

First Step to Nobel Prize in Physics

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ABSTRACT

The "First Step to Nobel Prize in Physics" is an annual competition in research projects in physics for secondary (high) school pupils organized by the Institute of Physics, Polish Academy of Sciences. This year the second competition of that type has been completed. Pupils from 36 countries took part in the first two competitions, what certainly should be treated as a great success. We have organized the above competition for the following reasons. During our contacts with secondary school pupils we discovered that some of them try to perform different physical investigations by themselves: at schools, in some laboratories and even at home. Then we decided to organize the National Competition in Pupils' Research Projects in Physics and next - after gaining some experience in the national scale - the international competition "First Step to Nobel Prize in Physics". Our aim was to recognize the effort of the pupils, give them a chance to compare their own achievements with the achievements of their colleagues and organize their work. One should underline that the "First Step" refers to quite different features (long term research work) of the pupils than the International Physics Olympiad (solving well formulated physics problems). The prizes in our competition are not typical. Instead of buying some items for our winners we decided to invite them to our Institute for a research stay. In our opinion in case of people whose hobby is physics such a form of prize is more valuable and more instructive than anything else. The aim of this article is to discuss a genesis of the competition, to present conditions of participation and to discuss the results.

INTRODUCTION

About 10 years ago the Institute of Physics, Polish Academy of Sciences in cooperation with the Polish Children's Fund has started to organize the so-called "Research Workshop on Physics". It is an event for secondary school students selected in the following way:

Each year the Polish Children's Fund grants special scholarships to gifted pupils. The procedure adopted there is complicated and we are not going to describe it in detail. The scholarships are granted in different branches: in physics, in technical sciences, in mathematics, in arts, in history, etc. There are also certain interdisciplinary grants. The participants of the Workshop are selected from the holders of the scholarships in physics or subjects related to physics (astronomy, mathematics, etc.). In autumn they receive about 10 problems to solve. The problems are prepared by the researchers employed in the Institute of Physics, Polish Academy of Sciences. Usually the problems are open, i.e. their solutions are not known. The pupils have two-three months to solve them. The pupils may try to solve all the problems or only some of them. Later the solutions are evaluated by the authors of the problems. The pupils-authors of the best solutions (or of the most interesting ideas, if the solution is not complete) are invited to the Institute of Physics to the Workshop. Usually the Workshop lasts 5 to 10 days. During the stay in the Institute the participants take part in real investigations going on in our laboratories. If the results obtained by a participant are valuable then this participant may be invited again to continue his/her work.

Some results obtained by the participants of the Workshop were really very valuable and published (e.g.: K. Giaro et al., "A Correct Description of the Interaction between a Magnetic Moment and Its Image", *Physica C*, 168 (1990) 479 - 481; M. Braun et al., "Vibration Frequency and Height of a Magnet Levitating over a Type-II Superconductor", *Physica C*, 171 (1990) 537 - 542).

Many scientists employed in the Institute of Physics are involved in both national and international Physics Olympiads from their establishing and have been in permanent contacts with the pupils and teachers.

During our contacts with the pupils at the Workshop as well as during

the Physics Olympiads we discovered that some of the secondary school pupils try to perform different physical investigations by themselves - at schools, in some laboratories and even at home. Then we decided to organize the National Competition in Research Projects in Physics for Secondary School Students. The aims of this competition were obvious. We wanted to recognize the effort of the pupils and give them a chance to compare their own achievements with the achievements of their colleagues. The first competition of this type started in 1991/92. The number of papers submitted was 59. We were really surprised with very high level of many of them. At the first competition 7 papers won prizes and 19 honorable mentions. It was very difficult to compare papers on chaotic behavior with the papers on theory of networks, etc. Therefore all the prizes were considered equivalent. The honorable mentions were divided into two categories: research papers and contributions. Inside each category the honorable mentions were considered equivalent as well. The prizes in our competition were not typical. Instead of buying some items for our winners we decided to invite them to our Institute for a two week long research stay. In our opinion in case of people whose hobby is physics such form of prize is more valuable and more instructive than anything else.

Since the first competition was a success we decided to repeat the national competition in research projects in physics every year. The second competition was organized in 1992/93. Its level was also very high, perhaps even somewhat higher than one year earlier. Also the number of participants and winners increased: 81 papers, 8 winners, 21 honorable mentions in two categories). In the third competition (1993/94) the number of papers submitted was 88, 10 of them won prizes and 14 - honorable mentions.

After analyzing papers submitted to the first national competition we decided to organize a similar competition on an international scale. Taking into account that the competition papers should be real research papers we named it "First Step to Nobel Prize in Physics". The Organizing Committee was established in spring in 1992.

THE FIRST INTERNATIONAL COMPETITION

The conditions of participation are described in the announcement reproduced in this article (the announcement refers to the III competition, but the conditions are practically the same from very beginning). It seems that the conditions are quite natural. Nevertheless, one point concerning the number of authors of the competition papers needs some explanation. We do realize that some investigations are performed in smaller or greater research groups. We decided, however, to focus our attention on gifted individuals rather than on efficient groups. The groups of young people are not stable. Moreover, in case of such groups we are not able to estimate contribution from different co-authors.

The announcements on the "First Step" were distributed in all possible ways available to us. They were sent to:

1. The people involved in the International Physics Olympiads (heads of the delegations, pedagogical leaders, institutions involved in preparation of the national teams, famous schools, famous teachers, some pupils participating in the Olympiad, etc.);
2. the embassies of different countries in Warsaw;
3. foreign institutions cooperating with the Polish Children's Fund;
4. editorial boards of different national and international journals for pupils and teachers (the announcements were published in about 20 journals, e.g. in "Quantum", "Indian Science Cruiser", "Delta" - unfortunately not all the journals are available in Poland and we are not able to list all of them);
5. Organizing Committees of about 40 national competitions cooperating with the Young Europeans' Environmental Research;
6. authors of books or articles for pupils and teachers;
7. friends and colleagues in different countries.

On behalf of the the Organizing Committee I would like to express our deep thanks to all the institutions and people who helped us in distributing information about the competition. Without this help any efficient work

would certainly be impossible.

In the first international competition the Organizing Committee received 134 papers from 23 countries. The interest in the competition was, however, much greater: we received about 400 letters, faxes, telexes. Many pupils received our announcement too late to take part in the competition but they plan to start in the next "edition" of the competition.

The papers were evaluated in several stages. In the first stage the papers not satisfying the formal requirements described in the announcement (no data about the author, language other than English, more than one author, etc.) were rejected. In the second stage the papers were refereed by scientists from the Institute of Physics of the Polish Academy of Sciences, the Center for Theoretical Physics of the Polish Academy of Sciences and the Institute for Experimental Physics of the Warsaw University. In the third stage the papers together with the referees opinions were compared with each other and discussed in detail. As a result the final list of winners was established. The list of winners contains three names. The number of good and valuable papers was, however, much larger than that. Unfortunately, they had either some mistakes, or were not finished or had some other defects. In spite of that they were very interesting and in order to honor the effort of their authors the Organizing Committee has decided to award them with honorable mentions. The honorable mentions were awarded in three categories: Research Papers, Contributions and Instruments. We would like to stress that the pupils who received the honorable mentions were not considered as winners of the competition.

According to the rules described in the announcement the winners of the competition, i.e: Mr. Melvin Leok Boon Tiong (Singapore), Mr. Iain Galloway (Great Britain) and Mr. Dmitry Ruslanovich Bitouk (Russia), were invited to the Institute of Physics, each for one month, for a research stay. We would like to say that some results obtained by them exceeded our expectations. For example, Mr. Leok in cooperation with Prof. M. Kus started to solve a very difficult problem on chaotic behavior of some atomic systems. His preliminary results are so interesting that the cooperation with him will be continued for several more months. Also Mr. Bitouk cooperating with Prof. K. Rzazewski found some interesting solutions

of certain problem on chaos and has been invited for an additional stay in the Center for Theoretical Physics to continue his investigations within framework of a research grant.

All the prize winners and those who won the honorable mentions received diplomas from the Organizing Committee and different gifts (physics books, physics journals and software) founded by the sponsors.

The diplomas and the gifts were sent to the participants by mail. Unfortunately, we were not able to organize any closing ceremony for 41 persons (i.e. for all the winners and those who won the honorable mentions) as the travel expenses exceeded our financial possibilities.

The proceedings of the first competition were published as a supplement to "Acta Physica Polonica A" in 1994 (vol. 85 - supplement). We hope that the proceedings will allow future participants to create proper image of the level of some pupils' investigations as well as of our expectations in respect to the competition papers.

The proceeding contain the awarded papers only. We were going to publish also some selected papers that won the honorable mentions. We asked authors of several papers, that were just about being awarded regular prizes, for introducing some changes and improvements. Unfortunately, their Authors have not performed necessary changes and improvements of the manuscripts in time. It is, however, not excluded that the "delayed" papers will be included in the proceedings of the next competitions.

It is interesting to remark that only two papers from Poland were submitted to the "First Step", although at the same time 81 papers were submitted to the second national competition. Why? We think that the main barrier was poor knowledge of English. We feel it is necessary to stress the role of this language in physics. All new discoveries, new effects, etc. are first published in English. This is why we decided that all the papers should be prepared in English. We hope that our competition will affect also practical knowledge of English by the best pupils.

THE SECOND INTERNATIONAL COMPETITION

The second competition "First Step" was organized in the academic year 1993/94. We got 89 papers from 26 countries. It is true that the number of papers in the second competition was less than in the first competition, but it was effect of our policy. Many pupils willing to participate in the second competition asked us for some sample papers of the first competition. Of course, always we sent the best papers. In result some potential participants, who planned to submit a kind of essay instead of a research paper, resigned from participation.

The percent of papers of descriptive character in the second competition was substantially less than in the first competition. In other words, the percent of really research papers substantially increased. You may see it from the statistics presented in the Table 1. Although the total number of papers decreased, the number of winners increased from 3 to 7. Also the number of honorable mentions in category "Research Papers" increased from 13 to 15.

In the second competition the following seven pupils were awarded with prize: Can Altineller (Turkey), Anton A. Belyaev (Ukraine), Z. Cournia (Greece), Janko Isidorovic (Yugoslavia), Marcus Mueller (Switzerland), Samuel F. Schaer (Switzerland) and Michal Rewiński (Poland). According to the regulation of the competition they will be invited to the Institute of Physics to the research stay for one month. In addition to the regular prizes the Organizing Committee awarded 26 honorable mentions

In the first competition the "geographic distribution" of the winners (including those who won honorable mentions) was, say, very nice (see Table 1). Remark, please, that the geographic distribution of the winners (including honorable mentions) in the second competition also is very nice. It shows that talented pupils are in any place, in any country and in any nation.

Again it is interesting to remark that only two papers from Poland were submitted to the second "First Step", although at the same time 88 papers were submitted to the third national competition.

THE NEXT INTERNATIONAL COMPETITIONS

We are going to organize the "First Step" every year. The deadline for sending the papers always will be the same: March 31. The third international competition is organized in the academic year 1994/95.

We invite your pupils to our competition. Remark, please, that our competition is practically free of any formalities. It is enough to sent the research paper to the Organizing Committee. That is all!

We wish great successes to our past and ... future winners. Let "First Step to Nobel Prize in Physics" be really first step to this prize!

"First Step to Nobel Prize in Physics" - statistics '94

No.	Country	1st FS 23 countries					2nd FS 26 countries					Together 36 countries				
		P	A	R	C	I	P	A	R	C	I	P	A	C	R	I
1.	Algeria	7	0	0	1	0	10	0	1	1	0	17	0	1	2	0
2.	Bangladesh	3	0	0	0	1	3	0	0	0	0	6	0	0	0	1
3.	Belgium	-	-	-	-	-	1	0	0	0	0	1	0	0	0	0
4.	Bulgaria	2	0	1	0	0	-	-	-	-	-	2	0	1	0	0
5.	Canada	-	-	-	-	-	3	0	2	0	0	3	0	2	0	0
6.	China	6	0	0	1	0	1	0	0	0	0	7	0	0	1	0
7.	Colombia	2	0	0	0	0	-	-	-	-	-	2	0	0	0	0
8.	Cyprus	1	0	0	1	0	-	-	-	-	-	1	0	0	1	0
9.	Czechlands	-	-	-	-	-	1	0	0	0	0	1	0	0	0	0
10.	Egypt	-	-	-	-	-	1	0	0	1	0	1	0	0	1	0
11.	Ethiopia	-	-	-	-	-	2	0	0	0	1	2	0	0	0	1
12.	Great Britain	4	1	1	0	2	1	0	1	0	0	5	1	2	0	2
13.	Greece	13	0	0	4	0	13	1	1	2	0	26	1	1	6	0
14.	Hungary	-	-	-	-	-	1	0	0	0	0	1	0	0	0	0
15.	India	12	0	1	0	3	7	0	0	1	1	19	0	1	1	4
16.	Iran	1	0	0	0	0	-	-	-	-	-	1	0	0	0	0
17.	Israel	-	-	-	-	-	2	0	0	2	0	2	0	0	2	0
18.	Italy	1	0	0	0	0	-	-	-	-	-	1	0	0	0	0
19.	Kuwait	-	-	-	-	-	5	0	1	0	0	5	0	1	0	0
20.	Macedonia	-	-	-	-	-	3	0	0	1	0	3	0	0	1	0

No.	Country	1st FS 23 countries					2nd FS 26 countries					Together 36 countries				
		P	A	R	C	I	P	A	R	C	I	P	A	C	R	I
21.	Latvia	-	-	-	-	-	3	0	0	0	0	3	0	0	0	0
22.	Nigeria	22	0	0	0	1	-	-	-	-	-	22	0	0	0	1
23.	Pakistan	3	0	0	1	0	-	-	-	-	-	3	0	0	1	0
24.	Poland	2	0	1	0	0	2	1	1	0	0	4	1	2	0	0
25.	Portugal	-	-	-	-	-	1	0	0	0	0	1	0	0	0	0
26.	Romania	4	0	1	0	0	3	0	0	0	0	7	0	1	0	0
27.	Russia	8	1	4	1	0	-	-	-	-	-	8	1	4	1	0
28.	Singapore	1	1	0	0	0	-	-	-	-	-	1	1	0	0	0
29.	Slovakia	8	0	0	0	1	1	0	0	0	1	9	0	0	0	2
30.	Sweden	-	-	-	-	-	2	0	0	0	0	2	0	0	0	0
31.	Switzerland	-	-	-	-	-	2	2	0	0	0	2	2	0	0	0
32.	Tunisia	9	0	0	0	1	-	-	-	-	-	9	0	0	0	1
33.	Turkey	6	0	0	2	2	12	1	5	0	0	18	1	5	2	2
34.	Ukraine	16	0	2	3	0	7	1	3	0	0	23	1	5	3	0
35.	USA	1	0	1	0	0	1	0	0	0	0	2	0	1	0	0
36.	Yugoslavia	2	0	1	0	0	1	1	0	0	0	3	1	1	0	0
Total		134	3	13	14	11	89	7	15	8	3	223	10	28	22	14

Notation:

P - total number of papers submitted, A - number of awards (prizes)

R - number of honourable mentions in category "Research Papers"

C - number of honourable mentions in category "Contributions"

I - number of honourable mentions in category "Instruments"