^{-5}
0.020	5.0×10^{-5}
0.025	4.2×10^{-5}
0.30	3.7×10^{-5}

Teaching and Learning Physics in a Cultural Context

Physics Learning Research Group, College of Education, Physics Education Department, Seoul National University

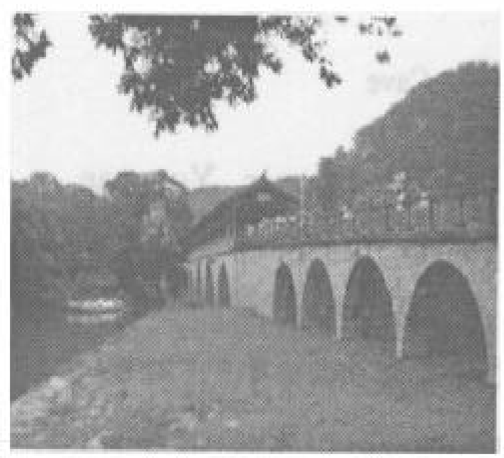
The Physics Learning Research Group from the College of Education of Seoul National University in Korea developed some questions that were presented at the International Conference of Physics Teachers and Educators, at Guilin, People's Republic of China held last August 19-23, 1999. The series of questions was part of a workshop on "Teaching and Learning Physics in a Cultural Context", and aimed to elicit the participants' comments and suggestions on how to make the questions better, and to encourage them to make their own questions that their group can ask to students at Seven Star Park in Guilin, PR China.

The questions were:

1. Floral Bridge

The bridge is about 125m long and said to have been built about 1,000 years ago.

(Q1-1) According to some guidebooks, the bridge has been destroyed every 62 years and rebuilt many times.



Floral Bridge

Can you guess the cause of this periodic collapse of the bridge?

(Q1-2)In the next figure, you can see a peculiar structure of a bridge roof. Why did they use many horizontal beams? Are they just for appearance or are they necessary to make the roof safer?

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Teaching and Learning *(Continued form page 8)*

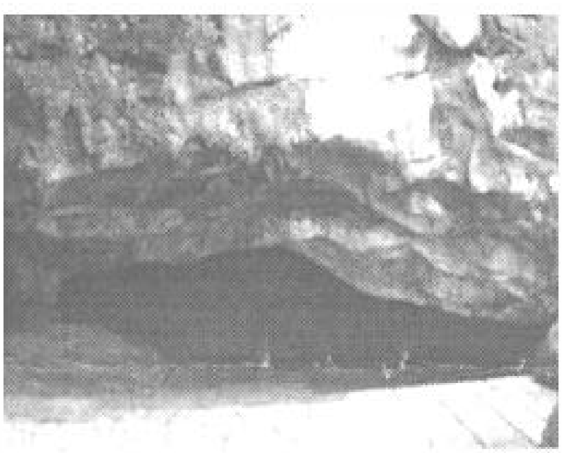
Roof Beams

2. Lament Wind Cave

The cave looks like a natural air conditioner. You can feel a cool wind in front of the cave.

(Q2-1) How does the wind come from the cave? Can you explain the cause of this cold wind?

(Q2-2) Is the speed of the wind always the same? Which factors can play an important role in determining the speed of the wind from the cave?



Lament Wind Cave

Physics in Stamps

Qin Kecheng

Physics Department, Peking University

One of the topics emphasized in the International Conference of Physics Teachers and Educators, at Guilin, People's Republic of China held last August 19-23, 1999 is enhancing interest and relevance in physics teaching and learning. One way to arouse interest in teaching and learning physics is to take into consideration the interest and hobbies of the students.

It was reported that there are 20 million stamp collectors in China, and 3.6 million are members of the Philately Association. Most of them are young people and students of schools in various levels. If interest in stamp collection can be combined with learning, we will gain much in physics teaching.

There is a lot of physics in stamps, so it would be feasible to combine physics teaching and interest in stamp collection. Stamps tell us the connection of physics with other aspects of social life and to collect them can foster good habits of learning.

Physics on Stamps

Stamps are excellent intuitive teaching material. It would be helpful if teachers encourage the students to find out the meaning of the picture on the stamps, like the ones shown below:

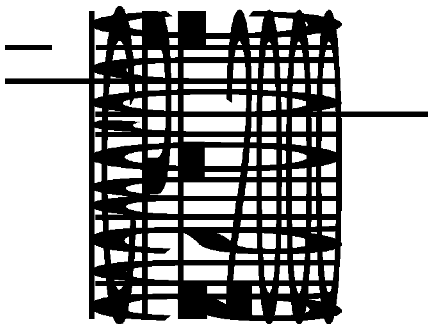
Sometimes the content of the stamp is wrong. The mistakes also help us to learn physics. On the stamps shown below, the colors of the rainbow are inverted, while the one on the right features a wattmeter, instead of an ammeter.

There are rich data and material on the history of physics on stamps. The stamp below records the tragedy of the Chernobyl Incident.

Anamorphic Images – a Combination of Art, Physics and Mathematics

Christian Ucke, Physics Department E 20/ Technical University Munich/Germany

Anamorphic images are distorted images. You all know the fun children have in museums or at fairs when they see themselves distorted in big concave or convex mirrors. There are many types of anamorphic images. Only two of these will be described here.

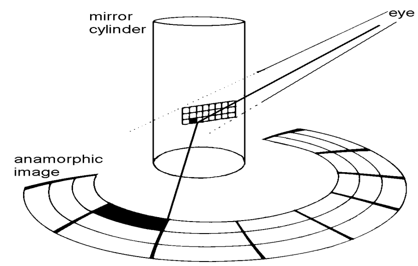


Here are some distorted words in Latin letters (made with CORELDRAW). Try to recognize what is written here. It is possible but not clear at the first look. However, if you view this image at a very shallow angle, you will recognize it. The first view reveals 'ICPE 2000' at the bottom; then the view perpendicular to the first view reveals anamorphic. This type of simple perspective anamorphic distortion can be found in many places: in paintings, wall paintings, drawings, underground stations or on the streets. This type of anamorphosis was closely related with the development of perspective in the fifteenth and sixteenth centuries. And of course you can describe this in mathematical terms as a relatively simple form of linear transformations.

The so-called cylindrical anamorphoses were not developed until quite a time later. The pictures appear correct when observed with a cylindrical mirror. Mainly artists used this form of anamorphic pictures, not only in Europe but also in Chinese culture, and they used it without thinking in physics or mathematical terms. With anamorphic images you can hide the content. If you know the trick of how to resolve the image, you can see them normally. Therefore these images have a certain magic aspect. And this is fascinating not only for children, but for adults as well.

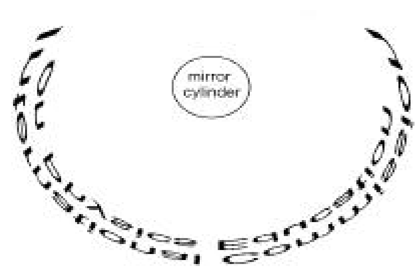
Here is a drawing which shows the basic construction of anamorphic grids. The observer is at a finite distance from the cylindrical mirror. One reflected ray is drawn in a thick line. The construction uses only the law of reflection, which means that the angle between the incident ray and the perpendicular ray to the cylinder surface must be the same as the angle between the perpendicular and the reflected ray.

With a computer you can develop new formulas to calculate any anamorphic picture pixel by pixel.



One method of calculating anamorphic images is the so-called raytracing. In raytracing anamorphic images, a virtual slide projector with the non-distorted, original image is assumed. From the eye a ray goes through the original image pixel by pixel and hits the mirror, where it is reflected and then hits the plane or another surface in a pixel. The color of the pixel is the same as in the image.

The German student Friedel Ulrich developed a program for anamorphic images with the raytracing method as a thesis in college at the German Gymnasium in Pfaffenhofen, Bavaria. The structure of his program is simple: a camera, a mirror object (cylinder, cone or sphere) and a plane can be selected and positioned. A digitalized image, e.g. from a digital camera, can be inserted. The program calculates the anamorphic image. The file ANAMORPHUENGLISH.ZIP with the program ANAENGL.EXE and a short help-file can be downloaded from the internet (URL:http://www.e20. physik.tumuenchen.de/~cucke/ftp/anamorph/ulrich/anam orphuenglish). With a Pentium 400MHz processor you need several minutes to calculate the anamorphic picture.



This example - a cylindrical anamorphosis - was calculated with this program. I have to mention that anamorphic images are normally turned upside down, which makes it even more difficult to recognize the content. Take a cylindrical mirror (easily available from chromatized syphon tubes, bended reflecting mirror foils or other sources) and view the anamorphic image. Perhaps you will have to enlarge the image with a copy machine.

Make your own very special greeting card for the next millennium either as a linear or as a cylindrical anamorphic image.

Physics Education Conferences

IUPAP Sponsored:

Physics Teachers Beyond 2000
August 27-September 1, 2000
Barcelona

- New contents for a new Physics conception in education
- Improving Physics teacher education
- New methods and tools in Physics education

Contact:
Roser Pintò
Department de Didactica de les Ciències
Universitat Autònoma de Barcelona

Santi Suriñach
Department de Fisica
Universitat Autònoma de Barcelona

VII International Conference on Physics Education
July 3-7, 2000
Porto Alegre (Gramado), Brazil

The main theme of the conference is the Preparation of Physics Majors and Physics and Physics Teachers in Contemporary Society.

Contact:
IACPE/SECTEOR/IFUFRGS
Caixa Postal 15051, Campus
CEP 91501-970 Porto Alegre, R.S. Brazil
Email: iacpe7@if.ufrgs.br

Computer and Information Technology in Physics Education
December 4-6, 2001
University of the Philippines, Quezon City, Philippines

The goal of this conference is to share experiences and research on the use of computers and information technology in teaching physics at all levels.

Contact:
The Conference Coordinator
telephone: (632) 9282621 to 25
fax: 632)9281563
email: director@ismed.upd.edu.ph

Other Conferences:

The Second Japan-China Symposium on University Physics Experiment Education
August 22-24, 2000
Waseda University, Shinjuku-ku, Tokyo, Japan

The symposium provides a forum for the exchange of information on the development of experimental physics education in colleges and universities, particularly on the teaching materials and methods used in Japan and China.

Contact:
Japanese side
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Phone: 86-(0)25-379-2870
Telefax: 86-(0)25-771 –2719
Email: zwhoo@seu.edu.cn

II Iberoamerican Workshop on University Physics Teaching
January 24, 2000
Havana University, Cuba

The main focus of this conference is to discuss common problems on Physics Teaching and to seek appropriate solutions.

Contact:
Dr. Octavio Calzadilla Amaya
Physics Faculty, Havana University
10400 Ciudad de La Havana, Cuba
email: tibero@ff.cc.uh.cu

International Conference on Science, Mathematics and Technology Literacy: Strategies for the 21st Century
Nov. 22-24, 1999
UP ISMED, Quezon City, Philippines

- To provide an international forum to exchange ideas and share experiences on strategies to promote science, mathematics and technology literacy at the basic and teacher education levels.
- To forge international links to promote science, mathematics and technology literacy.
- To propose recommendations for immediate and future actions.

Contact:
The Conference Coordinator
telephone: (632) 9282621 to 25
fax: (632)9281563
email: director@ismed.upd.edu.ph
website at http://www.ismed.upd.edu.ph/conference

Physics Education Publications

- Paul Black and Dylan William , *Inside the Blackbox – Raising Standards Through Classroom Assessment*
  Published by the College of Education,
  King's College London
  133 N. Rivers St., Wilkes-Barre, Pa 18711, London

- Art Hobson, *Physics Concepts and Connections,*
  University of Arkansas
  Published by Prentice Hall, Englewood Cliff, New Jersey, USA

- *Diwang Pisika*
  For the Advancement of Physics Teaching at All Levels in the Philippines
  Published by the UP ISMED, The Philippine Association of Physics Instructors and the Philippine Association of Physics Teachers
  E. Quirino Ave. UP Campus, Diliman, Q.C. 1101 Philippines

- *Physics Education*
  Institute of Physics Publishing, Techno House, adcliffe Way, Bristol, UK

- ICEC Newsletter
  International Communications Exchange Center
  Physics Education Society of Japan
  P.O. Box 29 Koishikawa, Tokyo, 112-8691, Japan

- Physics Education Research
  A Supplement to the American Journal of Physics
  Published by the American Association of Physics Teachers
  One Physics Ellipse, College Park, MD 20740 USA

If you want to add to the growing list of physics education publications, contact the International Commission on Physics Education Newsletter editor.

Websites on Physics Education

- International Commission on Physics Education Official Homepage
  http://www.physics.umd.edu/ripe/icpe/

  The ICPE homepage contains links to international physics organizations, relevant literature, organizational resources, Physics education people and groups, resources for teachers, and links to physics newsgroups and e-mail list, aside from the regular information pages and the IUPAP link.

- American Association of Physics Teachers
  http://www.aapt.org/
  The Official Homepage of the American Association of Teachers, this page contains useful information for physics teachers worldwide.

- The Nobel Foundation
  http://www.nobel.se/
  The official website of the Noble Foundation, which includes a page on Nobel prize winning physicists

- Palermo University IT and Physics education Website
  http://www.unipa.it

  This page contains online courses for physics teachers.

- Physics Link
  http://www.physlink.com/

  A comprehensive guide to physics on the Internet

- Physics 2000
  http://www.Colorado.EDU/physics/2000/

  An interactive website on modern physics

What I'm going to tell you is what we teach our physics students in the third or year of graduate school…
It is my task to convince you not to turn away because you don't understand it…. You see my physics students don't understand it … that is because I don't understand it. Nobody does.

- Richard P. Feynman, QED, The Strange Story of Light and Matter , Penguin Books, London

To apply for IUPAP sponsorship for a physics education conference, fill in this form and submit to the chair of International Commission on Physics Education at least a year before the proposed schedule.

INTERNATIONAL UNION OF PURE AND APPLIED PHYSICS
APPLICATION FOR SPOSORSHIP OF AN INTERNATIONAL MEETING

Name of IUPAP-Commission ICPE

1. **TITLE OF CONFERENCE** ____________________

Location ____________________ Date ____________________
Organizer or Secretary: Name____________________ Signature ____________________
Address ____________________
Phone ____________________ Fax ____________________
E-mail ____________________
World Wide Web URL (if available) ____________________

Type of Conference: General ☐ Topical ☐ Special ☐ *Number of Participants expected* _____

2. **NATURE OF CONFERENCE**
   a) *Ongoing series*: describe below briefly the scope of the conference, and attach a program and a list of speakers from one or more conferences. **OR**
   b) *New conference*: Bearing in mind that the proliferation of conferences is of general concern, describe below the particular reason for holding this conference.

____
____

(*continue this answer and any other answer on a separate sheet, as needed)*

   c) IUPAP policy call for adequate representation of applied aspects wherever appropriate, and – at general conferences – the encouragement of a Public Lecture. Indicate how this conference can be responsive to these concerns.

3. **INTERNATIONAL CHARACTER:** To qualify for IUPAP sponsorship:

   a) The meeting must be open to scientists regardless of nationality and citizenship. List below the name and address of the official who will be responsible for assuring that the host country fulfills its obligation, and discuss any potential problems that you know of at this time.

____
____

   b) The scientific advisory program ***must be international*** in character. List below three members of the Committee from three different nations.

____
____

   b) At least 30% of the attendees must be from outside the host country
   c) If the conference is by invitation, potential contributors from all IUPAP member countries must be eligible
   (Discuss on a separate sheet any unusual circumstance in fulfilling parts C and D)

4. **ORGANIZATION**

If you know of any potential conflicts with other conferences, please describe them on a separate sheet.

Has this conference the support of the Liaison Committee of the host country? Yes ☐ No ☐
Estimated total budget $_____________
Is there a registration fee? Yes ☐ No ☐ Amount __________
Is an IUPAP grant requested? Yes ☐ No ☐ Amount ___________

The International Newsletter on Physics Education is a publication of the International Commission on Physics Education and is produced twice a year. For comments, questions, or to be added to or deleted from the mailing list, please contact the editor:

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