

Cikháj – a physics summer camp for secondary school students

JANA JURMANOVÁ¹

Department of Physical Electronics, Faculty of Science, Masaryk University

This contribution provides basic information on a yearly physics summer camp for secondary school students, its history, contents of previous years and also of the current year which has the topic “Physics inside a computer”.

What does the camp look like?

We have organized a camp for secondary school students at Cikháj since 1995. During the camp, the education and holiday resort belonging to Masaryk University is full of secondary school students, their teachers, and camp organizers – university teachers, postgraduate and undergraduate students, all of whom are caring for the main and accompanying programmes.

All participants get their accommodation during Monday afternoon after which a dinner takes place with introductions and a detailed programme. After that follows the first evening with experiments, usually concerning optics and similar darkness demanding experiments.

A usual workday is started with a morning lecture course section that provides participants with basic information on the chosen topic. This section is split or finished by experiments belonging to this topic. In the afternoon some kind of relaxation programme (sport, games) takes place. In case of bad weather, some form of physics workshop or other indoor activity is prepared. The evening lecture differs from the morning lecture in both complexity and approach. Because secondary school students usually do not go to bed until midnight, in case of clear weather an astronomer has prepared both a telescope and an overview of all the interesting things that could be observed on the actual night sky.

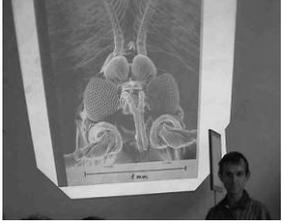
An overview of recent years

We have gathered more experience in the past twelve years than could fit into this text. Let us at least mention some of the interesting lectures of invited experts: People from the ON Semiconductor company (producer of monocrystalline silicone and semiconductor parts), Delong instruments (electron microscopes), professor Mornstein (medical diagnostics, fighting against pseudoscience), Mr. Tomáš Příbyl (rocketry, history of space flight) and doc. Kluiber (NASA and its training programme).

¹ janar@physics.muni.cz

We also have to appreciate the enormous effort of all team members, who are in charge for 24 hours a day.

Let us mention at least the titles of each of the twelve camps:

 <p>1995: From mechanics to relativity and physics in small scales</p>	 <p>1996: Macro and micro</p>	 <p>1997: Physics around us</p>	 <p>1998: Physics and transport</p>
 <p>1999: Physics in movies, newspapers, ... at school and in reality</p>	 <p>2000: Physics and time</p>	 <p>2001: The atom and its structure</p>	 <p>2002: Physics at the boundary</p>
 <p>2003: Physics and sport</p>	 <p>2004: Physics and literature</p>	 <p>2005: The works that have shaken the world of physics</p>	 <p>2006: Physics and the human body</p>

Cikháj 13 – 2007: Physics and computers

The upcoming camp will take place at 10th – 14th of September at Cikháj. The topic is “Physics and computers” and all lectures, seminars as well as afternoon sport and

relaxation programme will be connected to this topic – what is the underlying physics principle of different computer parts, how are computers built, what are the limits of technology (given by physics), or how can a computer be used by physicists for measurements and calculations.

More details about this camp as well as those of previous years can be found at our web pages: <http://www.physics.muni.cz/kof/cikhaj.shtml>.

Bonus at the end – experiments with a microwave oven

Experiments with microwave ovens are a popular and interesting part of experimental blocks at Cikháj. The reason for their popularity might be in the small dimensions of the oven and accessories (because all equipment has to be transported by a few cars) when compared to the number of experiments that can be performed with it.

It is strongly recommended to follow at least basic safety rules when working with a microwave oven. First of all, never turn on an empty oven, as it would get destroyed (this has been tested experimentally at least once). It is designed supposing that most of radiated energy gets absorbed by food inside. Therefore, when putting into the oven any object where low energy absorption is expected, add a beaker with water. Another possibility is to start the oven for a very short time (a few seconds). The best microwave ovens for these experiments are those having large inner space and a minimum of functions and programs. (Power regulation and a timer are sufficient features, grills and sophisticated programs are not needed for physics experiments). It is not necessary to emphasize that an oven that has once been used for experiments should never be used for food preparation.



The most popular experiments:

Never put metal objects into the microwave!

This is a warning from any user's manual. However, a physicist usually reads the manuals only as the last resort. So, he calmly puts an aluminium ring into the oven and (while not being such a risk-taker) adds a beaker with water. After a short time the ring would be surprisingly cold – but try to replace it with a thin wire bent into a circle...

MW burner

One can burn CD's not only in a CD burner. After a short exposure in a MW oven, the CD contains burnt traces at spots corresponding to standing wave antinodes. It is recommended to take the turning plate out of the microwave and to add a beaker with water.

Milk or water just before explosion

It is possible to bring water or milk to a superheated state. During this kind of warming, no mixing of the liquid occurs. (You can prove this when trying to warm milk for about 1 minute – the first sip is warm, but the lower layers remain cold.) The overheated water will start to boil around the condensation centre represented by a sharp tip that we insert into the liquid.

A cannonade as in the army

This is an effect well known to anyone who has ever made popcorn in his oven. The corn is being heated from inside and produces water vapour which then noisily breaks the coat of the corn. Beans, lentils or sausages behave similarly. If you really like cannonades, you might try small chestnuts. Better don't try to find out the answer for the quiz question "Which way to open a coconut is the fastest?" though, it is too risky.

Phone call into a microwave?

Is it possible to call to a phone placed in a (not working) microwave oven?

Don't throw out old bulbs, they might still have a use!

A microwave oven is an ideal tool for reusing old bulbs (with a broken thread or with nonstandard screws). The bigger the bulb, the higher will be the effect on the audience. The electromagnetic field inside the oven is intense enough to ionize the gas inside any modern bulb (all modern bulbs over 25 W are filled with a gas). The analysis of the gas discharge can give us information about the gas inside.

Power saving fluorescent tube with cable-saving effect

The same demonstration might be done with a fluorescent tube or glow tube. The explanation is the same, but the colour differs.

Sun not only in your mind

Put a tuff (?) made up from thin copper wires into a glass ball. When placed into the microwave, a plasma bowl (ball?) is created and lasts for a few seconds.

Happy Birthday or A plasma ball by Clever

Put into the oven a beaker with water and a few burning skewers or sparklers (see <http://www.nova.cz/tvarchiv/?238p=CLEVER> date: 27.4.2007). The question is:

What will be the result of a burning stick and water inside the microwave oven? (“Co vznikne z hořícího párátko a vody v mikrovlnce?”)

Fattened steel-wool (by Clever)

Steel wool put into a microwave oven is also an experiment from the TV show Clever: <http://www.nova.cz/tvarchiv/?238p=CLEVER> day 27.4.2007, with the question: “What will happen if a piece of steel-wool is put into the microwave?” (“Co se stane s ocelovou drátěnkou v mikrovlnné troubě?”). Weight measurement on precise laboratory scales shows a hardly believable result.

References

- [1] <http://www.physics.muni.cz/kof/cikhaj.shtml>
- [2] <http://www.nova.cz/tvarchiv/?238p=CLEVER>