INTERNATIONAL YOUNG PHYSICISTS' TOURNAMENT, 2004

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It all started in Russia around two decades ago. As a reward, Russia is the only country, apart from the host, permitted to enter two teams in the tournament. The International Young Physicists' Tournament (IYPT) has now grown from its beginnings in Eastern Europe to be a truly global competition. In 2004, in Brisbane, twenty-six teams from twenty-four countries and six continents met for the tournament. There would have been two more but for Immigration difficulties that prevented teams from Nigeria and Georgia from attending.

Poland was the champion in 2004, defeating the teams from Germany and Slovakia in the final. Australia 1 came in at a creditable eleventh and Australia 2, consisting of Year 11 students, managed an encouraging nineteenth. Other teams in the top ten were Russia 1, Korea, Indonesia, Switzerland, Bulgaria, Hungary and Austria.

How it works

The IYPT is a competition designed for senior high school students. Someone has described it as 'Tournament of the Minds meets Physics Olympiad'. While it does have elements of both of these events, it is much more.

Teams can consist of up to five students, with a minimum of three. Each team receives the list of seventeen problems for the tournament about six months before the event. They then spend all of their spare time – and one suspects some of their core time – theorising and experimenting to prepare solutions. Why seventeen problems? According to Professor Dr Valentin Lobyshev from Moscow State University, the creators of the tournament decided that sixteen problems were not enough while eighteen were too many! The problems for IYPT 2004 are listed at the end of this article.

The tournament consists of five preliminary rounds and a final. Each contest or physics "fight" takes place between three teams who take on the roles of Reporter, Opponent and Reviewer in turn. A fight commences with the Opponent challenging the Reporter to present their solution to a particular problem. The Reporter can accept or decline. During the preliminary rounds, a team can decline a maximum of three times before penalties are invoked. A team cannot report on the same problem more than once.

Once the Reporting team has accepted a challenge, they have a fixed time to prepare their presentation which is given by a single member of the team, again within a fixed time. It is then the Opponent's turn. During their time allowance, they can ask clarifying questions followed by one member delivering a critique of the report. This is followed by a "discussion" between the representative of the Reporter and that of the Opponent. Some of the discussions were vigorous to say the least!

IYPT 2004 champions: Poland

It is then the Reviewer's turn to ask clarifying questions of the Reporter and the Opponent before presenting a critical review of their performance and the physics. The presenter from the Reporter has the last say with a two-minute wrap up.

Judging the efforts

Each fight is judged by a panel of physicists, teachers and the odd engineer. In Brisbane, each panel had six members. At the conclusion of the fight, panel members are able to ask questions of the participants. Then they allocate a mark out of ten to each. The highest and lowest scores are discarded and the four remaining averaged. The score for the reporter is weighted by three (unless penalties for too many refusals have been invoked) and the Opponent's mark by two. The three rotations in each fight takes about three hours. The maximum score a team can receive from a fight is sixty, and an indication of the quality of the participants at Brisbane is that all teams but three averaged greater than forty marks per fight and one, the German team, averaged in excess of fifty.

Each team was accompanied by one or two Team Leaders who were responsible for the preparation of their charges as well as providing support and encouragement. Some Team Leaders served on the jury panels which didn't involve their team. In addition, there were a number of independent jurors including Professor Emeritus Gunnar Tibell from Sweden, the President of the IYPT, and other members of the International Organising Committee. The remainder of the jurors were recruited from the University of Southern Queensland, the University of Queensland, Griffith University and the CSIRO Division of Industrial Physics, Sydney.

In an effort to ensure consistency in marking, particularly with more than fifty jurors, a marking guideline was developed for the Brisbane competition. The guideline suggested marks against criteria for theoretical and experimental achievement as well as communication. While there were still the occasional outliers in panel marking, jurors adopted the guideline with enthusiasm.

The Organisation

The International Organising Committee (IOC), composed of a representative of each participating country, usually meets twice a year during the Preparatory Seminar (in October) and at the IYPT (in May - July). It's a policy forming organization and it has until now left the financial requirements to the individual countries and the Local Organising Committee of each IYPT. The IOC formulates the problems for the IYPT as well as establishing and changing the Regulations as required. The members also elect the President of the IOC, the Secretary General of the IOC and two members of the Executive Committee and select the host country for the IYPT of the following year. The Executive Committee acts to coordinate the actions of the LOC and IOC and manage the day-to-day affairs as necessary.

The Local Organising Committee (LOC) organises a Preparatory Seminar in the year preceding the IYPT (in October) and the tournament. The LOC must raise all the funds necessary to stage the preparatory seminar and the IYPT.

Australian participation

Australia's involvement in the IYPT is due to the energy and vision of Alan Allinson, the Head of Physics at Brisbane Girls Grammar School. The Tournament having come to his attention, Alan took a team of girls from BGGS to compete in the 1998 IYPT. This practice continued with subsequent teams achieving second place at Helsinki in 2001 and joint third in Odessa in 2002. The other Team Leader on these occasions has been the Head of Science at BGGS, Dr Sally Stephens.

With Australia's presence well established in the IYPT, Alan has turned his attention to establishing a national competition and selection trial, now officially called the IYPT Australia Challenge or IYPT Australia. IYPT Australia was first held in 2003 and in 2004 consisted of twelve teams from schools from South East Queensland. It is hoped that sponsorship will enable the expansion of IYPT Australia to other States in the near future.

The winning team of IYPT Australia in 2004 was from BGGS with second place achieved by a team of Year 11 students from All Saints Anglican College, the Gold Coast. For the Tournament, a student from each of Brisbane Grammar School and Kenmore State High School was selected to join the three BGGS girls to form the Australia 1 team for IYPT 2004, while two Year 11 students from Somerset College were added to the three All Saints students to make the second Australian team.

IYPT Australia will take place again in March 2005, with the winning team of three plus two selected students to represent Australia at IYPT in Switzerland in July.

The discussion between Germany and Slovakia in the final of IYPT 2004

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The IYPT programme offers an alternative to the Olympiad approach in that it provides high school students the opportunity to undertake realistic scientific research. The students work on open ended problems which have no one solution. They experience research in a team of peers under the mentorship of teachers and professional physicists and engineers. The research takes them away from their comfort zone and leads them to the challenge of more complex concepts with more advanced mathematics which they can then test by experimental techniques of varying sophistication. They must validate their findings to the most severe of critics, their peers.

The researching of IYPT problems is an effective form of problem-based learning, and several Queensland schools have incorporated the study of the IYPT problems into their teaching programmes and employed them in the assessment of all physics students.

The IYPT is a great addition to the secondary education physics scene in Australia. With appropriate levels of sponsorship from government and industry and support from the physics and engineering communities, it will contribute greatly to regenerating interest and participation in the discipline.

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IYPT problems for 2004

1. **Misty** - Invent and construct a device that would allow the size of a droplet of a mist to be determined using a sound generator.
2. **Stubborn Ice** - Put a piece of ice (e.g. an ice cube) into a container filled with vegetable oil. Observe its motion and make a quantitative description of its dynamics.
3. **Electric Pendulum** - Use a thread to suspend a ball between the plates of a capacitor. When the plates are charged the ball will start to oscillate. What does the period of the oscillations depend on?
4. **Dusty Blot** - Describe and explain the dynamics of the patterns you observe when some dry dust (e.g. coffee powder or flour) is poured onto a water surface. Study the dependence of the observed phenomena on the relevant parameters.
5. **Sea-shell** - When you put a sea-shell to your ear you can hear 'the sea'. Study the nature and the characteristics of the sound.
6. **Seebeck Effect** - Two long metal strips are bent into the form of an arc and are joined at both ends. One end is then heated. What are the conditions under which a magnetic needle placed between the strips shows maximum deviation?
7. **Coin** - Stand a coin on its edge upon a horizontal surface. Gently spin the coin and investigate the resulting motion as it settles.
8. **Pebble Skipping** - It is possible to throw a flat pebble in such a way that it can bounce across a water surface. What conditions must be satisfied for this phenomenon to occur?
9. **Flow** - Using a dc source, investigate how the resistance between two metallic wires dipped into flowing water (or water solution) depends upon the speed and direction of the flow.
10. **Two Chimneys** - Two chimneys stand on a box with one transparent side. Under each chimney there is a candle. A short period after the candles are lit one flame becomes unstable. Examine the case and present your own theory of what is happening.
11. **String Telephone** - How do the intensity of sound transmitted along a string telephone, and the quality of communication between the transmitter and receiver, depend upon the distance, tension in the line and other parameters? Design an optimal system.
12. **Kundt's Tube** - In a 'Kundt's Tube' type of experiment the standing waves produced can be made visible using a fine powder. A closer look at the experiment reveals that the regions of powder have a sub-structure. Investigate its nature.
13. **Egg White** - White light appears red when it is transmitted through a slice of boiled egg white. Investigate and explain this phenomenon. Find other similar examples.
14. **Fountain** - Construct a fountain with a 1m 'head of water'. Optimise the other parameters of the fountain to gain the maximum jet height by varying the parameters of the tube and by using different water solutions.
15. **Brazil Nut Effect** - When a granular mixture is shaken the larger particles may end up above the smaller ones. Investigate and explain this phenomenon. Under what conditions can the opposite distribution be obtained?
16. **Small Fields** - Construct a device based upon a compass needle and use your device to measure the Earth's magnetic field.
17. **Didgeridoo** -The 'didgeridoo' is a simple wind instrument traditionally made by the Australian aborigines from a hollowed-out log. It is, however, a remarkable instrument because of the wide variety of timbres that it produces. Investigate the nature of the sounds that can be produced and how they are formed.

ABOUT THE COVER

High Resolution Spectroscopy at the ANU

Researchers in the new Photon Collisions facility of the Atomic and Molecular Physics Laboratories, Research School of Physical Sciences and Engineering, The Australian National University: Mitsu Kono, Ken Baldwin, Ed Roberts, Steve Gibson (front to back - left hand side picture).

The suite of orange Lambda Physik excimer-pumped dye lasers are used to perform high resolution spectroscopy experiments on atmospheric molecules using nonlinear optical techniques in the vacuum ultraviolet region, and to investigate and characterise polyatomic molecules and radicals via photofragmentation techniques.

For more information on the project and products, please contact Dr Ken Baldwin (Kenneth.Baldwin@anu.edu.au) or Gerri Springfield (gerri.springfield@coherent.com.au), respectively.

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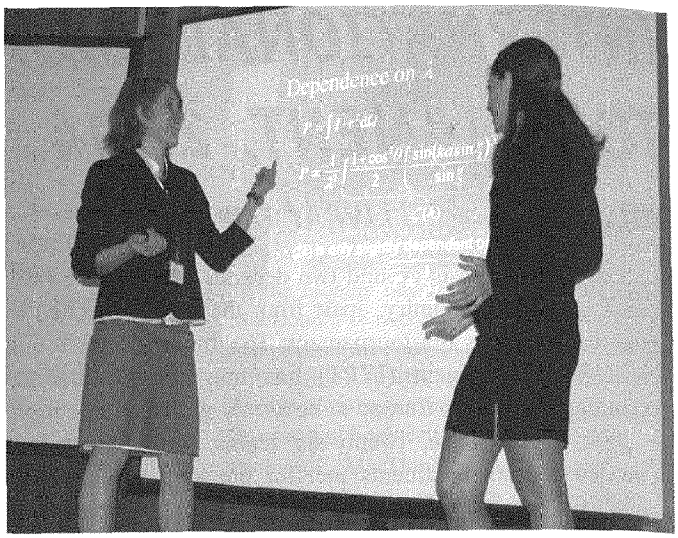

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