International Newsletter on Physics Education

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

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# Resolution on the Role of Women in Physics Drafted

Believing that it is important to physics to bring more women into its mainstream and leadership, the members of the International Union of Pure and Applied Physics (IUPAP) endorsed the resolutions adopted unanimously by the first International Conference on Women in Physics held on March 7-9, 2002 at Paris, France.

Over 300 physicists from 65 countries attended the conference. The conferees examined the issues in depth and generated a set of resolutions aimed at establishing fully equal opportunity for success in physics independent of gender.

Specifically, IUPAP resolved that:

1. ***Primary and Secondary Schools*** should have policies and procedures that give the same opportunities and encouragement to the study of physics by girls and boys.
2. ***Colleges and Universities*** should:
   a. ensure that their policies and procedures give female and male students equal opportunities for success, and
   b. ensure that their policies and procedures are such that female and male faculty and staff are, through transparent policies, treated equally with respect to recruitment, promotion, teaching schedules, research facilities, and roles in governance.
3. ***Research Institutes and Industry*** should ensure that policies are adopted and enforced regarding gender equity in recruitment and promotion to all levels.
4. ***Scientific and Professional Societies*** should foster gender equity by having an identified group examining policies and procedures, making available statistics on the

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## In this issue



# 3rd China-Japan Symposium on University Physics Experiment Education

The International Information Exchange Center on Physics Education (CPE), and the Chinese Physics Society hosted the 3rd China-Japan Symposium of University Physics Experiment Education on August 20-24, 2002 at Southeast University, Nanjing, P.R. China.

The conference aims to keep pace with scientific and technological development and to discuss and exchange experiences on cultivating 21st century's talents.

Activities included public lectures, plenary talks, workshops, and visiting to physics laboratories.

The conference main topics were:

1. Establishing and reforming the experimental contents and experimental means of unversity physics education in

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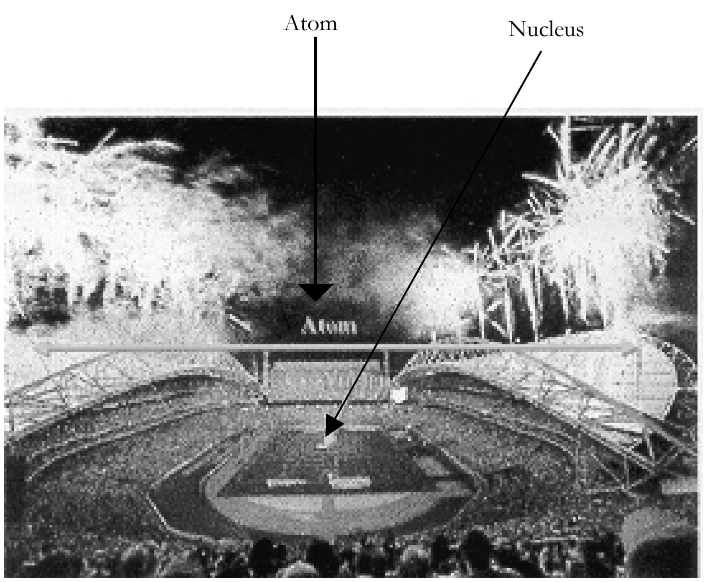
# Physics and Peacekeeping*

by M. N. Thompson and R. P. Rassool#
*School of Physics University of Melbourne, Australia*

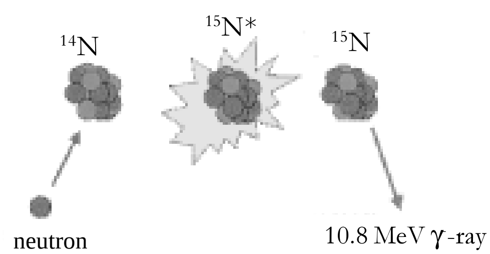
## The Nucleus and the Neutron

All the examples given here involve the detection of the element nitrogen using the technique of Thermal-Neutron Capture (TNC) by the dominant (99.6%) stable isotope of nitrogen ($^{14}$N). Discussing the nuclear process of TNC offers the opportunity to discuss the nuclear model of the atom, the minute size of the nucleus ($10^{-14}$ m) compared to the atom ($10^{-10}$ m)-a fact not evident in most illustrations in textbooks.



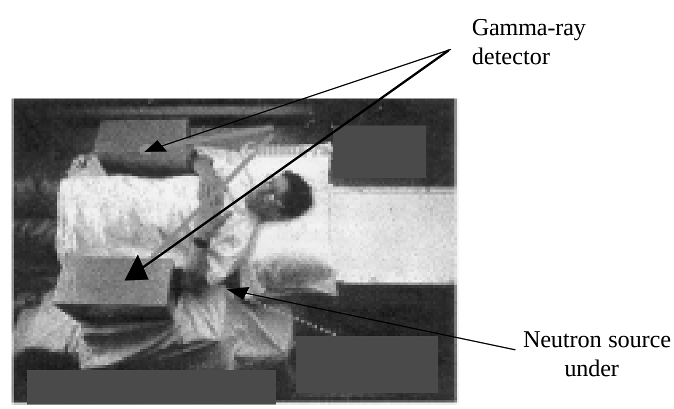

If the atom were the size of the Sydney Olympic stadium, the nucleus would be a pea at its centre.

When the nucleus of $^{14}$N, which has 7 protons and 7 neutrons, absorbs an extra neutron, it forms the isotope $^{15}$N, which is unstable and instantly decays by emitting a gamma-ray of energy of 10.8 MeV, which is a unique signature for the presence of nitrogen. The probability of the neutron being absorbed by a $^{14}$N nucleus is increased dramatically if the neutron is moving slowly. This process of "moderation" involves successive scattering of the neutron of light nuclei (preferably hydrogen, where a single head-on collision will stop the neutron). This process can provide a contemporary example for a simple 2-body elastic-scattering problem for students.




## Measuring the Protein in the Human Body

In many medical situations it is important to be able to accurately measure the protein content of the body. Common methods are somewhat inaccurate, or involve invasive procedures. As it happens, protein is the only compound in the body that contains nitrogen, thus a measure of the nitrogen in the body gives a measure of the protein. The requirements are a source of neutrons (provided by a small sample of $^{252}$Cf, that spontaneously fissions releasing energetic neutrons. These are slowed down by collisions with protons in the body-water, and absorbed by the nitrogen in the protein. Two detectors measure the number of nitrogen gamma-rays emitted, and within the required statistical accuracy, the body protein can be estimated in 10 minutes.




Protein measurement

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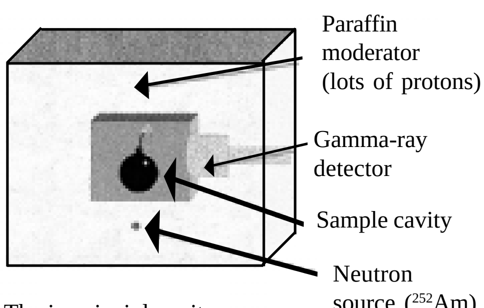
* This is an abridged version of an invited paper presented at the GIREP-ICPE conference held at Lund, Aug. 5-9, 2002.

# Drs. Thompson and Rassool are researchers in the field of photonuclear reactions and nuclear applications at the School of Physics of the University of Melbourne. http://www.ph.unimelb.edu.au/photo/

## Explosives Detection

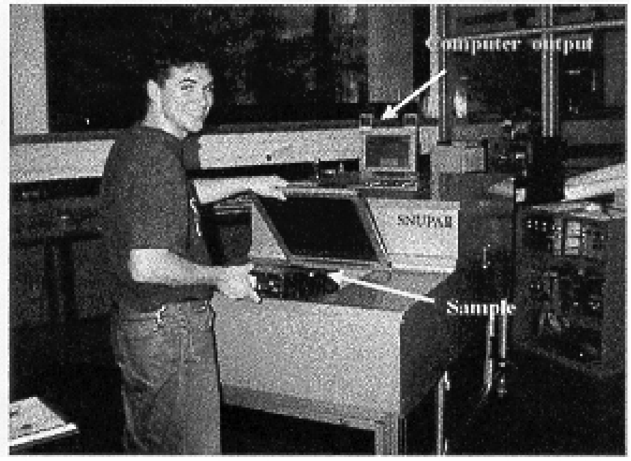
A few years ago a parcel bomb killed a federal police officer in Australia. Such an event was so atypical for Australia that it made major headlines. The authority concerned claimed in the press that there was no way to detect if a parcel contained explosive. Most mail scanners use metal detection as a trigger, or x-ray scanning. However, neither of these probes identify the presence of explosive; simply these ancillary components. We however knew that all stable explosives contain nitrogen: up to 40% by weight. We therefore, determined that we would develop our TNC technology to provide a sensitive, automatic parcel-bomb detection unit.

In principle, the unit is simple. One needs a source of neutrons (in our case a small amount of the transuranic element californium ($^{252}$Cf) which spontaneously fissions with the emission of several fast neutrons), these neutrons must be slowed down, so the unit has a large amount of hydrogenous moderating material. One needs a sample cavity through which a high flux of these neutrons are passing through, so that when the sample is present, neutron capture by the $^{14}$N will occur. The emission of the characteristic 10.8-MeV gamma rays are detected by detectors placed around the cavity.




The in-principle unit

Development from this in-principle unit of a fast, reliable, and sensitive parcel-bomb detector suitable for use in situations such as larger offices, government departments, and embassies was a challenge. This unit must require no operator intervention, and should unambiguously and automatically report the safety of the mail on the basis of the amount of nitrogen detected. Slow-Neutron Universal Parcel Analyser (SNUPA), result is shown in the figure. Mail is loaded into the tray, and in 30 seconds is scanned for amounts of explosive as small as 50g. The computer control returns the mail if all is safe, or alerts the operator to the possible threat. The technology has been licensed to an Australian company for commercialisation.




The SNUPA parcel-bomb detector

Following September 11, the use of x-ray scanning of carry-on luggage may be less than satisfactory. The interpretation of the x-ray images is entirely operator dependent, and it is unable to specifically target the presence of explosive material. Operators look for ancillary clues such as batteries and detonators, but the reality is that such items no longer need to be made of dense material such as metals, and may escape detection. Currently we are developing a version of SNUPA capable of rapidly scanning hand baggage at airport security. A longer-term aim is to extend this technology to the scanning of stowed luggage and airfreight.

## Antipersonnel Landmine Detection

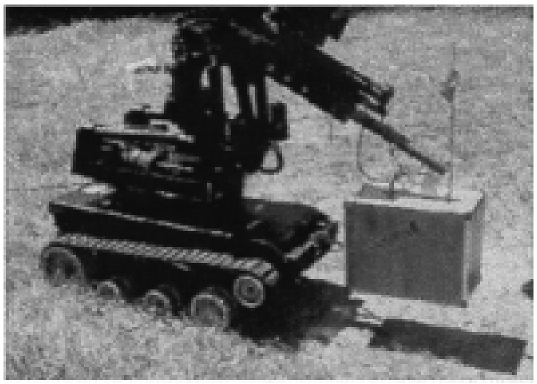
Immeasurable human misery and agricultural disruption are but two of the consequences of the scourge of anti-personnel landmines that remain in many countries throughout the world. United Nations sources put the number of unexploded landmines at 70 million in 64 countries, which maim or kill 26,000 people each year.

Current clearing methods rely on metal detection, probing, and trained dogs; they are slow, expensive and dangerous. Modern antipersonnel landmines contain little or no metal; consequently the sensitivity of metal detectors has to be set very high, so that on the average, of every thousand indications, only one is a landmine. However each indication must be physically probed to determine its nature involving significant risk and time.

We have already developed a proof-of-principle system, shown in the figure, which is transportable, and is capable

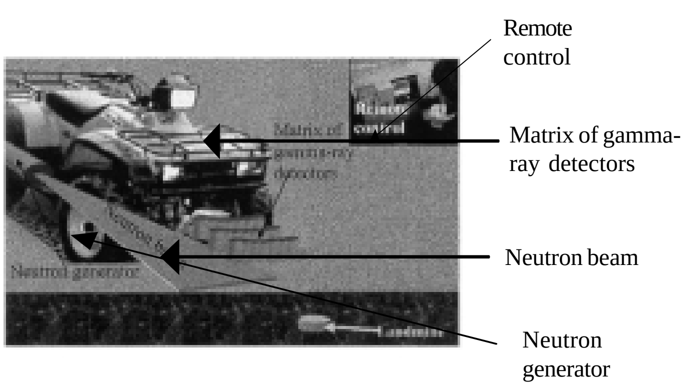
*See* next page

of detecting the presence of an antitank landmine in 30 seconds. However antitank landmines contain several kilogram of explosive, while an antipersonnel landmine may have as little as 50 g, and this may be 20 cm under the ground.



The proof-of-principle landmine detector

An ideal landmine detection system would search for the presence of the explosive itself, rather than the presence of metal. It should move with relative rapidity over the terrain, producing a subsurface map indicating the location of the landmine, alert the operator, and record its exact position via a GPS system allowing later disposal. We believe that the TNC technology used in SNUPA can be developed to provide such a system.




Concept of remotely controlled, efficient antipersonnel landmine detector system

To create the ideal antipersonnel landmine detector, significant development (and associated cost) is involved. Many and more neutrons will be required. This means that we can no longer use a fission isotope ($^{252}$Cf) as the neutron source, and plan to use a small neutron generator that for safety reasons can be turned on and off as required. The neutrons from this unit need to be "focused" to direct as many as possible into the ground. The single gamma-ray detector will be replaced with a matrix of detectors, similar to the geometry used in a "gamma camera" used in medical applications. Sophisticated computer software will be developed so that the operator will be presented with a sub-surface map of the region below the detectors that reveals the landmine location. Finally, the unit will need to be transported by a remotely controlled vehicle. Obtaining funding for this major research program is difficult, since its commercial return is small.

Although the study of nuclear physics at senior high school, and first-year university is not at depth, we feel that the applications outlined above might prove useful in providing some contexts that appeal to students.

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**3rd CHINA-JAPAN** (Continued from Page 1)

conformity with scientific and technological development trends of the 21st century, application of computer to physics education, physics experiment teaching and other relevant subjects.

2. University teaching by demonstration and multimedia and on integration of theoretical teaching and experiment (including teaching materials, reference books, C.A.I. etc.) and study on application of multimedia technology to physics experiment teaching;
3. Citing of advance knowledge of science and technology to university education of physics experiment and specific means and combination of university teaching and school teaching of physics experiment.
4. Integration of theoretical courses and experiment, effect and status of physics experiment teaching in developing creative consciousness, creative thought, and creative ability of university students.
5. Issues relevant to imitative experiment in long distance teaching.

## 24th IUPAP General Assembly in Berlin

The IUPAP held its 24th General Assembly in Berlin. New members and officers of all IUPAP Commissions have been elected for the year 2003 to 2005.

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# Art and Physics: A Meeting Point of Two Cultures*

by Dorothy Sebestyen
*Budapest Polytechnic, Budapest, Hungary*

## Art and Reality

In the print called "Belvedere," created by M.C. Escher, a ladder begins inside and ends outside a building but can still be climbed normally. A man and a woman are looking out through two openings in the same wall, one directly above the other, although the man is looking away from and the woman, toward us.

The main message of this print is the *impossible reality*, coming from the *correctly depicted details*. It warns physics teachers that in order to give a correct overview of the real world, they should not make a similar mistake. It says to us that we also have to open our students' mind to the *relationships* between the chapters of physics besides teaching the separate chapters; otherwise the students will have a false image about the realities of the world.

More generally, our final aim must be to help our students gain possession of an overview not only of physics, but also of the whole culture. On the way to reach this aim, and at the same time making physics more interesting and understandable, I try to find the meeting points of the so called "two cultures," between physics and art, history, or music.

The topic of this presentation is to show some ideas on how to create a connection between physics and art. I have classified the collected examples in three groups, expressing three aspects.

## I. Works of art, as hypothetical models, visual, didactic explanations, or illustrations of an abstract theory in physics

### 1. Examples disobeying physical laws

#### Perpetuum mobile

Escher's print, the *"Waterfall,"* is used in several physics textbooks as an illustration of the impossible perpetual motion. There is an impossible waterfall that feeds itself. *"The regular gravity affects the moving water, but the nature of space disobeys the laws of physics." (Hofstadter)*[1]

#### Impossibility in a conservative field

At the first glance, Escher's print *"Ascending and descending"* seems to be a realistic depiction of a building and some monks. But as we know, there must be a mistake somewhere in a continuously descending, or ascending staircase, if it creates a closed curve.

This can be a good illustration of an impossible case when we teach the characteristics of the gravitational potential, or the potential in an electrostatic field.

The artist's own comment reflects his humour as well: "The inhabitants of these living quarters would appear to be monks, adherents of some unknown sect. Perhaps it is their ritual duty to climb those stairs for a few hours each day. It would seem that when they get tired they are allowed to turn about and go downstairs instead of up. Yet both directions, though not without meaning, are equally useless. Two recalcitrant individuals refuse, for the time being, to take any part in this exercise." [2]

#### Frame of reference

In the "Gallery," Escher depicts an impossible juxtaposition of viewpoints, showing an infinite extent at the same time and making the habitual application of the frame of reference unacceptable.

#### Perspective illusion

Several illogical details are presented with a touch of humour in Hogarth's "Absurd perspectives" by consciously breaking the rules of perspective.

In Magritte's painting, "Carte Blanche," we also come across a physical impossibility: The different planes of space are confused; the Lady is riding in the foreground and the background at the same time.

### 2. Structure of matter

The regular division of a plane and the symmetry make Escher's works known as illustrations of crystallographic chapters. The "Sky and Water" can be used to illustrate this

*See* next page

* Paper presented at the GIREP-ICPE conference held at Lund, August 5-9, 2002.

problem: "In the structure of a crystal, what is of greater physical importance, the atoms, or the spaces between the atoms?"

The base of this application can be found in Escher's words about this work: "In the horizontal central strip there are birds and fish equivalent to each other. We associate flying things with sky, and so for each of the black birds the sky in which it is flying is formed by the four white fish that encircle it. Similarly, swimming makes us think of water, and therefore, the four black birds that surround a fish become the water in which it swims."[2]

**3. Expanding universe**

Martin Rees uses in one of his books, Escher's works as models to explain the essence of the expanding Universe.

According to his comments on the print "Cubic Space Division" if the rods of the lattice are extending at the same rate, the nodes are moving away from one another due to Hubble's law, but there is no preferred node and there is no centre of expansion.

In the very far past, the Universe was probably in a much more pressed form, as we can see it today, approaching the horizon due to the finite speed of light. This is illustrated by the "Angels and devils."

## II. Physical laws, as forms of expression for artists or as bases of technical tools to create works of art or to make them enjoyable

**1. Optics**

**Mirror effect**

We can find a lot of works of art using the reflection made by mirrors.

The convex mirror in Jan van Eyck's painting, "The Arnolfini Marriage," makes it possible to show the total view of the room and the persons in it.

The example of the optical effect as form of expression is seen in which Magritte's "False mirror," which illustrates an Austrian physics textbook.

**"Anamorphic" works**

The optical illusion of anamorphosis means a distorted picture, which, without distortion, can only be seen from a special angle or in a cylindrical reflecting surface. The example of the first case can be Holbein's painting, *"The Ambassadors."* The skull on the floor is recognizable only from a special angle.

The example of the second case can be seen in Dali's works, as the next two pictures show. *"The female nude"* and *"Harlequin"* can be discovered in these pictures by using a cylindrical mirror.

**Holography**

In the Dali Museum we can see Dali's first 3 dimensional collage, *"on whose technical aspects the Hungarian physicist Dennis Gabor, the father of holography, worked together with Dali."* I - being a Hungarian - read it proudly in the book of the Museum. [7]

**Camera obscure**

A special type of the camera obscure, invented by Kepler, was probably used by Canaletto to create his paintings about Venice.

**Painting with dots**

Seurat's paintings consist of countless tiny, colourful dots. It reminds me of how a *photo emerges from individual photon impacts.*

## III. Works of arts as models of the process of recognition and scientific thinking

**1. Model of scientific thinking**

Escher's print *"Day and Night"* can be the model of scientific thinking. Here we can see the progression of polders into the diamonds and, coming back to the real world at a higher level, the diamonds into the birds. This is similar to the two-way movement from the experimental observation to the abstract theory and, at the other level, by experimentally checking the theory, back to the real world.

**2. Subjectivity in scientific thinking**

The subjective element plays an important role in Vasarely's work, *"Gestalt". The eye is able to change the protrusive figures and the elements turn up as concave figures.*

Extending this thought, we can illustrate the subjectivity inherent in observation, measurement, and interpretation.

*To find meeting points between physics and art, here we saw examples to show that some works of art can illustrate the theories of physics, that some of them can be models of the process of scientific thinking, and that sometimes physical laws can help to create works of art or to make them enjoyable.*

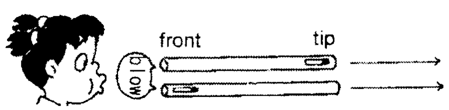
*See* ART AND PHYSICS, Page 12

# Mechanics Demonstrated with the Use of Darts

by Koji Tsukamoto*, Kiyonobu Itakura,
and Mokoto Kano*
*Tokyo University of Science, Japan

## Problem 1

There is a straw and a matchstick. A blowgun is made by putting the matchstick into the hole of this straw. Question is asked which do you think will fly farther when the matchstick is put in at the tip of the straw, or when it is put at the front of the straw?




A. The matchstick at the tip of the straw flies farther.

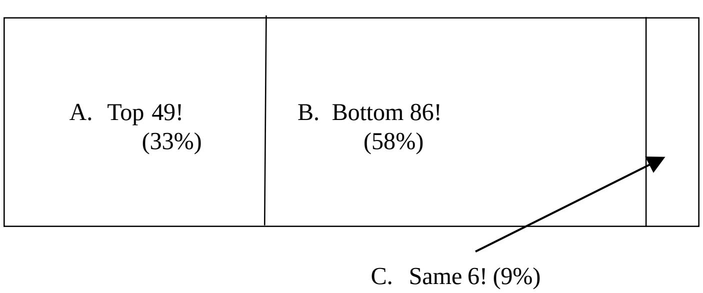
B. The matchstick at the front of the straw flies farther.

C. Both fly almost the same distance.

At first impression this problem seems a somewhat rough experiment. However, in spite of this perceived roughness, the same result can be obtained, whenever we do this experiment. This roughness therefore, becomes a positive factor instead of a negative factor as consistent results coming from such a rough experiment are very impressive. Some people mistakenly assume that an experiment must use a precise machine. However, it will be better if the judgement of anticipation is determined by using simple experiment equipment rather than by using complicated equipment.

If it can be shown clearly which anticipated result is right, then a bold experiment which does not care about minor errors is more effective.

The anticipated results to this problem by physics students were as follows:




Even if anybody performs this experiment at any number of times, option B i.e., a matchstick put into the front, flies farther than the one put into the tip.

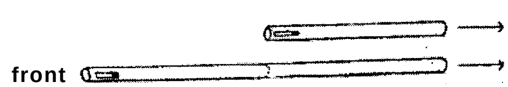
About 30 percent of the students answer A a matchstick put into the tip flies farther mainly because they too worried about resistance. Since they immediately thought about the problem of air resistance, instead of the force of the breath, they became overly concerned about the effect of friction with the wall of the straw. One student wrote:

> **On the problem of darts, I worried about the friction, so I thought that a matchstick placed at the tip would fly to a longer distance. But as a result of the experiment, the one which was placed at the front flew farther. After seeing this result, I knew the one which reacted to a longer period of force would have higher velocity.**
>
> **Trying to guess the result of experiment can make a lesson interesting.** (K.I. 5)

Although this student guessed incorrectly, he realized, based on this experiment result, that impulse (product of force and time) determines the velocity of the matchstick.

## Problem 2

Next, a matchstick will be put into the front of a straw of double length, and will be blown out. Which do you think will fly farther -a dart from a single straw or a dart from a double length straw?




A. In the case of 2 straws, the matchstick will fly farther.

B. In the case of 2 straws, the match stick will fly a shorter distance.

C. Both are almost the same.

* Paper presented at the 3rd China-Japan Symposium on University Physics Experiment Education held at China, August 20-24, 2002.

*See* next page

The anticipation analysis of physics students was as follows:

| | | |
|---|---|---|
| A. In the case of 2 straws the matchstick will fly farther 125!(85%) | | |

B. In the case of 2 straws it will fly to a lesser distance 15!(10%)

C. The same 8!(5%)

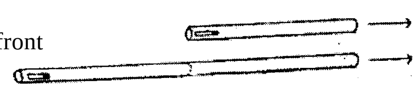
It is admirable that the physics students' percentage of correct answers increased. Only 58% students answered problem 1 correctly but in this problem, 85% students observed *impulse*. Saying that, was such a problem too easy for them?

No. When we did this experiment, a matchstick from two straws ¾ flies farther (option A), as most students expected. However, when it flew to such a long distance -much farther than students expected - they raised a cheer in surprise, proving they were not 100% sure of the result. In an ordinary type of lesson, we do not delve so deep into the problem. However, in the H-E method, we do the same type of problem repeatedly until about 100% of students answer correctly.

## Problem 3

If you put a matchstick into a straw that is 4 times longer and you discharge the matchstick from this straw by blowing it, will it fly at a higher velocity than when it is discharged from straw that is only 2 times longer?

front



A. It will fly at a higher velocity from a straw 4 times longer.

B. It will fly at a higher velocity from a straw 2 times longer.

C. Both will fly at the same velocity.

Does the velocity of a matchstick become faster as a straw's length becomes longer? The anticipation of students was as follows:

| | | |
|---|---|---|
| A. It will fly at a higher velocity from a straw 4 times longer 102! (69%) | B. 2 times longer 23! (16%) | C. The same 23! (16%) |

This time, the number of students who thought that its velocity would be slower if the straw was longer, increased a little. Theoretically, as a pipe is lengthened, it does not necessarily acquire unlimited velocity potential. When the breath which pushes a dart stops, the limit is reached. However, since a straw is very thin, and even though about ten are still connected, the breath continues. Actually, in the case of schoolchildren and junior high school students, the percentage of correct answers increases in these experiments, even though the first percentage of correct answers is low. However, University students tend to overcomplicate the problems.

When they see such kinds of similar experiments, they suspect that this problem changes each time, erroneously viewing them as preparation of examinations, instead of as basic physics knowledge.

If this experiment is executed, the dart will actually fly to a much longer distance. So, next we use an even longer tube.

## Problem 4

If we connect eight straws and twist a scotch tape around each joint, it will become difficult to support horizontally because of the softness of straws.

So, we searched for a firm but thin pipe like a straw and found a firm pipe with a length about 5 times of a straw length [1m]. If we connect two of these pipes and blow the matchstick, what is the matchstick's velocity?

A. A pipe which is 10 times the length of a straw that makes a higher velocity.

B. A pipe which is 4 times the length of a straw makes a higher velocity.

C. Both are the same.

| | | | |
|---|---|---|---|
| A. 10 straws makes a higher velocity 83!(56%) | B. 4 makes higher 34! (23%) | C. The same 29! (20%) | |

Other 2! (1%)

In the case of the University students, the number of students who think lengths can make a higher velocity decreases significantly to just over half.

However, if we do this experiment, the dart from the ten length straw is discharged at phenomenal velocity. This result is surprising, even if the anticipation is correct, because the dart discharges much faster than most students expected. If we hang down a sheet of newspaper in front of this ten length pipe, the dart is so fast that it will penetrate it easily. It is very remarkable that we can discover by such a simple experiment

*See* next page

(made by straws and matchsticks) that with increasing impulse (Force × time), the velocity of the dart will also increase.

**Today's mechanics education is still dominated with the view of Aristotelian mechanics.**

As to why University students' percentage of correct answers decreases as straws become longer, we should read the following students' comments.

**It was very interesting. Although I thought that the limit would be reached due to friction as the tube's length increased ten-fold, I was surprised that there was no limit. If we could see the motion of the matchstick, if it is painted by fluorescent paint, it would be much better.**

**And I want to do [Problem 5] by myself. I'm still not convinced only by looking at the demonstration. (W.A. 5)**

**Since I was concerned with the effect of resistance or friction, I was not able to answer correctly. (Y.A. 5)**

Since I am studying physics, I tended to care too much about the effects of air resistance and friction.

On [Problem 1], I chose "B" because I simply thought that both were the same when they fell from a level of 1m. I thought that the velocity of the dart would increase as the length of the airway increased. Namely, that the initial velocity from the far end of the tube would increase. However, I thought that if the length of the straw reaches about 10m, that it would be too long for the blowing to continue.

*I felt this experiment was very interesting and amazing but I couldn't see how far the matchstick actually flew. (I.F. 4)*

*I could anticipate that the distance of the flying matchstick increased as the length of blowgun increased. However, since I cared about the influence of friction, of a leak of air at the joint and of even the limitations of actual lung capacity. I didn't think the dart would fly so far, but the experiment proved my opinion that the flight distance increased as the length of the tube increased. (R.Y. 4)*

*It is natural to think that if the straw length is extended, the dart will fly at a higher velocity because the impulse is increasing. However, as I worried about the friction, I wondered if the theory was flawed. If we use some kind of pipe that is not straw, which definitely incorporates driction, then I think this experiment will become more interesting. (F.Y. 4)*

*In spite of my understanding of physics' principles, I couldn't choose the right answer with only a understanding of basic principles, it is difficult to understand the actual phenomenon completely. To truly comprehend the phenomenon, I feel it is most important to actually do the experiment. (S.T. 4)*

Students worried about friction so much that they presumed that the velocity limit set by the Laws of Motion would come sooner than it actually could.

By the way, how about ordinary school children, junior high school students, and high school students? We have 20 data records of this lesson in elementary school, junior high school and high school. Now let's look at the typical data of each school category.

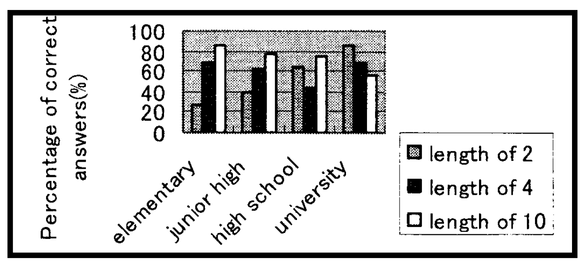
Percentage of correct answers

| | elementary school | junior high school | high school | university |
|---|---|---|---|---|
| length of two | 28% | 39% | 65% | 85% |
| length of four | 68% | 62% | 43% | 69% |
| length of 10 | 85% | 77% | 75% | 56% |

**Elementary school:** Fujimoto Kiyomi 6-1 class Suenari-sho (Hyougo, 2000)

**Junior-high school:** Naka Emiko 3-1 class Shibusawa-chu (Kanagawa, 2000)

**High school:** Satou Shigenori 2nd grade of Information Technology in Okayama Technology High School (Okayama, 2000)




Seeing this result, the percentage of right answers for physics students is highest on the problem of two lengths, and the longer the straw, the more the percentage decreases. On the other hand, in elementary or junior high, the percentage of right answers increases as the straw lengthens. In high school, although the percentage decreases on the problem of four lengths, it finally improves. It is evident that physics students are too worried about the effects of friction.

However, if we do these experiments, the dart's velocity changes significantly with the length of the tube, the influence of air resistance or friction having no relevance.

For these experiments, some people say "We don't know how influential air resistance or tube friction actually is. So it is quite natural that many university students didn't answer correctly." However, as we already mentioned, the velocity

*See* next page

of darts increases, as long as the breath continues. Its acceleration overcomes the effects of friction inside the straw – rendering any possible friction irrelevant.

In Asia and South America, people have captured small animals such as monkeys by using blowguns since antiquity. The length of the blowtube they used reaches 4~5m. The bore of the blowtube is larger than of a straw but in spite of this, they can blow darts very effectively.

The habit of thinking about resistance before thinking about impulse is just old-fashioned Aristotelian style thought; it is not 'classical mechanics.' The students who study physics in the university are chained to the view of Aristotle's mechanics, so they cannot think about mechanics intuitively or instinctively anymore.

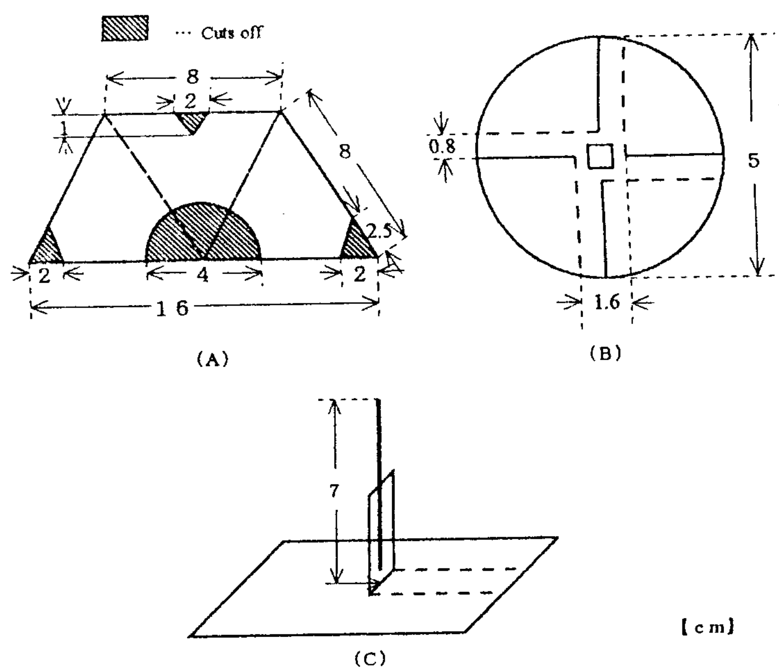
We can say that university students have studied classical mechanics extensively, and yet they cannot even answer such an essential problem correctly. They were good at physics in junior high or in high school so they should be excellent students. They can solve mathematical problems with ease. But this hides the fact that the more they are "excellent" in physics, the more they are under the influence of Aristotle's mechanics. This illustrates the problems within today's education of mechanics very well.

# Thermal Radiation Meter

by Masazumi, Mori Tadotsu
*Municipal Tadotsu Elementary School, Kagawa, Japan*
*Kagawa University Department of Education Graduate School*

**Procedure:**

1. Cut the black drawing paper into a triangular shape. This will function as the absorber of the meter. ... (A)
2. Have another light paper of any kind, cut it in a ball shape and paste a ballpoint size of an aluminum tape at the center. This will serve as the propeller. ... (B)
3. A long needle fix in a slightly hard board/ paper will support the paper propeller. ... (C)
4. Make use of the transparent or clear plastic cup to cover the set-up. (You can try using your hands to facilitate the heat transfer.) Place it outside directly stricken with the sunrays.




Source: The textbook of High School Physics 1A of the Keirinkan Publication, Japan.

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**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

**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

**E. F. Redish**
Department of Physics
University of Maryland
College Park, MD 20742-4111
USA
Fax: (1-301) 314-9531
redish@physics.umd.edu

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

**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

**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

**Minella Alarcon**
UNESCO Regional Office for Science and Technology for South East Asia, JI. MH Thamrin 14, Jakarta, 10002
INDONESIA
m.alarcon@unesco.org

**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@einsteinismed.upd.edu.ph

**24th IUPAP** (*Continued from* Page 4)

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**RESOLUTION** (Continued from Page 1)

participation of women in physics at all levels, identifying leading women physicists and promoting them as role models, including women on program committees and as speakers at meetings and conferences, and including women in society governance.

5. ***National Governments*** should ensure that women have the same access and opportunity as men in research and in advanced teaching, that women are included in national planning and review committees, and that funds are awarded only to organizations that have policies of gender equality.

6. ***Funding Agencies*** should ensure that there is no gender bias in the grant-funding process, that all competitions are open and widely publicized, that criteria for funding are clear, and that women are included in review and decision making committees. Limits on age of eligibility or grant duration that seriously disadvantage applicants taking family leave should be reconsidered. Statistics should be made available giving by gender the proportion of successful applicants.

IUPAP further resolved that Liaison Committees will transmit the report of the Conference on Women in Physics and the above resolution to their Adhering Bodies, and that the Secretariat will transmit it to other Scientific Unions and International Organizations. Further, the proceedings of the International Conference on Women in Physics should be made known and widely available.

The General Assembly recommends that Adhering Bodies appoint women to Liaison Committees, that gender be a consideration in nominations to Commissions and the Council, and that IUPAP-sponsored conferences be required to have women as members of their program committees.

**ART AND PHYSICS** (Continued from Page 6)

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



*Editor:*
**Vivien M. Talisayon**
***University of the Philippines***
***National Institute for Science and Mathematics Education Development (UP NISMED)***
*E. Quirino Avenue, UP Diliman 1101*
*Quezon City, 1101*
*Philippines*
*Fax: (632) 928-2625*
*E-mail: vmt@ismed.upd.edu.ph*
*Assistant Editor:* Gunnar Tibell

*Editorial Assistant:* Ginette Nolasco-Almaden
*Design & Layout:* Rosita R. Cruz, Ginette Nolasco-Almaden and John Jerry Maramag



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