

CROATIAN PHYSICAL SOCIETY: PRESENT STATUS AND PROSPECTS

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In Croatia scientists, teachers and students of physics are gathered in the Croatian Physical Society, CPS¹, founded on December 19, 1990 with the aim to promote and develop scientific, educational and pedagogic activities in the field of physics. The association is registered under the name of “Hrvatsko fizikalno drustvo” and is governed by the Constitution. Prior to 1990, the Croatian physicists acted within the frame of the Society of the Croatian Mathematicians and Physicists (founded in 1949), which developed out of the Mathematics-Physics Division of the Croatian Society of Natural Sciences (founded on August 27, 1945).

1 Introduction

The history of physics education and research in Croatia begins in the 12th century with philosopher and astronomer Hermann of Dalmatia, who played an important role in the transmission of Aristotelian physics to the medieval Europe. The most prominent names until modern times include Rudjer Boskovic (18th century), Nikola Tesla (19th century) and Andrija Mohorovicic (20th century). Rudjer Boskovic was a physicist and mathematician, who introduced in physics the idea of a force that is repulsive at short distance and attractive at great distance. Nikola Tesla, born in Croatia in mid-19th century, made the majority of discoveries in the United States which contributed to the understanding and application of alternating electric current as the foundation of the electrification of the world. In recognition of his contributions the SI unit of magnetic induction – the “tesla” – is named after him. Andrija Mohorovicic made his discoveries in the field of geophysics at the Department of Physics of the University of Zagreb founded at the end of 19th century. By analyzing seismological data Mohorovicic discovered the boundary between the Earth’s crust and the mantle, the so-called Mohorovicic discontinuity. A modern and fresh stimulus to Croatian physics research was given by the establishment of three scientific institutions: Rudjer Boskovic Institute (Zagreb) in 1950, Institute of Physics of the University (Zagreb) in 1960, and the recently built new facility of the Department of Physics of the Faculty of Science (Zagreb) in 1991. Today, the research takes place at the mentioned Institutes and Physics Departments of four main Universities in Croatia: University of Zagreb, Split, Osijek and Rijeka, the latter at the same time being the centers for education of students.

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Fig. 1 Building of the Physics Department of the Faculty of Science, University of Zagreb where the seat of Croatian Physical Society is situated.



Fig. 2 Certificate of Appreciation and Medal of a Honorary Member.

2 Membership

The Croatian Physical Society gathers scientists, teachers and students of physics. The seat of CPS is at the building of the Physics Department of the Faculty of Sciences, University of Zagreb, (fig. 1). Currently the Society has 614 members out of which 348 scientists, 145 physics teachers, 37 retired members and 84 students (who are not regular members and do not pay the membership fee). The number of CPS members held rather steady for years and only recently it has started to show a slight increase. Much of the recent increase can be attributed to the growth in the young members category being due to the action initiated by the CPS Managing Board in 2010 and we hope that this positive trend will continue. The action offers a one-year free trial membership available to freshly graduated physics students. The aim is to attract young physicists to the Society, get them active and see them continue into the regular members category. Reaching that aim will help maintain and hopefully increase the active part of the membership by offsetting the number of retiring members which is expected to grow in the forthcoming decade. In addition to regular and student members, the CPS constitution foresees that the Assembly may elect individuals, who have made an outstanding contribution to the advancement of physics or have rendered significant services to the Society, as Honorary Members of the Society (fig. 2). In 2010, the CPS Managing Board proposed Bozo Metzger (97) and BSc Branka Mikulicic (81), to become Honorary Members based on their outstanding contribution to the advancement of physics and physics education in Croatia. Their election was approved at the Assembly meeting in December 2010.

3 Bodies and resources of the Society

In order to fulfil its aim CPS acts either directly through its president or through the Divisions defined by the Constitution and projects created by its members. The bodies of the Society are the President, the Vice-president, the Assembly, the Managing Board, the Supervisory Board and the Court of Honor. The competence and the structure of the bodies are defined by the Constitution. The Assembly is the supreme authority of the Society and consists of all regular members. The president represents the Society and nominates at his/her discretion the closest collaborators: Secretary and Treasurer, as well as the Secretariat Staff (administrative secretary and bookkeeper). The president of the Society is also the president of the Assembly and Managing Board (fig. 3).

The resources of the Society consist of dues paid by members, grants that may be awarded by public or private bodies, gifts and donations, as well as other resources which the Society may derive from its own activities. In the last decade the majority of CPS income has been provided by the Ministry of Science, Education and Sports of the Republic of Croatia. Grants obtained by the City of Zagreb, as well as by other sponsors from Croatia have been of lesser amount. Nevertheless, they should be acknowledged too. Unfortunately, government money including the basic operation grant has been cut down substantially in the last few years so that certain activities had to be temporarily frozen waiting for better days to come. Only recently, signs of recovery started to emerge at the horizon. It is vital for the Society to give considerable thought in the near future to how the situation might be improved at a longer time scale.

Fig. 3 Members of the CPS Managing Board (MB) and CPS Project Leaders at the occasion of Electoral Assembly and a reception in December 2010. Back row (left to right): A. Hamzic (CPS president 2005–2006), B. Pivac (CPS president 2011–2012), I. Aviani (E-school project leader) and M. Basletic (Leader of the Summer school for Young Physicists 2011–2012). Front row: I. Bogdanovic-Radovic (Scientific Division leader 2009–2010), E. Oreskovic (representative of elementary school physics teachers in MB 2007–2010), M. Planinic (Educational Division leader 2007–2010), Z. Roller-Lutz (vice-president 2005–2006), V. Horvatic (secretary 2005–2008, web master), S. Tomić (CPS president 2007–2010), D. Androic (Leader of the Summer school for Young Physicists 2008–2009), K. Ilakovac (Editor in Chief of scientific journals *Fizika A* and *B*) and G. Jerbic-Zorc (secretary 2009–2010).



4 National activities

CPS has five divisions: the Scientific Division, the Educational Division, the Division for Industrial and Applied Physics, the Division for promotion of Physics and the Students Division.

The Scientific Division is mostly concerned with questions related to research. It organizes the Scientific Meeting of CPS on a two-years basis where the Croatian researchers meet to present the newest research results and discuss issues concerning the status of the research in Croatia. The last two meetings were held in the picturesque village of Primosten on the Adriatic coast. The rather high attendance, motivated oral contributions and vivid round tables show that this event is well accepted by the CPS members and promise that it should have a bright future. It is worth mentioning that since 2007 the best physics students from four Croatian universities are invited to attend these meetings and their stay is covered by their host departments and research institutes.

The Educational Division activities are in major part related to elementary and high-school teaching. The Division members work permanently on physics education by helping in improving the plan, program and educational process. The CPS members are aware that more should be done to increase the number of physics students and increase the

quality of physics education which is indispensable in preparing students for today's knowledge economy. The Division organizes series of lectures on selected topics of contemporary physics for schoolteachers. Also, biannually it organizes the Croatian Symposium on Physics Education. The Division represents schoolteachers at the Ministry of Science, Education and Sports and in front of general public as well.

The division for Industrial and Applied Physics organizes workshops and round tables at which physicists from the academic community and industry meet. This Division has become more active only recently; however, two workshops organized in 2009 and 2010 at the Institute of Physics in Zagreb were very successful and showed that efforts should be continued in this field. Participants from both sides pointed out how such meetings are more than welcomed and that there is an urgent need to establish a collaboration between them in order to facilitate and improve achievements in industry applications.

The Division for promotion of Physics aims to promote the CPS projects at Croatian TV channels, radio stations and in printed and electronic newspapers. In the real life, the Division and project leaders take care to inform media of

their on-going activities and events. The CPS portal is regularly updated with news covering the CPS and EPS projects and events in Croatian and English languages. Throughout 2010, the CPS portal registered 27114 visits from 84 countries (80 per day), out of which 25515 were from Croatia. It is vital to keep the web page active in the future and identify the measures to be taken in order to ensure that the positive trend in the visits number continues.

The most popular project of the Student Division is the project named Physics Express, which was initiated during the World Year of Physics in 2005. In the framework of this project, our students visit schools all around Croatia and promote physics through presentations of simple experiments demonstrating physics in daily life and by establishing a direct communication with school students (fig. 4). Since 2005 until today, almost 5000 elementary and high school students in about 100 schools have seen the presentations given by Physics Express.

Since 1992 the Society edits two international peer-reviewed scientific journals *Fizika A* and *Fizika B* in which original research articles covering all branches of physics and its applications, including teaching and history of physics are published in English. The actual tendencies and

Fig. 4 Physics Express visiting an elementary school in Rijeka. Left: Ines Filipas from Physics Express explaining the exercise entitled "Rubens tube", while one of the students is trying to induce the tube standing waves by identifying the right frequency with his voice. Right: Ines Filipas and Nikola Markovic from Physics Express demonstrating that water can boil at room temperature under the vacuum.



strong competition in global scientific publishing, the fact that hiring and promotion committees measure scientific performance mostly relying on numerical indicators such as the impact factor of journals in which the candidates published their work, and a negative trend of the financial support, raised intense discussions whether to continue to publish national journals or to close them and merge to one of the European Physical Journals editions. As a recent outcome of thorough discussions inside CPS and consultations with EPJ publishers (SIF and Springer officers), the Managing Board reached a decision to merge the journal *Fizika A* to EPJPlus electronic journal that has started publication in January 2011. As for the journal *Fizika B*, the possibility to keep it and transform it into the journal of special issues needs to be examined further so that a final decision was temporarily postponed.

In cooperation with the Croatian Mathematical Society, CPS also edits a popular magazine entitled "Mathematical-Physical Journal (MPJ)" for elementary (age 12–14) and high school students (age 14–18) and physics and mathematics teachers. MPJ was founded in 1950 and celebrated its 60th Anniversary last year. Each volume (comprising four issues annually) contains articles covering diverse topics

from mathematics, physics, astronomy and informatics, information concerning national and international physics and mathematics competitions and reviews of new science books. MPJ regularly publishes theoretical problems aimed to be solved by curious students; the solutions of these problems are published in the next issues.

Other activities of CPS include projects and groups like Electronic-school of Physics (E-school), the Summer School for Young Physicists and Women in Physics. Further, in cooperation with the Croatian Education and Teacher Training Agency and Ministry of Science, Education and Sports, CPS organizes elementary and high-school competitions in physics at regional and national levels, as well as the preparation of gifted students for the participation in the international competitions Physics Olympiad and Young Physicist's Tournament.

E-school was established twelve years ago as a web site dedicated to the news in physics and physics problems, intended not only for high-school students and physics teachers, but also for all individuals interested in physics. In the last three years almost 100 additional Internet pages were created with new educational material. The E-school Internet portal registers in average 200 visits per day. That is the

best sign of how popular and attractive this project is.

Annually CPS organizes the Summer School for Young Physicists dedicated to diverse topical subjects in physics to which the students who achieved the best results at the national physics competition are invited. CPS considers this event as a kind of reward to students that distinguished themselves and gives them the opportunity to follow the lectures of the best Croatian scientists and participate in the interactive laboratory exercises.

Following the Summer School, Summer Preparatory Classes are organized to the end of selecting the best 5 students to represent the Croatian team at the International Physics Olympiad. CPS also helps in the selection and preparation classes of the Croatian team which participates in the International Young Physicists' Tournament taking place every year in different countries all over the world. These competitions represent the zenith for high-school students for whom physics is more than a school subject; rather it is a real passion for them. The Croatian high-school students in both of these competitions usually achieve very good results: standard achievement is winning the bronze medals, which makes us all very proud of them.



Fig. 5 Members of the Croatian team (left to right): Vedran Komlen, Nina Kamcev, Veronika Sunko, Marija Doslic and Vilim Stih in front of the elementary school "Petar Berislavic" where the competitions at the 21st IYPT, 21 – 28 May, 2008, Trogir, Croatia were held.



Fig. 6 Members of the Croatian team (left to right): Vilim Stih, Ljudevit Palle, Denis Osvald, Marko Jercic and Borna Vukadinovic at the opening ceremony of the 41st International Physics Olympiad, 17–25 July 2010 which was held in Zagreb, Croatia.

The Working group Women in Physics surveys the status of female physicists in the academic community, organizes round tables and search to establish policy priorities to improve the additional difficulties women encounter as compared to men, especially (among others) concerning the need to deal with both professional and family responsibilities.

5 International activities

As an additional expression of commitment to help promote physics education, CPS took the responsibility to organize three important international events in the last three years: the 21st International Young Physicists' Tournament in 2008, the 24th International Conference of Physics Students in 2009 and the 41st International Physics Olympiad in 2010, the latter being organized in cooperation with the University of Zagreb. The 21st International Young Physicists' Tournament took place in the historic town of Trogir, a harbour on the Adriatic coast in Croatia founded in the 3rd century BC (fig. 5). This event gathered teams from 24 countries

all over the world. The unique aspect of the Tournament, compared with other contests, is that it constitutes a competition among teams of high school students, instead of individuals. The concept of this gathering also encourages and enables expression of creativity, innovative thinking, and development of the ability to solve complicated problems by applying scientific methods and approaches.

The second event, the 24th International Conference of Physics Students, was organized in Split, the second-largest urban centre in Croatia, a historical town and an important harbor in the central part of the Adriatic coast founded in the 6th century BC. This conference gathered almost 500 students from 22 countries worldwide. The students' conference is unique as a physics conference, since it primarily gathers students of physics and only few senior researchers are invited as guests. The approach of this conference is to provide participants with numerous opportunities for an intensive communication, through active participation in presentations and scientific discussions among participants coming from various

countries and continents.

The third event, the 41st International Physics Olympiad in 2010 was held in Zagreb, the capital of the Republic of Croatia (fig. 6). The earliest mentioned settlement on today's position of the city was a Roman town existing as early as in the 1st century AD, while the first recorded appearance of the name Zagreb is dated 1094. The Olympiad is an international individual competition for high-school students. Each year it brings together teams of the brightest physics students from around the world for a week of intense physics problems. The competing students are given both theoretical and experimental exams that touch on a wide range of physics subjects. This Olympiad gathered 370 high-school students representing 80 different countries and various parts of the world. A numerous contingent of the CPS members contributed to the success of this event working hard not only on the nine days during which the event took place, but throughout the one-year long preparation period. We consider that this event was of extremely high importance not only for the Croatian academic community but also for the whole country. For this

reason we are thankful to the Ministry of Science, Education and Sports, and the City of Zagreb, as well as to other sponsors from Croatia and Europe (SIF and EPS), for their valuable support without which this event could not have been organized.

CPS is a member of European Physical Society (EPS) and the International Union of Pure and Applied Physics (IUPAP) and through its members participates in their activities. CPS participated in the EPS project World Year of Physics in 2005 and since 2007 is active in the EPS project "The implementation of the Bologna Process into Physics Studies in Europe".

6 Motivation and priorities in the coming years

Presently it is very critical that we all pay greater attention to the important issue on how should we teach physics to young people and future generations who are going to build the civilization of the 3rd millennium. Within the efforts to support this process and to promote an interactive science education, including a rigorous training in conceptual and analytical thinking, CPS has created and has been implementing several projects as presented above. Another goal of equal merit is to persist making substantial parallel efforts to achieve a better support of research. It is exactly the synergy of improved education (scientific thinking) and research that guarantees a safe and prosperous future.

We consider that the task to help develop a scientific mind and thinking among the young already at the elementary and high-school level should continue to be one of the priority goals of the Society since an individual's level of creativity and innovative scientific thinking is critical for a long-term sustainability of our (Croatian) society, and also for many other countries, specially those in developing regions of the world. This

becomes evident given that nowadays our world faces many critical scientific and technological challenges, such as climate change, limited water, energy and other natural resources, unbalanced development, current economic crisis, and many other problems of fundamental importance for the future of our planet and humankind. So there is an increasing need for well-informed and scientifically educated citizens, for the use of accurate scientific information in development of sustainable and socially responsible public policies and practices, and for promoting participation of all key stakeholders, including a more active role of citizens, experts and scientists in decision-making processes. It is rather evident that even if the students do not pursue scientific research subsequently, still many of them will be able to use the skills they gained during their high-school education and through events like competitions in physics at national and international level, and will be better prepared for their future studies and professional careers.

The task to promote physics and sciences turns to be a challenging one nowadays. The CPS projects like E-school and Physics Express, edition of popular magazines for teenager students and the Summer School for Young Physicists, among others, support this goal strongly. CPS hopes that the Croatian government as well all other governments worldwide understand the need for a strong science base as critical and essential for our future economic prosperity and well-being. Namely, the global economy, we live in, is changing the nature of work and the kinds of job young people will enter, and consequently demands scientifically literate workforces. It is somehow paradoxical that nowadays we testify how physics declines in public prestige although there is a historical record, a particular one throughout the 20th century, that explains the importance

of basic, curiosity-driven research for economic prosperity and justifies believing this should continue to be the case. This implies that we all need to support a common aim to achieve high levels of ambition for the education of children and young people in science. This also implies communicating physics both to physics community and to wider public and to increase the awareness and understanding about the relevance of physics in broad areas ranging from energy and environment to medicine and health.

CPS is a proud member of EPS and IUPAP. We are confident that in this way and only together we can forge an effective partnership for the benefit of science, education and humankind worldwide. And perhaps most importantly of all we need to understand and feel that physics and a scientifically based approach to life represent a basic tool which can help humankind to create a new, just and meaningful world.

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