

## The Balkan Physics Olympiad – a little piece of history

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Balkan Physical Union has set major objectives in promoting Physics, science education and cooperation between the Balkan countries. Based on these existing aims, the Council held in Sofia in 2018 launched the idea of organizing the Balkan Physics Olympiad, as a strong platform for promoting the excellence in Physics proved by junior high school students. After a first edition held in 2019 in Thessaloniki (Greece), other two editions took place online, in 2020 and 2021, under the organization of Romania and Bulgaria. With notable results after the three editions so far, with a steady increase in the number of participating countries, it can be said that the Olympiad wins in recognition, prestige, and interest. The aim of this paper is to present a short history of this unique competition, but also of its development perspectives.

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## 1. The Beginnings

Soon after it was decided to establish a new international physical society, *i.e.*, the Balkan Physics Union<sup>1</sup> (BPU), in 1985, an international contest in Physics, held under its auspices, was launched. Its name was Balkan Olympiad in Physics. The competition was dedicated to high-school students with a passion for Physics with the purpose to offer them a new, regional, platform to manifest their competence in Physics, both as theoretical problem solvers, as well as experimentalists<sup>2</sup>. The first edition of the Olympiad took place in Plovdiv (Bulgaria), in May 3-10, 1986, and the second edition in Bucharest (Romania), in May 1987. Unfortunately, after only two editions, the competition ceased to exist<sup>3</sup>.

## 2. The New Beginnings

At the BPU Council held in Sofia in 2018, the idea (presented by the BPU president Goran Djordjevic and the executive secretary Kostas Vourlias) of organizing the Balkan Physics Olympiad was again enunciated, as a platform on which the gifted high school students in the participating countries could assert themselves. This generous idea was enthusiastically approved and the Hellenic Physical Society, Greece, the Department of Physics of the Aristotle University of Thessaloniki, the Ministry of Macedonia and Thrace, and the Regional Government of Central Macedonia assumed the role of the local organizers of the first edition of the new Olympiad, to be held in 2019.

The new Balkan Physics Olympiad, also known as BPO, after its acronym, brought new and necessary features to the competition. Chief among them is that BPO is addressed to junior students, *i.e.* students 17 years old or less<sup>4</sup>. This made BPO the only Physics Competition in Europe dedicated to juniors. By giving the juniors the opportunity to participate in their first international Physics competition, BPO has the gift to boost the juniors' confidence and to help prepare them for the international contests where they will also meet senior students.

### Aims

The Balkan Physics Olympiad's aims are:

- To offer an opportunity for an exciting Physics competition among junior students;
- To challenge, encourage and help develop Physics education in all participating countries;
- To foster friendly relationships among students and teachers of the participating countries;
- To create opportunities for the exchange of information about school syllabi and practices within the participating countries;

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<sup>1</sup>In November 1985, at the 8th Congress of the Union of Yugoslav Societies of Mathematicians, Physicists and Astronomers (UYSMIPA), held in Pristina (Yugoslavia), two professors, A. Milojevic (Yugoslavia) and Ioan Ursu (Romania) proposed the foundation of BPU.

<sup>2</sup>The Olympiad consisted in two rounds: a theoretical, as well as an experimental one.

<sup>3</sup>The problems and their solutions form the "old" Balkan Olympiad in Physics are already prepared and will soon be published to complete the BPO collection and to recount a piece of recent History of BPU.

<sup>4</sup>More precisely, for the first edition of BPO, held in 2019, the participant students must have had the date of birth after January the 1<sup>st</sup>, 2002.

- To offer a set of lecturers and workshops suitable and adjusted for younger students;
- To create a unique opportunity for students to gain valuable experience for future participation in the International Physics Olympiad (IPhO);
- To initiate discussions and cooperation regarding the education in Physics for the secondary schools of Balkan countries;
- To promote Physics, science and education in general.

### General rules

Among the rules governing each edition of BPO, the following are of general interest:

- Each participant country has a team of up to 4 students<sup>5</sup> (a complete team) and up to two teachers (a leader and a deputy leader);
- The students are selected from the national competitions held in their countries;
- The contest is individual, has one test, consisting of 4 questions, one of which should have an experimental character;
- The BPO can only be held in one of the BPU member countries<sup>6</sup>;
- The host country may also invite students/ teams from other countries, named guest teams;
- The official language of the BPO is English.
- Participant students may solve the problems in the official language of their country or in English. The team leader of each country has the task of translating the contest questions in the official language of their country.

### The Scientific Committee

The Scientific Committee oversees the smooth running of the Olympiad and is governed by the following rules:

- The Scientific Committee consists of a chairman (representing the host country) and members, one from each the other participating countries;
- The chairman of the BPO Scientific Committee is appointed by the BPU Executive Committee based on the proposal from the host country
- The tasks of the Scientific Committee are:
  - to establish the curriculum,
  - to select problems and to prepare the test<sup>7</sup>,

<sup>5</sup>The old Balkan Olympiad in Physics had 5 students in each participating team.

<sup>6</sup>The member countries of BPU are, in alphabetical order: Albania, Bulgaria, Cyprus, Greece, North Macedonia, Republic of Moldova, Montenegro, Romania, Serbia, and Turkey.

<sup>7</sup>Each country can propose up to four problems (including their solutions) and they should be sent to the Chairman of the Scientific Committee up to a deadline set by the host country.

- to evaluate the solutions of the contestants,
- to decide upon the final scores and awards.

### The awards

At the end of the competition, there is an awards ceremony, which is part of the closing ceremony. The rules established for awarding the medals and diplomas are:

- Each participating student receives a Certificate of Participation;
- There are 3 categories of prizes to be awarded:
  - First prize (gold medal, for the best 10
  - Second prize (silver medal, for the next 15
  - Third prize (bronze medal, for the next 25
  - Honorable Mention (for the next 17
- The Scientific Committee may propose special prizes (*e.g.* for the most original solution of any of the theoretical problems or for the experimental one) and the final decision is given by the BPU Executive Committee prior to the awards ceremony.

### The syllabus

Before the start of the first edition of the BPO, the contest syllabus [1] was established as the cross-section of the high-school national curriculum in Physics for all the 10 countries acting as members of BPU. The result, which is emphasized in Appendix 1, contains topics from Classical Mechanics and Electricity. The syllabus was unchanged for the first four editions of BPO, although discussions about its update are currently ongoing.

## 3. The First Balkan Physics Olympiad (BPO1 - 2019)

As mentioned above, the first edition of the new BPO was organized in 2019 and took place between 14 and 18 of July 2019, in Thessaloniki, Greece, under the auspices of the Balkan Physical Union and supported by the European Physical Society (EPS).

In their invitation, the organizers promised the participants a "great festival of knowledge, love for physics and friendship among Balkan people" and they kept the promise in spades. The entire Olympiad has been held in the beautiful campus of the American Farm School from Thessaloniki. At this event there were 37 students present from 11 countries, 8 of which were BPU member countries. The 3 guest countries brought 8 students in the competition (*see* Appendix 2, Table 1).

Besides the competition itself and the social program (including a guided tour of the American Farm School campus, a city tour, an excursion to Aqua park, and a star gazing session organized by "The Friends of Astronomy Club of Thessaloniki"), the teams had the opportunity to participate to a rich series of 10 conferences on various topics, opened by professor Goran Djordjevic, the BPU president. All the conferences are listed in Table 2, Appendix 2.

The Local Organizing Committee was chaired by dr. Kostas Vourlias, the executive secretary of BPU [2], and the Scientific Committee was presided by prof. Kostas Kleidis, Head of the Mechanical Engineering Department, International Hellenic University.

At the end of the competition, 25 students were awarded medals and Honorable Mentions, as follows: 4 gold medals, 7 silver medals, 7 bronze medals and 7 Honorable Mentions. The South-eastern European Network in Mathematical and Theoretical Physics SEENET-MTP and its Centre provided a trophy for the "absolute" winner. The distribution of medals and Honorable Mentions by country is given in Table 3, Appendix 2. The list of participants, students, leaders, organizers and Committee members, as well as the names of laureates can be found on the competition webpage [3]. A very nice and well detailed presentation of the first Olympic event appeared in the press organ of the European Physical Society shortly after its conclusion [4].

#### 4. The Second Balkan Physics Olympiad (BPO2 - 2020)

The second edition of BPO was organized in 2020 amid the coronavirus pandemic. Because BPO is an international contest with a relatively small number of participants, the BPU Executive Committee agreed with the proposal made by the Local Organizing Committee to hold the Olympiad in an online format. In this way the students intending to participate could keep a high level of motivation. Also, it was important to avoid a new interruption of this contest. Under these conditions, BPO2 - 2020 took place online, between 22 and 31 of October 2020, organized by University of Craiova, Romania, under the auspices of the Balkan Physical Union (BPU), and supported by the European Physical Society (EPS). The competition day was 24<sup>th</sup> of October, 2020 and the Awards Ceremony took place on the 31<sup>st</sup> of October, 2020.

At this edition of BPO the number of the participant students increased to 47, representing 12 countries. Compared to the previous edition, the only additional participating country was Republic of Moldova. More details can be seen in Table 1.

The Local Organizing Committee was chaired by prof. Radu Constantinescu from University of Craiova, the vice-president of BPU [5], and the Scientific Committee was presided by assoc. prof. Sebastian Popescu, from "Alexandru Ioan Cuza" University of Iasi, Romania.

At this edition of the Olympiad, besides the online format, there were two elements of novelty. One was the double evaluation of the students' solutions, by the official graders, as well as by the team leaders, acting as the national graders. The second was the introduction of a moderation process, each team being represented by its team leader. Each session was dedicated to a competition question and for each question there were discussions on each case where there were differences between the grades given by the leaders and those given by the official graders in order to avoid any errors and to award the appropriate number of points for each correct reasoning of the participant students.

At the end of the competition, 34 students were awarded medals and Honorable Mentions, as follows: 5 gold medals, 7 silver medals, 14 bronze medals and 8 Honorable Mentions. The distribution of medals and Honorable Mentions by country is given in Table 3, Appendix 2. The list of participants, students, leaders, organizers and Committee members, as well as the names of laureates can be found on the competition webpage [6].

## 5. The Third Balkan Physics Olympiad (BPO3 - 2021)

The third edition of BPO was organized in 2021, again, during the coronavirus pandemic. Under these conditions, BPO3 - 2021 took place between 23<sup>rd</sup> of September and the 2<sup>nd</sup> of October 2021, organized online by Union of Physicists in Bulgaria, under the auspices of the Balkan Physical Union (BPU), and supported by the European Physical Society (EPS). The competition day was 25<sup>th</sup> of September 2021 and the Awards Ceremony took place on the 2<sup>nd</sup> of October, 2021.

At this edition of BPO the number of the participant students increased to 57, representing 15 countries. All the countries that participated the previous year were also present at this edition of the Olympiad. In addition to these, 3 new countries were represented by their selected teams: one member of BPU (Albania), as well as two new guest countries - Iran and Kazakhstan (*see* Table 1, Appendix 2).

The Local Organizing Committee was chaired by prof. Alexander Dreischuh – professor at the “St. Kliment Ohridski” University of Sofia, Bulgaria, and the Scientific Committee was presided by dr. Maya Zhekova, from the same university [7]. For all the BPO editions held until now, the members of the International Organizing Committee were: prof. Goran Djordjevic – BPU President (chairperson), prof. Radu Constantinescu – BPU Vice-president, dr. Kostas Vourlias – BPU Executive Secretary, and prof. David Lee – EPS Secretary General.

At the end of the competition, after the moderations, 42 students were awarded medals and Honorable Mentions, as follows: 6 gold medals, 9 silver medals, 16 bronze medals and 11 Honorable Mentions. The distribution of medals and Honorable Mentions by country is given in Table 3, Appendix 2. The list of participants, students, leaders, organizers, and Committee members, as well as the names of laureates can be found on the competition webpage [8].

## 6. In the meantime...

The next edition of the competition, BPO4 - 2022, was held between the 7<sup>th</sup> and the 9<sup>th</sup> of October, 2022, in Nicosia, Cyprus. It was organized by the Cyprus Physicists Society, under the auspices of BPU and supported by EPS, Cyprus Ministry of Education, Culture, Sport, and Youth, and by the Physics Department of the University of Cyprus. This edition of the competition was held in a hybrid format, the members of the Scientific Committee traveled to Cyprus, while the students participated online. The Scientific Committee was chaired by Fotios Ptochos, Associate Professor with the Physics Department of the University of Cyprus, whereas the Local Organizing Committee by Dr. Demetrios Philippou, Cyprus Physicist Society [9]. More information about this edition of the competition can be found on the dedicated webpage [10].

## 7. Conclusions

After three editions of the new Balkan Physics Olympiad, during which the competition steadily grew, it became one of the well-established international Physics competitions, addressed to the high-school junior students from Balkans able to obtain high performance. Balkan Physics Olympiad proved to be a veritable launching ramp for the International Physics Olympiad, many of its laureate students obtaining valuable results at the latter competition (*see* Table 4 in Appendix 2).

The fact that the number of guest countries increased, adding countries, the national teams of which are at the top of the rankings of all the important Physics Olympiads, provides an additional argument for the growing importance of Balkan Physics Olympiad as a unique international competition – probably the only one dedicated to juniors.

At the end of the 3rd Balkan Physics Olympiad, the president of Balkan Physics Union proposed that starting with the next edition (2022), to award a special prize for the best result obtained by a girl in the competition. The executive Committee of Balkan Physics Union, as well as the Scientific and the Local Organizing Committees of the 2021 edition of the Olympiad embraced the proposal. Among the reasons, this prize would emphasize that smart girls choose Physics and are very good at it, that Physics is unisex and cool for everybody - girls and boys alike and, also, that Balkan Physics Union equally cherishes the accomplishments of all students, regardless of gender!

## References

- [1] <https://balkanphysicalunion.info/wp-content/uploads/2019/06/Balkan-Physics-Curricula-v.2.0-final.pdf> (accessed: 23.08.2022).
- [2] <https://balkanphysicalunion.info/?p=1056> (accessed: 23.08.2022).
- [3] <https://balkanphysicalunion.info/?p=826> (accessed: 23.08.2022).
- [4] <http://www.epsnews.eu/2019/11/the-first-balkan-physics-olympiad-bpo2019/> (accessed: 23.08.2022).
- [5] <https://balkanphysicalunion.info/?p=1546> (accessed: 23.08.2022).
- [6] <https://balkanphysicalunion.info/?p=1518> (accessed: 23.08.2022).
- [7] <https://balkanphysicalunion.info/?p=2130> (accessed: 23.08.2022).
- [8] <https://balkanphysicalunion.info/?p=2064> (accessed: 23.08.2022).
- [9] <https://balkanphysicalunion.info/?p=3141> (accessed: 23.08.2022).
- [10] <https://balkanphysicalunion.info/?p=3004> (accessed: 23.08.2022).

## A. Appendix 1: Syllabus for Balkan Physics Olympiad (2019-2022)

### A.1 Classical Mechanics

**Measurement:** Fundamental quantities and derived quantities; Conversion of units; Significant digits of numbers.

**Motion in One Dimension:** Position, velocity, and acceleration; Motion diagrams.

**Motion in Two Dimensions:** Position, displacement, velocity, and acceleration. Projectile motion: the trajectory of a projectile as combination of horizontal motion with constant velocity and vertical motion with constant acceleration; A body projected horizontally; Height and range of a projectile.

**The Laws of Motion:** The concept of force; Newton's first law; Newton's second law; Newton's third law; Forces of friction; Free-body diagram.

**Energy of a System:** Work done by a constant force; Kinetic energy; Kinetic energy and the work–kinetic energy theorem; Potential energy of a system; Conservative and non-conservative forces; Relationship between conservative forces and potential energy; Mechanical energy of a system; Changes in mechanical energy for conservative and nonconservative forces; Mechanical energy of a block–spring system.

## A.2 Electricity

Electric current; electric resistance; Ohm's law; electromotive force; resistors in series and parallel; equivalent resistance in simple circuits; electric power.

## B. Appendix 2: Synoptic tables

No.	Country	BPO2019	BPO2020	BPO2021
<b>BPU members</b>				
1	Albania	—	—	4
2	Bulgaria	4	4	4
3	Cyprus	4	4	4
4	Greece	4	4	4
5	Moldova	—	4	4
6	Montenegro	3	4	1
7	North Macedonia	2	4	4
8	Romania	4	4	4
9	Serbia	4	4	4
10	Turkey	4	4	4
<b>Guest Countries</b>				
1	Bosnia and Herzegovina	2	4	4
2	Slovenia	2	3	4
3	Turkmenistan	4	4	4
4	Iran	—	—	4
5	Kazakhstan	—	—	4
	<b>TOTAL</b>	37	47	57



No.	Country	BPO2019				BPO2020				BPO2021			
		Au	Ag	Bz	HM	Au	Ag	Bz	HM	Au	Ag	Bz	HM
	<b>BPU members</b>												
1	Albania	-	-	-	-	-	-	-	-	-	-	-	1
2	Bulgaria	-	3	1	-	1	2	1	-	-	2	1	1
3	Cyprus	-	1	2	1	-	-	2	-	-	-	2	-
4	Greece	-	1	1	1	-	-	1	1	-	-	1	2
5	Moldova	-	-	-	-	-	1	3	-	1	-	2	-
6	Montenegro	-	-	-	1	-	-	-	3	-	-	1	-
7	North Macedonia	-	-	-	1	-	-	1	1	-	2	2	-
8	Romania	3	1	-	-	2	1	1	-	3	1	-	-
9	Serbia	1	1	2	-	1	1	-	1	-	3	1	-
10	Turkey	-	-	-	1	-	-	-	-	-	-	1	-
	<b>Guest Countries</b>												
1	Bosnia and Herzegovina	-	-	-	1	1	-	2	1	1	-	1	2
2	Slovenia	-	-	1	1	-	2	1	-	-	-	1	1
3	Turkmenistan	-	-	-	-	-	-	2	1	-	-	-	2
4	Iran	-	-	-	-	-	-	-	-	-	-	1	2
5	Kazakhstan	-	-	-	-	-	-	-	-	1	1	2	-
	<b>TOTAL</b>	4	7	7	7	5	7	14	8	6	9	16	11

No.	Presenter	Topic
1	Goran Djordjevic	Gravitational waves and black holes
2	Georgios Mavromanolakis	Studying Earthquakes: Locating the epicenter
3	Costas Zoukidis	The effect of nano bubbles (AgroNB) in the ag production
4	Tuncay Tunc	X-ray crystallography for high school students
5	Sebastian Popescu	Physics Breakthroughs of 2018
6	Emmanuel Chaniotakis	Studying Earthquakes, The Sound of Earth
7	Viktor Urumov	Chapters of Physics and IPhO - International Physics Olympiads
8	Dragoljub Dimitrijević	Cosmology of the Early Universe
9	Stevan Đurđević	Quantum Hall Effect
10	Blaz Zmazek	Difference vs. differential equations

Table 4: Results obtained by the laureates of BPO at IPhO - International Physics Olympiad

No.	Name of the laureate	Country	Results at BPO	Results at IPhO
1	Vlad Ștefan OROS	Romania	BPO1-2019: Au BPO2-2020: Au	IPhO2021: Au IPhO2022: Au
2	Tudor Gabriel MOCIOI	Romania	BPO1-2019: Au	IPhO2021: Au
3	Momcilo TOSIC	Serbia	BPO1-2019: Au	IPhO2021: HM
4	Aleksandar ILIEV	Bulgaria	BPO1-2019: Ag	IPhO2021: Bz
5	Viktor VASILEV	Bulgaria	BPO1-2019: Ag	IPhO2021: Bz
6	Dusan BEGUS	Serbia	BPO2-2020: Au	IPhO2021: Ag
7	Aleksandar PRODANOV	Bulgaria	BPO2-2020: Au	IPhO2021: Ag IPhO2022: Au
8	Marko VUCIC	Bosnia and Herzegovina	BPO2-2020: Au	IPhO2021: Bz IPhO2022: Bz
9	Vasil NIKOLOV	Bulgaria	BPO2-2020: Ag	IPhO2021: Ag
10	Yavor YORDANOV	Bulgaria	BPO2-2020: Ag	IPhO2021: Bz IPhO2022: Bz
11	Ștefan NICOV	Moldova	BPO2-2020: Ag	IPhO2021: Bz IPhO2022: Ag
12	Domen LISJAK	Slovenia	BPO2-2020: Ag	IPhO2021: Bz IPhO2022: Bz
13	Aleksa DJORDJEVIC	Serbia	BPO2-2020: Ag	IPhO2022: Bz
14	Marius FRIJA	Moldova	BPO2-2020: Ag	IPhO2021: Bz IPhO2022: Bz
15	Margulan ISMOLDAYEV	Bulgaria	BPO2-2020: Ag BPO3-2021: Ag	IPhO2022: Ag
16	Fatih ŽGALJ	Bosnia and Herzegovina	BPO2-2020: Bz	IPhO2021: Bz
17	Majkl GEORGIEVSKI	North Macedonia	BPO2-2020: HM BPO3-2021: Ag	IPhO2021: HM IPhO2022: HM
18	Dženan MIDZIC	Bosnia and Herzegovina	BPO2-2020: HM BPO2-2021: Au	IPhO2022: HM
19	Andrei-Darius DRAGOMIR	Romania	BPO3-2021: Au	IPhO2022: Au
20	Alexandru MOMOIU	Romania	BPO3-2021: Au	IPhO2022: Au
21	Jan STOJANOVSKI	North Macedonia	BPO3-2021: Ag	IPhO2021: HM
22	Anja SUSNJAR	Serbia	BPO3-2021: Ag	IPhO2022: HM
23	Vuk HIP	Serbia	BPO3-2021: Ag	IPhO2022: Bz
24	Emilija NIKOLOVSKA	North Macedonia	BPO3-2021: Bz	IPhO2022: Bz