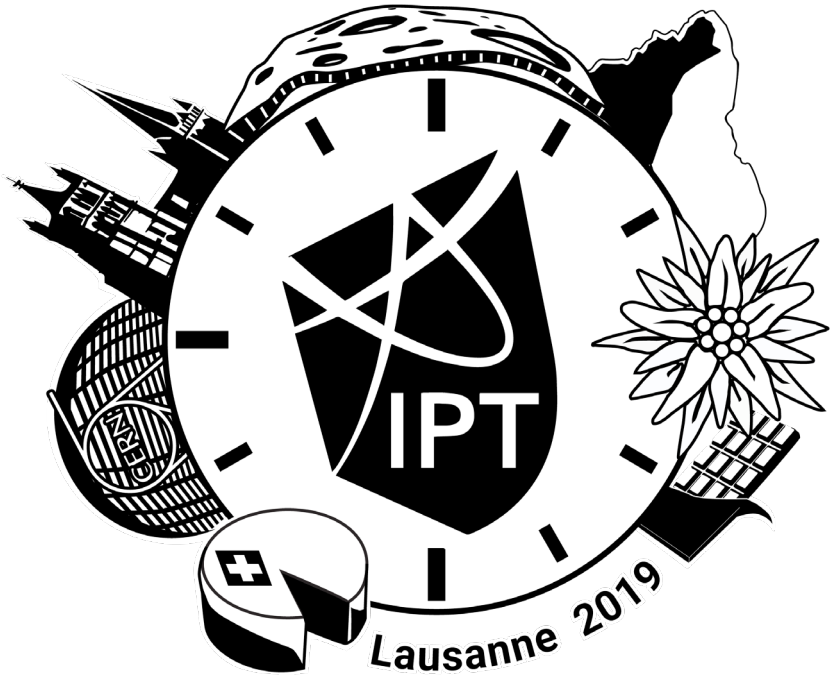
EPFL

11th International Physicists' Tournament



Lausanne
April, 21-26
2019

A word from the Vice-President for Education

On behalf of the Senior Management of the Ecole Polytechnique Fédérale de Lausanne (EPFL), I would like to wholeheartedly welcome the International Physicist's Tournament. Students are the heart and soul of a university and at EPFL we always welcome new ways to fuel their enthusiasm. I can't think of a better way to do that than via this tournament, in which knowledge and creativity combine. The latter in particular is difficult to train in a classroom, but is essential to the practice of Physics. Let the Science begin!

Prof. Dr. Pierre Vandergheynst
Vice-President for Education of EPFL

A word from the Director of the Physics Section

Welcome to the 11th edition of the International Physicists' Tournament! That is for sure a competition, but also a unique place to cross different scientific cultures, to build up a problem solving team, and to go beyond academic education. This tournament offers the opportunity to the participants to confront their physics knowledge to challenging experiments. This is a place where participants learn about pragmatism and where they can demonstrate a high level of creativity. This will contribute making Physics an even more living science!

Prof. Nicolas Grandjean
Director of the Physics Section of EPFL

Welcome to the IPT 2019!

From the 21st to the 26th of April, 2019, EPFL has the pleasure to host the 11th edition of the International Physicists' Tournament (IPT, iptnet.info) – the biggest international competition in physics for teams of university students, bringing together almost 200 physicists coming from all over the world to defend the colors of their university and country.

EPFL is happy to organize the IPT 2019 and provide you with an opportunity to learn more about its various study programs, research directions and career opportunities and enjoy its beautiful campus on the Geneva Lake. The Local Organizing Committee with the help of multiple generous sponsors and passionate volunteers prepared for you a whole week of great activities, including the whole-day visit to CERN, to make sure you enjoy your stay in Lausanne!

The IPT Physics Fights are free and open to the public, so we invite everyone to come and watch them! And the Grand Final will be broadcasted live on the official IPT channels!

List of problems

Tesla coil engine

When a thin metal wire is placed on top of a Tesla coil, the wire shoots off sparks from its ends and acquires a rotational motion, as if propelled by the sparks. Explain the phenomenon. Optimize the electrical and mechanical part of the setup to obtain the maximum rotational speed. What is the efficiency of such an engine compared with conventional electric engines?

Yut

When making a choice or playing a game, we employ methods such as tossing a coin, rolling dice, or, throwing a Yut stick. Yut sticks are roughly half-cylindrical in shape and as such it is much easier to bias the outcome of up vs. down than it is for a coin or dice. If the floor is soft, then the stick is likely to have its flat side up, as the round side has a larger surface. If the floor is hard and the stick is 'rolled', the stick is likely to have its round side up. How does the probability of the outcomes depend on the relevant parameters?

Apples and Oranges

A simple radio can be made even from a potato. Will the quality of the sound depend on the fruit/vegetable type and/or any other parameters? What hypothetical plant could provide high fidelity sound? Can the setup be modified in order for it to work as a radio transmitter?

Escaping helicopters

Certain species of trees (such as maple, ash, or the guapuruvo) produce a type of dry fruit known as a samara. It has a winged structure that allows the seeds to be carried by the wind over large distances. How does the terminal speed of a samara depend on the relevant parameters? Is it more efficient than a parachute?

Water dancing ball

When a ball lying on a hard and flat surface is hit by a jet of water that falls perpendicular to the surface, it may start to oscillate. Investigate how the oscillations depend on the relevant parameters.

Broken pencils

It is universally believed that the fall of a pencil leads to the breakage of its graphite rod. What is the probability of fracture? How does this probability depend on the height of the fall and the length of the pencil? Propose an effective non-invasive technique to test whether the rod of a pencil is damaged.

Drunken glass

Sometimes, when we place a glass upside down on a wet flat table, it starts moving. Investigate its speed dependence on the relevant parameters and try to maximize it.

Runaway bubbles

Bubbles float in all directions when a jet of water pours from the tap into a container. Investigate the distribution of the distance to the jet from which bubbles escape, and its dependence on the impact velocity of the jet with the water and the depth of the water tank. Will the situation qualitatively change in a waterfall?

Rail track divination

The sound of an approaching train, propagating in metals, reaches our ears earlier than the train arrives. Is it possible to estimate the distance to the train and speed of

its movement using this phenomenon? Estimate the accuracy and precision of your method.

Cup flyers

A lightweight cup flyer thrown horizontally with a high backspin initially rises against gravity. Consider a flyer with a center of mass that is shifted from its geometrical center. Explain the flyer's trajectory and discuss the influence of the center of mass location and other relevant parameters on the maximum height and the stability of the flight.

Circle magnet

If you stack many small cylindrical magnets, the resulting stick of the magnets will have some elasticity. Is it possible make it sufficiently elastic to join both ends of the magnet stick? If yes, what is the minimal attainable ratio of the radius of the resulting circle of magnets to the single magnet radius?

Jet charged!

With charged rods or balloons one can make a fine water jet bend. Study the jet trajectory. What is the smallest radius of curvature of the water jet that can be achieved? Are loops or helices possible?

String shooter

A closed loop of string fed between two high-speed rotating wheels seems to defy gravity. Explain the overall shape of the loop and investigate the propagation of waves on the string.

Solar cell characterizer

Propose and implement a method to determine the irradiance and color temperature of a light source by using solar cell materials? How accurately can they be measured? What are the limitations of your method? What are the relevant parameters?

Pouring a Sandcastle

Take a large flat dish (of at least 30 cm in diameter) and fill it with water to a 2cm depth. Next, gently pour 1 liter of dry sand on it from a height of around 40 cm. After a few seconds, a sand stalagmite starts to rise from the dish. What is the maximal height you can reach by this construction method? What are the most relevant parameters controlling that maximal height?

Camera inception

If you project in real time what a camera is recording and use that camera to film this projection, you will see a pattern of recursively nested images (the so-called Droste effect). Due to the finite speed of light and processing time of the camera, each image will be slightly shifted in time. Determine under what conditions can the effect be used to measure the spvveed of light.

Lab Shock Diamonds

Shock Diamonds are diamond-shaped structures appearing in the super-sonic flow exhaust from a propelling nozzle. Although very common in the exhaust of aerospace propulsion system, the phenomenon may also appear in other systems. Using standard laboratory equipment, construct a setup to effectively observe Shock Diamonds, specifying the important parameters and methodological considerations employed in their creation and observation.Investigate the dependence of the shape and number of diamonds on the important parameters. What properties of the gas and jet can be inferred from your observations?

Program

21 Apr — Day of arrival

14:00 - 19:00	Arrival and Check-In	Youth Hostel
19:00 - 20:00	Welcome Dinner	Youth Hostel
20:00 - 21:00	Jury Meeting (jury members only)	Youth Hostel
21:00 - 22:00	1st IOC meeting (IOC members only)	Youth Hostel

22 Apr — 1st competition day

8:00 - 9:00	Breakfast and transfer to EPFL	Youth Hostel
9:00 - 9:30	IPT Opening	CO 1
9:30 - 13:30	**1st Physics Fight**	**CO 015-017, 122-124**
13:30 - 14:30	Lunch	L'Esplanade
14:30 - 18:30	**2nd Physics Fight**	**CO 015-017, 122-124**
18:30 - 21:00	Welcome Speech and traditional dinner	L'Esplanade

23 Apr — 2nd competition day

8:00 - 9:00	Breakfast and transfer to EPFL	Youth Hostel
9:00 - 13:00	**3rd Physics Fight**	**CO 015-017, 122-124**
13:00 - 14:00	Lunch	Vinci
14:00 - 18:30	**4th Physics Fight**	**CO 015-017, 122-124**
18:30 - 20:00	Dinner	CO hall
20:00 - 21:00	Announcement of semi-finalists	CO 1

24 Apr — Semi-final

8:00 - 9:00	Breakfast and transfer to EPFL	Youth Hostel
9:00 - 13:00	**Semi-final Physics Fights**	**CO 122-124**
13:00 - 14:30	Lunch and announcement of finalists	Vinci
14:30 - 16:00	EPFL Lab Visits	EPFL campus
16:00 - 18:30	Visiting Lausanne	Lausanne
18:30 - 21:00	Free presentations & apéro	CO1 & CO hall

25 Apr — Excursion day

8:00 - 9:00	Breakfast	Youth Hostel
9:00 - 10:00	Transfer to CERN	
10:00 - 13:00	Excursion to CERN	CERN
13:00 - 14:00	Lunch (packed)	CERN
14:30 - 18:30	Excursion to CERN	CERN
18:30 - 20:00	Transfer to Youth Hostel	
20:00 - 21:00	Dinner	Youth Hostel

26 Apr — Grand Finale

8:00 - 9:00	Breakfast and transfer to EPFL	Youth Hostel
9:00 - 13:00	**Grand Final**	**Forum Rolex**
13:00 - 14:00	Lunch	Vinci
14:00 - 17:00	Awards ceremony	Forum Rolex
17:00 - 18:30	2nd IOC meeting (IOC members only)	CO 123
18:30 - 22:00	Farewell dinner	Forum Rolex

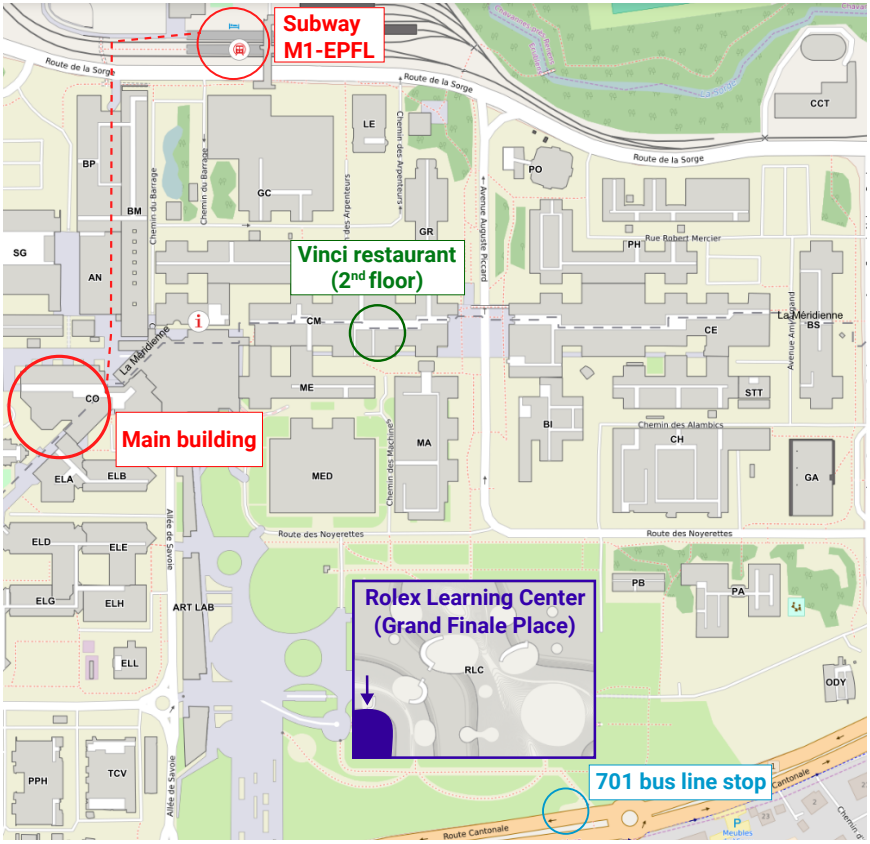
27 Apr — Day of departure

8:00 - 9:00	Breakfast and packing	Youth Hostel
9:00 - 11:00	Check-Out	Youth Hostel

Maps

How to get to the EPFL campus from the Youth Hostel:

Where to go on the EPFL campus:



Teams


Moscow Institute of Physics and Technology


Voronezh State University


Universite de Lyon


École Polytechnique


University of Erlangen-Nuremberg


University of Warsaw


National and Kapodistrian University of Athens


University of Zagreb


Taras Shevchenko National University of Kyiv


Karazin Kharkiv National University


Industrial University of Santander


KTH + Chalmers University of Technology


École Polytechnique Fédérale de Lausanne


Federal University of ABC


UC Berkeley


National Institute of Science Education and Research


Politecnico di Milano + Università di Bologna


Technical University of Denmark


University of Queensland

Website and Social media

You will find results and important information during the tournament on the IPT 2019 website: 2019.iptnet.info

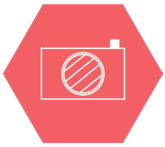
We will be live feeding as well on social networks:

facebook.com/InternationalPhysicistsTournament/

bit.ly/2P1erW6

twitter.com/ipt_official

instagram.com/the_ipt_official/



Feel free as well to share online with everyone your best moments (text, pictures, videos, etc.) by simply adding the hash-tag #IPT2019

We are going to take a lot of pictures and movies during the tournament. If at any time you feel uncomfortable with it, feel free to tell us and we simply will stop shooting you.

If you take pictures or videos, make sure the subjetcs are fine with it! And send your pictures to us, so they can appear on the IPT website!

Some (Very Basic) French

Good morning	Bonjour	Where?	Où?
Good evening	Bonsoir	Yes, please	Oui, s'il vous plaît
Goodbye	Au revoir	No, thank you	Non, merci
Thank you	Merci	Sorry	Désolé
Excuse me	Excusez-moi	Do you speak English?	Vous parlez anglais?
How much?	Combien?		

Emergency numbers

On campus: +41216933000

Everywhere else in Switzerland: **144**

Or call the European emergency number: **112**

The Organizing Committee

The organizing committee is composed of two parts: the International Organizing Committee (IOC) is responsible for carefully selecting and publishing the list of problems, while the Local Organizing Committee (LOC) is in charge of organizing the tournament at the hosting university.

Members of the LOC, who who heroically did their best to make the IPT 2019 a success are shown on the right. You can easily recognize them during the tournament as they will be wearing black IPT T-shirts (together with volunteers). The LOC is also cooperating with the EPFL associations of physics students (Les Irrotationnels) and PhD students in Physics (PolyPhys), and is supported by the Swiss Physical Society, the Physics section of EPFL, Institute of Physics, Faculty of Basic Sciences and EPFL Vice-Presidency for Education.

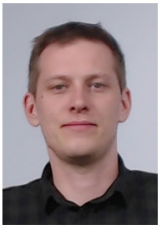

Jean-Philippe Ansermet


Evgenii Glushkov


Daniele Mari


Quentin Dubey


Joel Fischer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You can also write us an e-mail with any questions or feedback you might have:
switzerland@iptnet.info

Our Sponsors

We are very grateful to the following companies and institutions for their generous support of the IPT 2019!

SWISS NATIONAL SCIENCE FOUNDATION