

# THE ROLE OF PHYSICAL EXPERIMENTS IN POPULARIZATION OF EXACT SCIENCES

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**ABSTRACT.** Physical experiments play crucial role in exact sciences. We test our theories which we try give account of the world by experiments. On the one hand, themselves are an inexorable judge which one judge our conceptions about function of the world and on the other side physical experiments can demonstrate a beauty of laws of nature. The Nicholas Copernicus Observatory and Planetarium in Brno (the Czech Republic – EU) has a longtime experience with it.

**Key words:** education: popularization

## 1. Introduction

Education plays important role in our civilisation, therefore we need to pay attention to it. In addition to formal school education an informal education take place outside the system, where knowledge gained can be put in a use in entertaining way.

## 2. The Nicholas Copernicus Observatory and Planetarium

The Nicholas Copernicus Observatory and Planetarium is in Brno in the southeast of the Czech Republic. It is almost inn the centre of the city, which makes it easily accesible for tourists, school trips and members of the public.

Our main focus is on educating and informing the public about astronomy. We stage astronomical observations, audiovisual performance for schools and general public, exhibitions and give lectures on optics for elementary and high schools. I was deputed originate a new conception of lessons on optics.

On the list of the multi-visual performances for the public you will find programmes aimed at a modern survey of the solar system structure and a study of remote areas of the universe at the observation satellites, the ancient history of Brno, etc. We must not forget to mention our foreign language programmes, productions and performances for people with visual impair-

ment. The pleasant environment of the main planetarium, which includes top audio-visual technologies, is also very convenient for various commercial presentations, seminars and formal events.

At the Brno observatory we have several types of telescopes on disposal, beginning with portable apparatuses up to lenses of 15 or 20 centimetres in diameter. The attractions of the evening sky can be examined with assistance from staff at the observatory. Our visitors will be able to see the moon, some of the planets and, naturally, also distant objects in the universe, such as double stars, star clusters, nebulae and galaxies. One can also observe the actual Sun in detail by means of a projection of the Sun onto a large screen by specially adapted telescopes. For foreign visitors we have prepared an audiovisual performance called ‘People and Stars’. On the photographic shots, the audience will be shown all the attractive parts of Brno. They will also see the star sky the brightest stars and distinctive constellations and for a finale, they will hear a dramatic story about the explosion of a supernova, which occurred in 1987. The presentation, which is a commentary with slides combined with a projection on the sky dome, lasts approximately one hour. Visitors can also take a look at the exhibition in the planetarium foyer and can buy astronomy books. More about us ([www.hvezdarna.cz](http://www.hvezdarna.cz)).

We have not made only audio-visual performances, observation of sky and exhibitions but we have organized professional as well as popular lectures too.

## 3. The Adventure Science

We have a long time and rich experience in astronomical education, see (Pokorny, 2001; Mikulasek, 2001). For general public we have prepared special series The Adventure Science. The series Adventure Science includes two special shows: *The Adventure Physics* (Tyc, 2006) and *The Adventure Chemistry* (Pisala, 2006) for general public. *The Adventure Optics* is third part of series The Adventure Science, this once for students

of elementary and middle schools. These shows show Physics and Chemistry as attractive natural sciences for everyone.

### 3.1.1 The Adventure Physics

The Adventure Physics is a special show. The lecturer is showman with excellent knowledge of physics and other natural sciences. The lecturer shows some amusing experiments from mechanics, thermodynamics, acoustics, optics and electromagnetism.

For example:

- mechanics: squeak of door, law of conservation angular momentum with revolving chair, Archimedes' cannon, swimming of picayune on water level
- acoustics: Lissajous figures, blow out of the candle
- thermodynamics: hot-flue balloon, liquid nitrogen
- optics: reflection, diffraction and scattering of light
- electromagnetism: eddy currents, experiments with microwave oven and CD disc

### 3.1.2 The Adventure Chemistry

The Adventure Chemistry is second part of the series The Adventure Science. The lecturer demonstrates nontraditional chemical experiments (e.g. colored acido-basics reactions, explosives reactions with hydrogen and oxygen, fast crystallization) and explains fundamentals of chemistry, which we can watch every day around us in common life.

### 3.1.3 The Adventure Optics

Structure of lectures:

- *Trailer*: Advertising trailer (it is mainly for the teachers and students to have some idea what the (optics) lecture is about). We have prepared two trailers, for geometrical optics 'Autopsy of the eye' and for wave optics 'Blue sky – Scattering of the light'.)
- *Lecture*
  1. An introduction into the basic terms and jargon used in the field of physics (it can serve to refresh memory of those who has some previous knowledge and introduce new words and concepts to fresh students)
  2. Application, explanation about the use of the optics in the arts, technology and military use, also in the nature. We show them applications of laws of optics in everyday life.
  3. Reinforcing the gained theoretical knowledge by short but spectacular experiments, underline the use of the optics in everyday life

events. For example, to show the boundary of geometrical optics an experiment with the use of two polarised filters and optically active substance (in this case my glasses with the hardened plastic lenses and cellophane, which has mysterious influence on students because they could not understand yet the laws and phenomenon of the optics and they are lost to explain the observed experiment. Similarly, in the wave optics, the observation of fluorescence in the glass with the tonic illuminated by UV LED diode and comparison with the same glass filled only with the water (Ledvinka, 2007).

- *After lecture*. The printed materials will remind student of the experiments they witnessed and in addition, it will point into everyday application of the optics. Those printed materials follow the structure of the lecture, using the appropriate and correct terms and jargons, then the application and evaluation. However, those materials do not attempt to replace any textbooks or lessons. I am preparing the file of all experiments for my co-workers which ones are used.

## 4. Conclusion

Our experience evince interest of general public about natural sciences. School children can be captured by science too but they need an attractive form of natural sciences.

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## References

- Pokorny Zd.: 2001, *Astronomické vzdělávání (Astronomical Education)*, inaugural dissertation.
- Mikulasek Zd.: 2001, *Course of Astrophysics*, inaugural dissertation.
- Ledvinka S.: 2007, *Dobrodružná optika na brněnské hvězdárně (The Adventure Optics in The N.C.O.P in Brno)*. In *Modern trends 3. Plzen*, 1 p.
- Ledvinka S.: 2005a, *Phys. Ed., Bristol, UK: IOP Publ.*, **40**, 305-305, ISSN 0031-9120.
- Ledvinka S.: 2005b, *In Proc. 37th Conf. On Variable Stars Research. pub. Brno*, 2 p.
- Tyc T.: 2006, *Dobrodružná fyzika (The Adventure Physics)*, *The Nicholas Copernicus Observatory and Planetarium in Brno*.
- Pisala J.: 2006, *Dobrodružná chemie (The Adventure Chemistry)*, *The Nicholas Copernicus Observatory and Planetarium in Brno*.