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**An Overview of Physics Olympiads and Tournaments
at gymnasial and university level, national and international**

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An Overview of Physics Olympiads and Tournaments at gymnasial and university level, national and international

Antoine Pochelon, EPF Lausanne, Lukas Gallmann, ETH Zürich, Cyrille Boinay, WO, Bern, Samuel Byland, MNG Rämibühl, Zürich, Evgenii Glushkov, EPF Lausanne

At a pivotal age where important choices have to be made, physics olympiads and tournaments offer to young women and men - from the gymnasial level to university, individually or in teams - the possibility to measure themselves with physics. It gives them also the opportunity to meet other young people in a stimulating atmosphere. The aim of this overview is to show the various possibilities for young people with an interest in physics.

Age class	National	International	Registration to next national selection
Gymnasial, High-school , Berufsschule, Ecole des métiers < 20 years	SwissPhO Physics Olympiad	IPhO International Physics Olympiad EuPhO European Physics Olympiad	Registration and participation directly under www.physics.olympiad.ch 19 Aug. 2019 - 30 Sept. 2019
Secondary school (last participation in the year of their graduation)	SYPT Swiss Young Physicists' Tournament	IYPT International Young Physicists' Tournament	March 2020 (dates to be announced on www.sypt.ch), probably SYPT Physics Week (supervised preparation) in February 2020
Younger students 12 to 16 years of age	SYNT Swiss Young Naturalists' Tournament	IYNT International Young Naturalists' Tournament	March 2020 (dates to be announced on www.synt.ch), probably SYNT Workshop (supervised preparation) in February 2020
University students, Bachelor & Master level	Swiss Selection for the Int. Physicists' Tournament	IPT International Physicists' Tournament	December 2019. Information and registration (updates in September): switzerland.iptnet.info website for next IPT available in August (see iptnet.info)

Physics Olympiad in Switzerland

The science olympiads have their roots in Central European school competitions. Once UNESCO and several other pioneers became involved, the number of participants and professions represented increased. The first International Physics Olympiad was held in 1967. Switzerland has participated since 1995, with considerable success.

National elimination rounds involving a multi-stage selection and training process are held to determine the five most promising new talents, who then go on to participate in the European and International Olympiad. In Switzerland and Liechtenstein this process is run by nine specialist associations (biology, chemistry, computer science, economics, geography, mathematics, physics, philosophy and robotics), which together form the umbrella association of the **Science Olympiad**. The associations are funded through donations. Young people do not have to pay to participate in the Science Olympiad, and the association members work on a voluntary basis. All motivated students at secondary education II level are eligible to participate.

The Physics Olympiad embodies a unique spirit of engagement, passion for science and open-mindedness, as clearly demonstrated by the number of volunteers involved. Over 800 participants per year are able to network and communicate with people beyond language and cultural borders. For the young people involved, the Physics Olympiad is a one-off, unforgettable and exciting experience. Furthermore,

the Olympiad takes place during a crucial decision-making phase of the students' lives and helps to generate perspectives within science. See also p. 55.

The **International Physics Olympiad (IPhO)** is an annual physics competition for high school students under the age of twenty. It is one of the seven International Science Olympiads. The first IPhO took place in Warsaw, Poland, in 1967. Today, 75 countries from five continents participate. In 2016, the IPhO was hosted by the University of Zürich [1].

The **European Physics Olympiad (EuPhO)** is a contest for Secondary II students. The third edition in 2019 was hosted by the University of Latvia in Riga. EuPhO is the little sister of the International Physics Olympiads [2].

Swiss Physics Olympiad (SwissPhO)

www.physics.olympiad.ch

President: Sebastian Käser

Science Olympiad - Wissenschafts-Olympiade,
(supporting all domain olympiads)

www.science.olympiad.ch

President: Michele Dolfi

Contact address:

Science Olympiad
Hochschulstrasse 6
CH-3012 Bern

info@olympiad.ch
+41 31 631 39 86

International Physics Olympiad (IPhO) European Physics Olympiad (EuPhO)

IPhO	Olympiad's Location	Result of Swiss Team
2019	Tel Aviv, Israel	(7-15 July)
2018	Lisbon, Portugal	-
2017	Yogyakarta, Indonesia	B : 2, H : 3
2016	Zürich, CH [1]	B : 1, H : 4
2015	Mumbai, India	B : 2, H : 3
2014	Astana, Kazakhstan	S : 2, B : 4
2013	Copenhagen, Denmark	B : 2, H : 3
2012	Tallinn, Estonia	S : 1, B : 2, H : 2

Eu-PhO	Olympiad's Location	Result of Swiss Team
2019	Riga, Latvia	H : 3
2018	Dolgoprudny, Moscow, Russia [2]	H : 1

B: bronze medal, **S**: silver medal, **H**: honorable mention

Websites:

IPhO: <http://ipho.org/>

en.wikipedia.org/wiki/International_Physics_Olympiad

EuPhO: <https://www.facebook.com/eurpho/>

<https://eupho2019.lv/>



Physics connects young students from all over the world: International Physics Olympiad 2016 in Switzerland (Credits: Roman Ernst)



Participants of the 2019 finals of the Swiss Physics Olympiads. (Photo: Markus Meier)

Swiss and International Young Physicists' Tournament (SYPT, IYPT)

The International Young Physicists' Tournament (IYPT), sometimes also referred to as the „Physics World Cup“, is

a scientific competition among secondary school students interested in physics. A so-called *Physics Fight* lines up three teams of five students each. They in turn take the roles of *reporter* (presents the solution to one of the given IYPT problems), *opponent* (criticises the solution and leads the discussion with the reporter), and *reviewer* (reviews the contributions of the reporter and opponent). All three teams get scores from a jury of experts.

The 17 *IYPT problems* are published about a year before the tournament. They are open-ended questions chosen such that no single or clear correct solution exists. Each presentation will show different aspects of the problem. Careful preparation and creativity in solutions are as important in order to receive high grades from jurors as are correct school physics and mathematics.

Swiss Young Physicists' Tournament (SYPT) International Young Physicists' Tournament (IYPT)

Aimed age class: secondary school

International Tournaments:

IYPT	Tournament's Location	Result of Swiss Team
2018	Beijing, China	Bronze Medal (10 th of 32)
2017	Singapore	Bronze Medal (13 th of 30)
2016	Ekaterinburg, Russia	Gold Medal (3 rd of 29)
2015	Nakhon Ratchasima, Thailand	Bronze Medal (11 th of 27)
2014	Shrewsbury, UK	Bronze Medal (14 th of 28)
2013	Taipei, Taiwan	Gold Medal (3 rd of 26)
2012	Bad Saulgau, Germany	Silver Medal (7 th of 28)

The first participation of a Swiss team at the IYPT dates back to 2003 (Uppsala, Sweden: Switzerland 16th of 23). The association "Pro International Young Physicists Tournament in der Schweiz" (Pro IYPT-CH) was founded in 2004. It hosted the IYPT 2005 in Winterthur, Switzerland and has organised the national tournament (SYPT) since 2008.

Websites:

SYPT: www.sypt.ch

IYPT: www.iypt.org

IYPT 2018 (Beijing, China): www.iyptc.cn

IYPT 2019 (Warsaw, Poland): www.iypt.pl

Number of countries at international tournament: 30 (still increasing)

President of Pro IYPT-CH:

Samuel Byland, MNG Rämibühl, Rämistrasse 58, 8001 Zürich, samuel.byland@sypt.ch

Team leaders for IYPT 2018:

Emilie Hertig (emilie.hertig@sypt.ch) and Eric Schertenleib (eric.schertenleib@sypt.ch)

President of IYPT: Dr. Martin Plesch

Samuel Byland has been a member of the IYPT Executive Committee since 2014.



Team participating at the SYPT 2019. Discussing the solution presented by another team is an essential part of a "Physics Fight".

© Cyrill von Krähenbühl

In preparing for the IYPT students do not just learn how to tackle difficult physics problems, but also how to work in a team, use computers to collect and analyse data, present scientific results and debate. The Physics Fights are in English, helping the students prepare for their future at university, where an increasing number of lectures and seminars are held in English.

The Swiss Young Physicists' Tournament (SYPT) is a national tournament in the spirit of the IYPT. Important differences are the smaller teams (three instead of five students) and the fact that participants can choose the problem they want to present. At the SYPT more than twenty teams from all parts of Switzerland meet for two days, typically at a university. Although it is a physics competition, the tournament is much more than that. Participants greatly enjoy meeting other likeminded students and there is enough time to get to know each other.

While preparing for the SYPT, the participants work on their problem at their own school and/or at an SYPT Physics Week, where they are supported by experienced coaches. At the SYPT each participant has once the role of the reporter, opponent and reviewer. In the final fight the most successful three teams aim for the title of the *SYPT Champion*.

The best participants are invited for the *SYPT Team Qualification* where they try to get one of the five spots in the Swiss team for the IYNT.

Swiss and International Young Naturalists' Tournament (SYNT, IYNT)

The International Young Naturalists' Tournament (IYNT), is a science competition, modelled after the IYPT and aimed at younger students, 12 to 16 years of age. A so-called *Science Fight* lines up three teams of six students each. They in turn present and discuss their solutions to one of the 23 given IYNT problems, criticise the other team's solution and review the performances of the other teams. All three teams get scores from a jury of experts.

17 of the IYNT problems are published about a year before the tournament. They are divided into three groups for the first three rounds. In the first two groups one usually finds problems from all natural sciences, but also from mathematics and computer science. They invite for both theoretical and experimental investigations and offer the students a

first glimpse at scientific work. To receive good grades from the jurors they should apply their scientific knowledge and demonstrate an understanding of scientific procedures.

The third group of problems is titled "Invent Yourself", where students are presented with a topic and should phrase their own research question, which they then work on. The remaining six problems are published at the beginning of round four. They need to be solved and presented within 45 minutes with no aid from the tutors being allowed.

In preparing for the IYNT students do not just learn how to conduct scientific experiments, but also how to work in a team, use computers to collect and analyse data, present scientific results and debate. The Science Fights are in English, helping the students prepare for their future at university, where an increasing number of lectures and seminars are held in English.

The Swiss Young Naturalists' Tournament (SYNT) is a national tournament in the spirit of the IYNT. Important differences are the smaller teams (two instead of six students), the fact that participants can choose the problem they want to present and the omitted review. At the SYNT more than twenty teams from all parts of Switzerland meet to present and discuss their findings, typically at a university. Although it is a science competition, the tournament is much more

Swiss Young Naturalists' Tournament (SYNT) International Young Naturalists' Tournament (IYNT)

Aimed age class: students aged 12 to 16 (by year of birth)

International Tournaments:

IYNT	Tournament's Location	Result of Swiss Team
2018	Tbilisi, Georgia	Gold Medal (1 st of 15)
2017	Nanjing, China	Gold Medal (2 nd of 18)

The Swiss team participated twice at the IYNT and could qualify for the final on both occasions. The association "Pro International Young Physicists' Tournament in der Schweiz" (pro IYPT-CH) was founded in 2004 and has organised the national tournament (SYNT) since 2017. It has also organised the SYNT's older sibling, the SYPT since 2008.

Websites:

SYNT: www.synt.ch

IYNT: www.iynt.org

Number of countries at international tournament: so far 17 different nations (still increasing)

President of Pro IYPT-CH:

Samuel Byland, MNG Rämibühl, Rämistrasse 58, 8001 Zürich, samuel.byland@synt.ch

Team leaders for IYNT 2018:

Richard Fitzpatrick, Florian Koch (florian.koch@synt.ch)

President of IYNT: Dr. h.c. Evgeny Yunosov

than that. Participants greatly enjoy meeting other likeminded students and there is enough time to get to know each other.

While preparing for the SYNT, the participants work on their problem at their own school and/or at an SYNT Workshop, where they are supported by experienced coaches. At the SYNT each participant has once the role of the reporter and opponent. In the final fight the most successful teams aim for the title of the SYNT champion. What is more, the best participants get the chance to represent Switzerland at the IYNT.

International Physicists' Tournament

The International Physicists' Tournament (IPT) is the biggest international competition in physics for teams of university students, which encourages the ability to innovate and communicate to solve complex physics problems that we see in everyday life. IPT unites hundreds of young scientists from around the world, who are passionate about physics, more than 150 of which participate each year in the International Final. Around 20 nations are represented annually, each one sending their best team to the tournament.

Preparation begins 8 months before the tournament (typically, at the end of August), when teams, consisting of 4-6 students each, receive a list of 17 problems which have no known solutions in scientific literature. The problems are usually connected to everyday phenomena that many of us have observed in our daily lives. However, they have to be treated on a high scientific level, which adds to their complexity. For each problem, the teams try to create a theoretical model that they further verify with experiments and simulations, analyse the obtained data and present their study in the best way possible. This very much resembles the shape of an independent research project [3].

The tournament is composed of four preliminary rounds, a semi-final and a final. During each round, each team not only presents its solution to one of the problems but must also debate on its validity with an opposing team. This helps students build the skills of defending their models and experimental procedures. A third team is responsible for the analysis of strengths and flaws of the other two teams. The roles vary throughout a round, allowing each team to present a solution, oppose another team and, summarize the debate happening between the two other teams.

The IPT lets you get hands-on research experience early in your scientific career. In contrast to the standard lab exercises, it provides you with the unique freedom to choose your own way of tackling an open physics problem – from literature study to data analysis – exactly like research is carried out in the scientific world! You will be working in a team with like-minded peers on various physics experiments (which are, usually, pretty fun to do!), learning to present your research and getting experience in scientific debates. You will also get an opportunity to publish the results of your research after the IPT in scientific journals. Last, but not least, you will largely expand your network of contacts in the scientific community and enjoy an amazing atmosphere of a

International Physicists' Tournament (IPT)

Aimed age class: 18-24 years old (Bachelor & Master students)

IPT	Tournaments' Location	Result of Swiss Team
2019	Lausanne, Switzerland	5 th of 19
2018	Moscow, Russia	1 st of 16
2017	Göteborg, Sweden	13 th of 18

IPT has been created in 2009 following a long tradition of Physics competitions in Eastern Europe.

Websites:

General: iptnet.info

http://en.wikipedia.org/wiki/International_Physicists%27_Tournament

Last edition : 2019.iptnet.info

Next edition: available in August

All information about participating in the next national selection (2020): switzerland.iptnet.info or by e-mail switzerland@iptnet.info

Swiss representative in the international organizing committee:

Evgenii Glushkov, evgenii.glushkov@epfl.ch

Captain of the last Swiss team:

Nicholas Greensmith, nicholas.greensmith@epfl.ch

President of the International Organizing Committee:

Vivien Bonvin, EPFL (2015-2017)

David Collomb, University of Bath (2017-2019)



Final reviewer led discussion in a fight, with, from left to right: Kiev opponent, Sweden defender, Brazil reviewer. © A. Pochelon

week-long event together with your team and students from all over the world!

[1] International Physics Olympiads, Zürich, 10-17 July 2016, A. Pochelon, *SPG Mitteilungen* 50, p. 68, 2016

47th International Physics Olympiad 2016 in Zurich, S. Birrer, I. Steinegger, *SPG Mitteilungen* 44, p. 19, 2014

[2] Die Europäische Physikolympiade EuPhO 2018 in Moskau, A. Mastrocola, SwissPhO, *SPG Mitteilungen* 55, p. 61, 2018

[3] Great success at the International Physicists' Tournament, Evgenii Glushkov, *SPG Mitteilungen* 55, p. 58, 2018