

Summer School Learning Plan

Physics as You Do Not Know It

The summer camp ‘Physics as you do not know it’ aims at bringing new perspectives and strengthening positive attitudes towards physics among the girls. We consider the overarching topic of the FAJN 2022 ‘Optics’, to have a great potential to attract girls.

The light as a spectrum of colours and optical principles of sight and eye-disorders will be in the focus of the summer school. The optical principles and properties of colours will be studied simultaneously with principles of mixing colours in visual arts, including applied arts (fashion, design). Besides that, geometrical optics and its application in medicine, especially ophthalmology will be inquired. Participating girls will investigate the human eye as a lens and the impact of changes of the lens to eye-disorders.

During the summer school, the participating girls will become familiar also with photometric. They will investigate illumination and its impacts of ergonomics and therefore interior design and marketing.

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CPU Nitra GEM Summer School

Target Group:

Grades 6-10, age 12-16 years, all school types



Venue:

Faculty of Natural Sciences and Informatics, Constantine the Philosopher University in Nitra, Slovakia

Transportation to the venue / digital access to the Summer School:

Arranged by parents, transportation to the various places within the Summer School will be arranged by the University

Subsistence:

Water, non-alcoholic beverages, fruits and small refreshments will be provided at the venue, lunches will be in the restaurants.

Contact person for girls and their guardians:

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Schedule

1st Day

8:00 – 10:15	Welcome, organizational issues.
	Meet-and-greet activities
	Ice-breaking games
10:15 – 11:15	7 activities regarding eye-sight
11:15 – 12:15	Building groups
12.15 – 12.45	Introduction of groups
12:45 – 14:00	Lunch
14.00 – 15.30	Searching terms: essential concepts in physics related to optics

2nd Day

8:00 – 8:30	Lookback - the most enlightening experience
8:30 – 11:00	Heureka - scientific research
11:00 – 12:45	Searching terms: essential concepts in physics related to optics
12:45 – 13:45	Lunch
13:45 – 15:15	Heureka - scientific research
15:15	Sports competitions

3rd Day

8:00 – 8:30	Lookback - the most enlightening experience
8:30 – 10:30	Star way
10:30 – 12:45	Heureka – scientific research
12:45 – 13:45	Lunch
13:45 – 15:45	Searching terms: essential concepts in physics related to optics

4th Day

8:00 – 8:30	Lookback - the most enlightening experience
8:30 – 9:15	Excursion. Traveling to the laser arena
9:15 – 9:30	Instructions
9:30 – 11:00	Team competition with lasers (3 × 30 min)
11:00 – 12:30	Measurements
	<ul style="list-style-type: none"> • Distance of effect of laser weapon • Reflected beam examination • Measuring wavelength and intensity UV radiation sources for disinfection • Measuring the impact of other radiation to the laser weapon
12:30 – 13:30	Lunch
13:30 – 14:45	Individual competition with lasers
14:45 – 15:00	Travelling to the school venue

5th Day

8:00 – 8:30	Lookback - the most enlightening experience
8:30 – 9:30	What we learned in the laser arena - presentation of the results of the groups
9:45 – 11:45	GPS competition outdoors - searching terms
11:45 – 12:45	Building a lego house - non-traditional group building a lego house - development of communication in a group (blinded)
12:45 – 13:45	Lunch
14:00 – 15:15	Knowledge competition - charged heads
15:15	Evaluation of the camp, diplomas and prizes

Learning Activities

Learning Activities	STEM/ICT subject knowledge	Knowledge of inspiring models and their meaning	Knowledge of the role of STEM/digital world of work	Entrepreneurial mind-sets	Transversal skills
Ice-breakers					x
Team-building activities	x	x	x		x
Searching terms	x	x	x	x	x
Heureka activities	x	x	x	x	x
Measurements in laser arena	x	x	x	x	x

The activities in the summer camp can be divided into socialisation activities aiming primarily on transversal skills (ice-breakers, team-building) and educational activities (searching terms, HEUREKA activities, measurements in laser arena). Most activities will be conducted in groups formed on Monday and keeping for the whole week. The pedagogies involved are based on inquiry-based science and mathematics education, including collaborative problem-solving, hands-on activities and laboratory work in the university research laboratories.

Through the ice breaking activities a positive learning atmosphere will be built and the participating girls will better get to know each other. Through these activities communication skills and collaboration competences are addressed. The team-building activities are very important for the further group work throughout the summer school. To be successful in collaborative problem-solving in STEM, the group-members should be able to collaborate, communicate effectively. The activities support the creativity and critical thinking, flexibility, leadership and social skills.

To step into the topic easily, on the first day they will get introduced to the overarching theme of the camp, optics being active themselves. By trying out the different technologies themselves, the participants will not be afraid of the topic of optics and gradually step deeper in it: the mentors will lead them through these activities in the role of an eye doctor. They will test their near and distance

reading, check colour-blindness, examine using a cheiroscope and ask to solve optical illusions. In addition, they will observe the difference when looking at a picture with the right and left eye separately and with both eyes at the same time. They will find that their brains combines the images they see with their right and left eye into one coherent image. The girls will also have the opportunity to try on special 3D glasses and 'drunken glasses', with which they will try to walk in a straight line. The girls will be thus introduced to the different devices used by ophthalmologists, as well as to the various visual problems that can occur. This will help seeing where the physics terms are used in real life contexts.

Searching terms activities are repeated almost every day and are focused on understanding the essential concepts in physics related to optics. The terms are connected with the female scientists and researchers. It consists of several stages visited by each group. At the stage, the girls complete a sports activity, for which they will find out a physical concept. It will be explained and each member will learn the term and the explanation. Although, we do not want any lecturing, we want girls to be able to verbalise the obtained knowledge, i.e. to explain the term with their own words and examples. For example, the "Star way" activity: Girls will be given a map of the starry sky on which they will mark their path. Each star will be labelled by the name of the leader responsible for particular term. They need to go to each station three times to succeed; the difficulty of the tasks will increase each time. The task will be considered successfully completed when the group travels the entire star way.

Heureka activities are the main learning activities of the summer camp. These are activities conducted in small groups of 3-4 girls supervised by one camp-leader. The participating girls solve a problem in STEM (with content or context in optics) with the scaffolding provided by the camp-leader. Heureka activities include: use of IP Coach system, tablets and other technology to enhance the information and technology literacy skills, Computers and colours, UV measurements, What makes us see, Colour spectrum, Optical environment, Mirror image, Scatterometer imaging, Water lens. During the week each group will participate in each activity in different order.

Lecturers and mentors

There are a lot of women involved in organisation and conducting the summer school. We invited some of them as we expected they would serve as role models for participating girls.

Ľubomíra Valovičová (assoc. prof. in Physics education, experienced summer camp organizer) focuses her research work on empirical cognition in physics from pre-primary to secondary education, mainly via inquiry-based activities. She is experienced in organising the summer camps (more than 15 years) popularising activities for mathematics and science and will be responsible for the organisation of the camp and be the head of camp-leaders in the summer school.

- Ján Ondruška (researcher in material physics) is an experienced summer-camp leader. He will be involved in management of the activities. He collaborated in the design of the summer-camp activities.

Silvia Haringová (graduate students in Mathematics Education) focuses her research on mathematical problem-solving with special focus on modelling problems.

Veronika Klobušická (medical student) will be involved in activities focused on eye-disorders.

Dominika Mikušová (student of material physics) is an experienced summer-camp leader.

- Mária Siptáková (energetic auditor) has a doctoral degree in Physics. She works as the energetic auditor in the national body. She agreed to participate as a camp-leader based on her experience as camp-leader when she was a graduate student.

Janka Medová (researcher in mathematics education) focuses her work on inquiry-based mathematics education and related education of pre-service and in-service teachers. She collaborated in design of interdisciplinary activities involving mathematics and physics. During the summer school, she will be mentoring the students of initial teacher education.

The students of initial teacher education will participate as the camp-leaders. They will be chosen in June 2022 out of the following applicants: Juraj Blunár (physics – biology), Michal Fojtík (mathematics – computer science), Patrícia Kopecká (physics – chemistry), Renáta Klimanová (physics – geography), Peter Lenický (mathematics – physics), Adela Synaková (mathematics – physics).

CPU Nitra GEM Summer School Support Site

You can find more information about the Summer School in the national language by following this link: <https://www.fpvai.ukf.sk/sk/vyskum-fpv-ukf/projekty/52-veda-a-vyskum/projekty/1473-gem>

