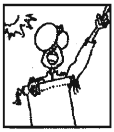

Report on the 1st Indian National Physics Olympiad and the 29th International Physics Olympiad

Background

The International Physics Olympiad (IPhO) has been held practically every year since its inception in 1967. Students who are 19 years old or younger and who have not yet entered a university/a degree college are eligible for the physics olympiad competition. The competition has both a theory component and an experimental component. Every country participating in the physics olympiad sends a team of (upto) five students. India participated in the International Physics Olympiad for the first time this year (1998).

For the past several years there has been a general feeling in the physics community in the country that we should institutionalize physics olympiad activity aimed at searching for promising senior secondary students, nurturing their talent and preparing them for the IPhO. India has been participating since 1989 in the International Mathematical Olympiad (IMO) and our teams have been doing well at this prestigious competition. The mathematical olympiad activity is organized by the National Board of Higher Mathematics of the Department of Atomic Energy (DAE) Government of India. India hosted the IMO at Mumbai in 1996.

It was naturally thought that India with its strong scholastic tradition and vast human resources in physics should participate in the IPhO also. India had so far not participated in IPhO mainly because of the relatively limited availability of olympiad level facilities for training and evaluation in physics, especially in its experimental component, in our schools and pre-degree colleges. In recent years, however, the Indian Association of Physics Teachers (IAPT) has built up a countrywide network for its National Standard Examination in Physics. Moreover, through DAE's assistance, the Tata Institute of Fundamental Research (TIFR) has set up a National Centre, Homi Bhabha Centre for Science Education (HBCSE), having its separate premises in Mumbai, with international class training facilities. In view of these considerations, the DAE took the initiative in the matter and decided to inaugurate the physics olympiad programme under the umbrella of its Board of Research in Nuclear Sciences (BRNS). Accordingly, DAE set up a National Steering Committee (NSC) as the apex body for the physics olympiad programme in the country with representation from different Departments of the Government of India and physics associations. The actual programme is implemented by IAPT and HBCSE with help and support from the Indian Physics Association (IPA), National Council of Educational Research and Training (NCERT), other leading institutions/ university departments/colleges and interested physicists and physics teachers. The Ministry of Human Resource Development (MHRD) of the Government of India supports international travel while all other financial aspects of the programme are funded by BRNS (DAE).

Selection of the Indian Team

The NSC evolved a three-round process for selecting the Indian team for an IPhO. In view of the countrywide coverage that is possible on account of IAPT's network of branches, responsibility of the initial selection has been taken up by IAPT. In fact, the first round is the National Standard Examination in Physics (NSEP), that is conducted by IAPT at a large number of centres throughout the country. For the year 1997–98 the NSEP was held on Sunday, December 21, 1997. As a result of the first round about 200 students were selected to go to the second round, which was the Indian National Physics Olympiad (INPhO). The organization of INPhO is a joint responsibility of HBCSE and IAPT and it is scheduled in February every year. This year, being the year of its inception, INPhO (the 1st INPhO) was held in May 1998. It had both theory and experimental components on the lines of IPhO and was held simultaneously at 10 Centres in the country. The first 35 students, selected on the basis of their performance, were awarded the NSEP–INPhO gold medals. These 35 gold medalists underwent an intensive four-week training programme (IPhOTC) organized by HBCSE, Mumbai from May 18 to June 12, 1998. The training programme served as the third and the final round for the selection of the Indian team for IPhO. The faculty for training was drawn from HBCSE, IAPT, IPA and other leading organizations/institutions in the country. A special physics olympiad training laboratory has been set up at HBCSE. The trainees went through a series of tests in problems and experiments. At the end of the training camp, the top five, according to their performance in the camp, were selected to receive the IPhOTC Merit Awards and to represent India in the 29th IPhO held in July 1998, at Reykjavik, Iceland.

The 29th International Physics Olympiad

The Indian team, which went to Reykjavik for the 29th IPhO consisted of five students, selected as described earlier, and two teacher leaders. As per an IPhO practice, one of the teachers was designated the delegation head and the other teacher was designated the pedagogic leader. The members of the team were:

Shivi Shekhar Bansal	Obra Intermediate College, Obra, UP	Student
Vijay S Bhat	Birla High School, Calcutta	Student

Shri Saikat Guha	St. Michael's High School, Patna	Student
Abhishek Kumar	Delhi Public School, New Delhi	Student
Dilys Thomas	Loyola Junior College, Pune	Student
T S Natarajan	Indian Institute of Technology, Chennai	Pedagogical Leader
H C Pradhan	Homi Bhabha Centre for Science Education (TIFR), Mumbai	Delegation Leader

All the five students had finished their Std.XII science when they went to Reykjavik. They had all appeared for the Joint Entrance Examination of the Indian Institutes of Technology (JEE-IIT) and, it is noteworthy that, secured a good rank (within first 100) at that examination. This correlation of the results of the JEE-IIT with the selection of the Indian team for the IPhO, in a sense, validated the selection procedure for the IPhO.

The theory component of the 29th IPhO Examination was held on 4th July and the experimental component on the 6th. There were 56 countries and 266 students participating in this IPhO. The teachers from the participating countries along with the members of the host organization (University of Iceland) formed the international board of paper-setters and examiners. The international board met thrice. The first meeting was held on 3rd July where the hosts put forth their proposed theory question paper for discussion, modification and finalization. The second was a similar meeting for the experimental component and was held on 5th July. The teacher leaders of each country also served to translate the question papers originally prepared in English into the language of the respective country and the students' answer papers in their respective languages into English. The students' answer papers were graded by two groups of examiners, namely the respective teachers and the ones appointed by the host organization. Both these groups met on 8th July for moderation and finalization of the marks secured by each student. The results were declared on the evening of 8th. Prizes were awarded in a closing ceremony held on 9th. July 7 was a day of rest and July 2, which was the first day after their arrival in Reykjavik for most students, was the day of orientation. During the examination period (from 3rd to 6th) the students and their teachers were completely separated from each other. The teams from every country had a local student host to guide them. The students got plenty of opportunities for sightseeing and socializing with fellow students from other countries and in general were well looked after.

The Problems at the Olympiad

The statements of the problems were rather lengthy and are not reproduced here. The theory paper consisted of three problems each with 4-5 sub-sections. The first problem was on analysing the uneven rolling of a hexagonal prism on an inclined plane. In the second problem, the melting of ice and the behaviour of water under a temperate ice-cap (i.e. an ice-cap at the melting point) was considered. A small volcanic eruption (in the form of a cone) on the ground beneath the cap causes the melting of ice. The eruption is detected by a cone shaped depression in the otherwise flat top of the ice-cap. By making appropriate (given) assumptions and applying considerations of thermal and hydrostatic equilibrium the observed depth of the depression can be related to the height of the volcanic eruption. The third problem was based on the interpretations of measurements made in 1994 on radio-wave emission from a compound source within our galaxy. The apparent transverse speed of one of the two sources is greater than the speed of light. The students were asked to resolve the puzzle by calculating the real transverse speed of the sources. The theory questions were such that although what was required to solve them was within the abilities of good Std.XII students, the contexts in which they were set were new, unfamiliar and contemporary. Each of the three problems carried 10 marks.

In the experimental component there were two experiments. In one, the shielding of a magnetic field was to be probed using the field of a coil wound on a C-shaped ferrite core and a pick-up coil-detector which could be shielded by aluminum foils of varying thicknesses. In the other experiment the self and mutual inductances of two coils wound on a rectangular ring type of ferrite core were to be studied. The core could have an air gap and the effect of this gap on the inductances allowed calculating the permeability of the core. The students were supposed to make appropriate formulations of the experiments, derive the necessary theoretical expressions, decide the mode of presentation including which graphs to plot and give error estimates. To what extent a student behaves as an 'experimentalist' was tested through the experiments. The two experiments carried a maximum of 8 and 12 marks respectively.

The Results of the Competition

Out of the 266 students from 56 countries who appeared for the 29th IPhO, 11 won Gold Medals, 15 Silver Medals and 43 Bronze Medals. The next 55 in order of merit received Honourable Mention. The cut-offs of absolute marks out of a maximum of 50 were 42.0, 36.3, 30.0 and 23.0 for the four categories, gold, silver, bronze medals and honourable mention, respectively.

India's maiden performance at IPhO was reasonably good. Of the Indian team, Abhishek Kumar won a silver medal and Vijay Bhat won a bronze medal. The other three, Shivishekhar Bansal, Dilys Thomas and Saikat Guha received honourable mention. Thus all the five Indian students were in merit categories, i.e. either they were medal winners or they received honourable mention. Only 12 countries achieved this distinction of having all their students in the merit categories. This achievement was significant in the context of 1) India's first ever participation in a physics olympiad and 2) the higher standard of the 29th IPhO. The higher standard was apparent from the fact that the number of gold and silver medals this year (11 and 15 respectively) was considerably less than the average number (20 each) in the two categories over the past few years.

A highlight of the Indian performance was winning three special prizes. This lent additional prestige to their performance. Abishek Kumar topped the candidates from the countries participating in the olympiads for the first time and received the IPhO President's prize. (The newly participating countries this time were Greece, Ireland and India).

Vijay Bhat secured 10 out of 10 in the Theory Question No.2 and he was the only student to achieve this distinction and secured a special award for the best solution.

Saikat Guha was awarded a special prize on behalf of the European Physical Society for the best balance between theory and experiment.

The absolute winner of the competition was Yuao Chen of People's Republic of China. All the 5 Chinese students including a female participant, Yuan Liu, secured gold medals. The physics olympiad is considered to be an individual event and not a team event. Hence no ranking of participating countries was officially published. Moreover, marks obtained by students who did not make it to any merit category were not declared. This meant that marks of all 5 team members of a country were not available unless all of them were in the merit categories. As mentioned earlier, only 12 countries achieved this distinction.

When the total team marks of these 12 countries were compared India ranked tenth in the list. This is a creditable performance, but can certainly be improved upon. It is to be noted that although Germany, Great Britain and USA participated in the competition, they did not figure among these 12 countries and out of these 12 countries, 7 are Asian.

Inquiries revealed that countries which did well at the physics olympiads had in general: a) a comprehensive competitive selection procedure, b) extensive and rigorous training programmes covering both theory and experimental components, c) tough competitive entrance examinations at the higher secondary school level within the country and d) four or more years of high school level physics. The situation in India is certainly not unfavourable from the point of view of the above four factors. With the infrastructure for a comprehensive selection process and requisite training already established one may expect from our students a substantially better performance at the IPhO next year and in the years to come.

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