

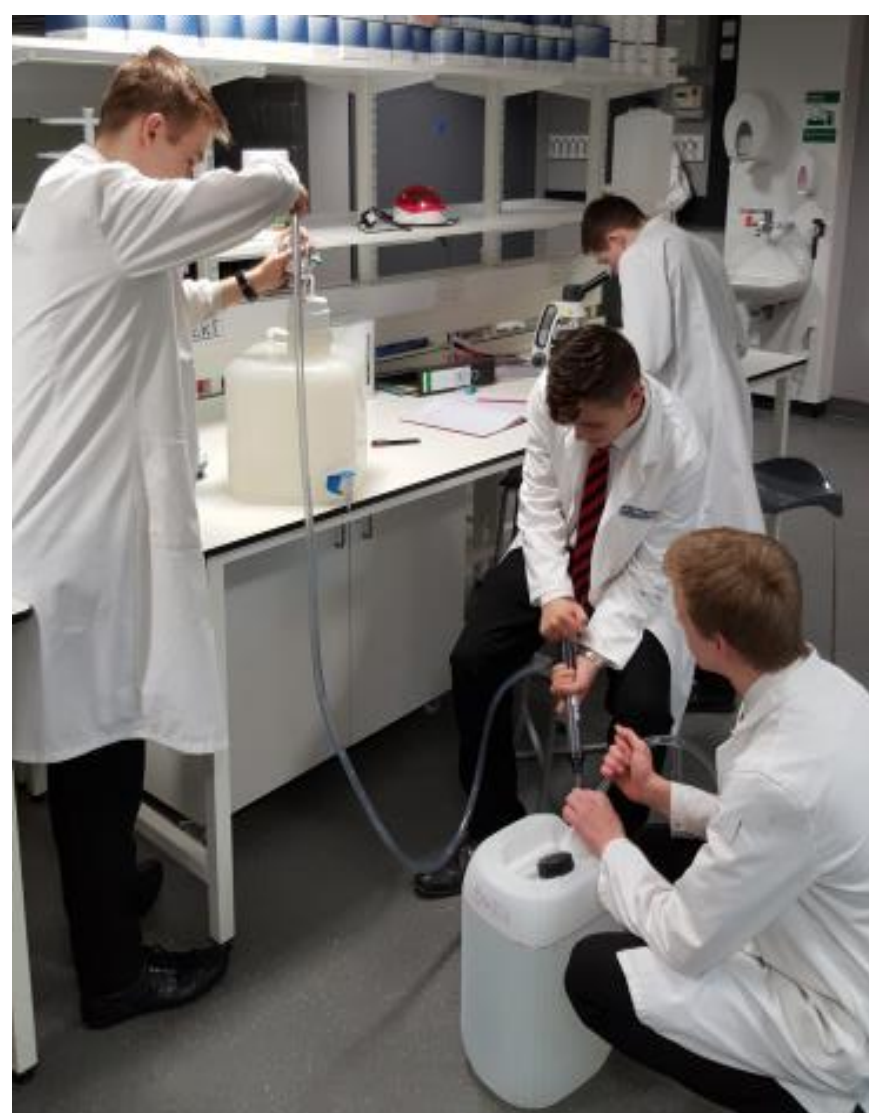
Dr John Dyer | Liverpool Life Sciences UTC | Liverpool | UK

The Humble Little Water Flea: Engaging minds from primary to university



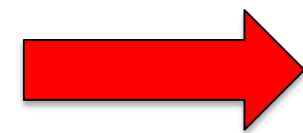
The ability to work with a live creature and see its internal organs functioning is an incredibly engaging experience for students of all ages. Water Fleas, *Daphnia Spp.* usually reproduce clonally making them a great system for studying inheritance and variation.

In partnership with academics at the University of Liverpool we have set up a Daphnia Lab at Liverpool Life Sciences UTC which has already been used by over 400 students aged 7-19 to study anatomy, physiology, pharmacology, reproduction and non genetic inheritance.



1. Setting up the Daphnia Lab...

Systems were setup to culture *Daphnia* including correct lighting, making lab pond water, and culturing their algal food. Students are involved in all aspects of setting up and maintaining populations.



2. Extended Projects for 16-18 year olds...

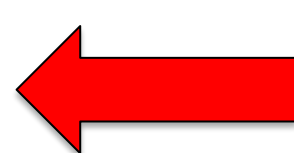
Students can/are using the *Daphnia* as a model organism for the UK extended project qualification. Projects have included the physiological effects of drugs, the impact of water quality and also non-genetic inheritance.



4. Primary School Engagement...

Over 150 visiting primary school children have had the opportunity to investigate the *Daphnia* in the lab.

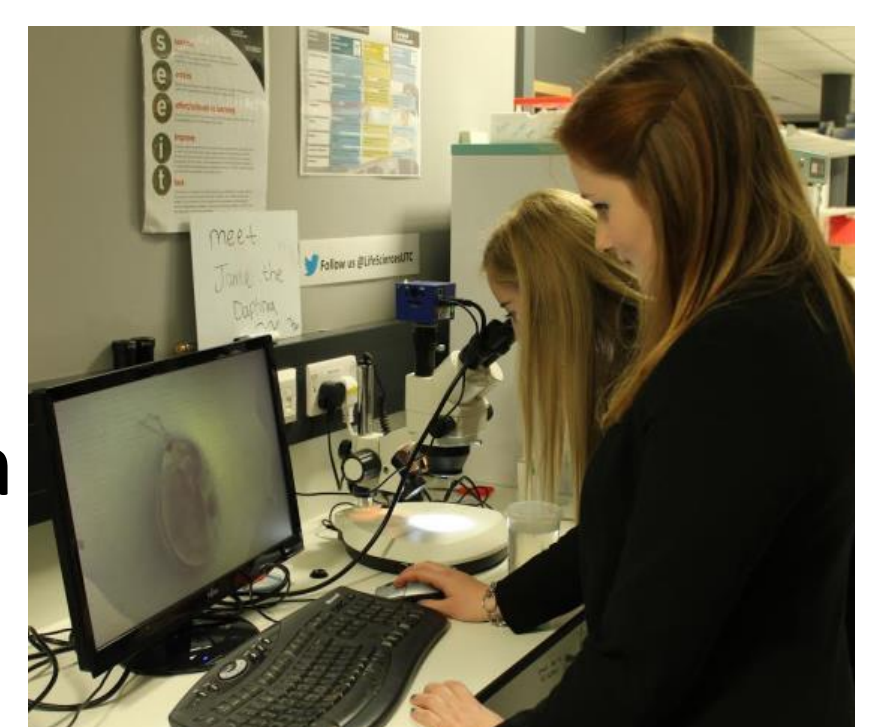
Many 11-12 year old students been involved in acting as demonstrators during these sessions.



3. Short Projects for 11-16 year olds...

Over 150 of our students have completed short independent projects using *Daphnia*.

They were given the opportunity to plan their own investigation using *Daphnia* as a model organism.



Conclusion: the success of this project is built upon strong partnerships between university, college and primary schools. Over 400 students aged 7-19 have already worked with this fascinating creature.

Kazimierz Paprzycki | Zespół Szkół im Adama Mickiewicza | Objezierze | Poland

On the trail of the mysterious radio waves world

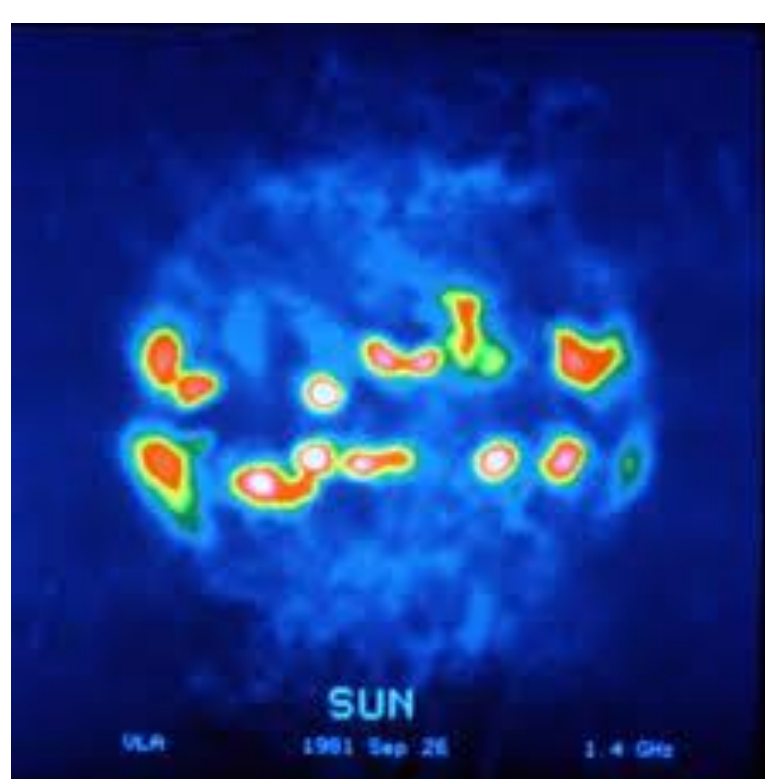
A group of lower secondary school students build their own radio telescope with the use of inexpensive and widely available materials coming from home satellite receiving systems. This telescope can receive not only the radio signal of the sun but also the signal from artificial satellites of Earth like Hot Bird, Astra or signals from radio internet transmitters.



We used satellite dish with 100 cm diameter, Low-Noise Block (LNB) downconverter, satellite signal strength meter with the audio tone built in, 3 meters of coaxial cable, butt connectors, 12-18 V power supply and a tripod to mount the whole set-up.

We named our little radio telescope Swiatowid which is the name of a pre-Slavic god who had four faces and could see everything around.

Working on the project the students also learned about the construction and location of the biggest radio telescopes in the world. While constructing our telescope we visited the village called Piwnice near to Torun to see the largest radio telescope in the middle eastern Europe – 32 meters in diameter.



After combining all the elements together we directed the antenna towards the sun using optical guidance. With great emotions and expectations we registered the radio signal of the sun!

Lilla Kerényi & Gyula Nyerges | TIT Budapesti Planetárium | Budapest | Hungary

Taste the Universe

Celestial bodies are sometimes so incomprehensible for us, it is even difficult to imagine. However, if we are not able to visualize them, the study of their properties is a more difficult task. Models are made to help our imagination. It is even more inspiring and enjoyable if these models are eatable after our detailed study. Well, let's cook edible models of some objects from our Universe!

MENU

Eclipsing binary eggs

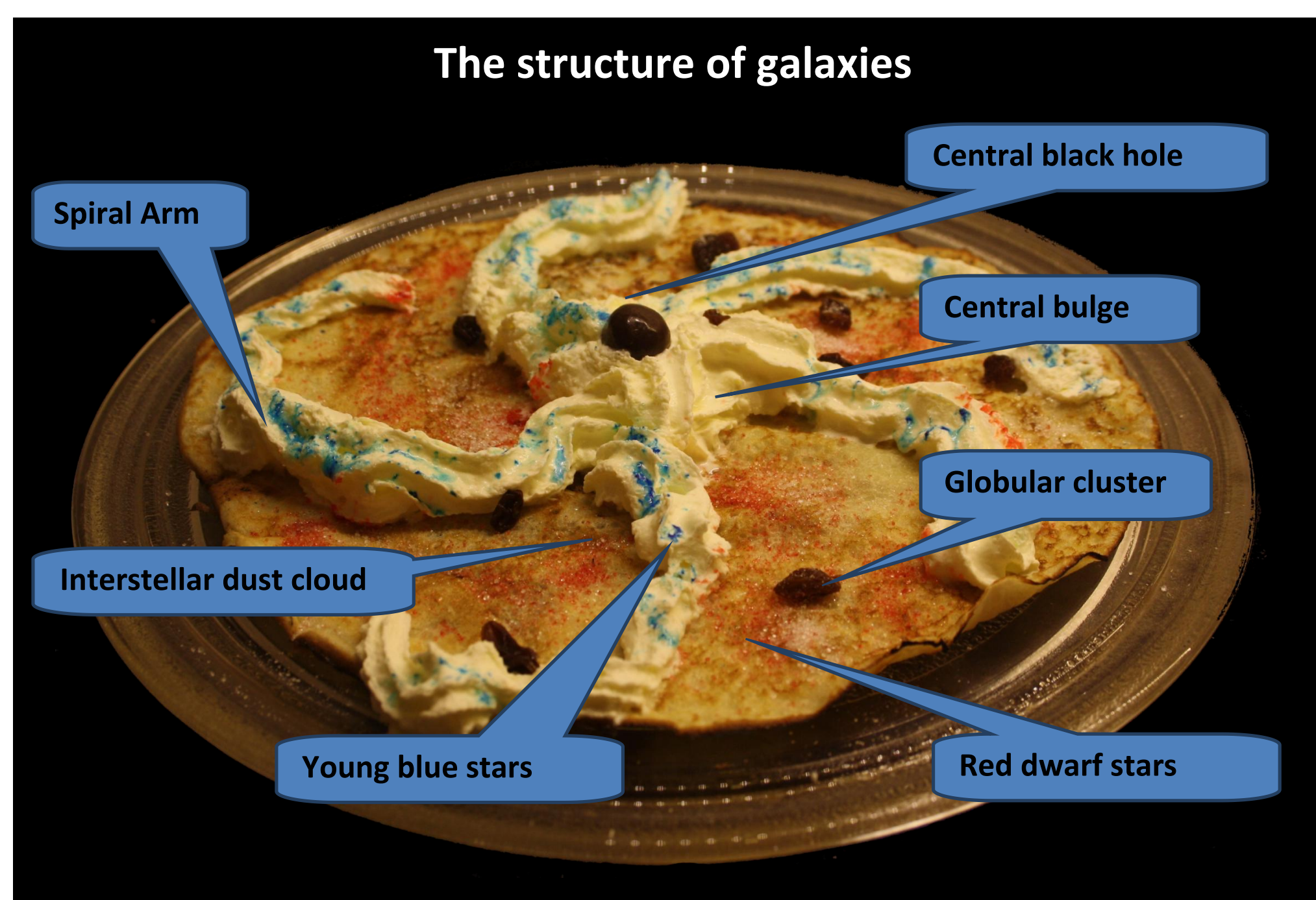
Galaxy pancake

Expanding Universe cake

Solar system fruit basket

Comet ice cream

Galaxy pancake



Spiral galaxies consist of a rotating disk of stars and interstellar medium, along with a central bulge of generally older stars and a huge black hole in the middle. This components are illustrated with different toppings on a pancake.



Expanding Universe cake

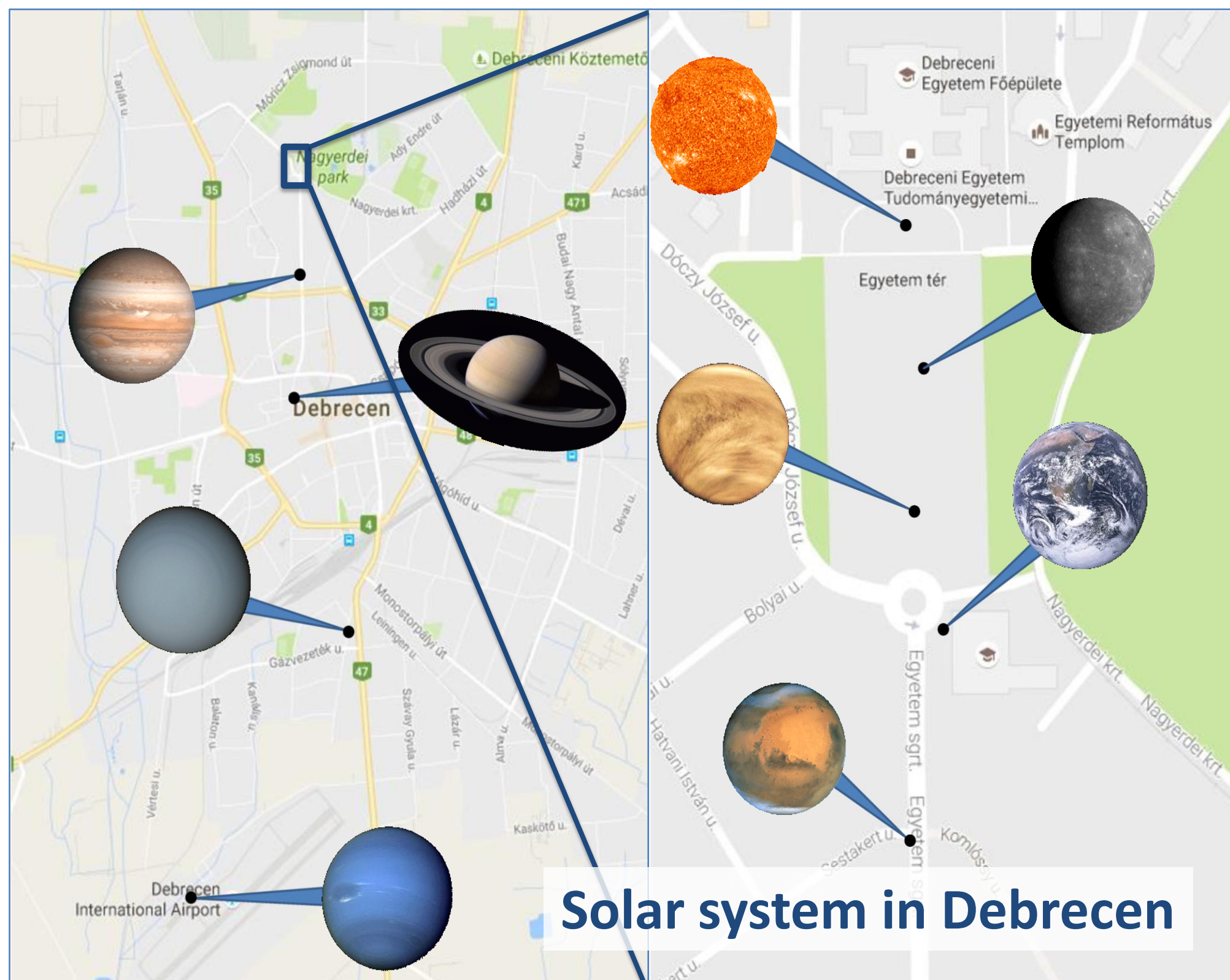
The fact of the receding galaxies in all directions may suggest us a false picture about the expanding Universe that we must be the center of the expansion. A simple (and tasty) experiment can reveal that is not obligate.



Lilla Kerényi & Gyula Nyerges | TIT Budapesti Planetárium | Budapest | Hungary

Taste the Universe

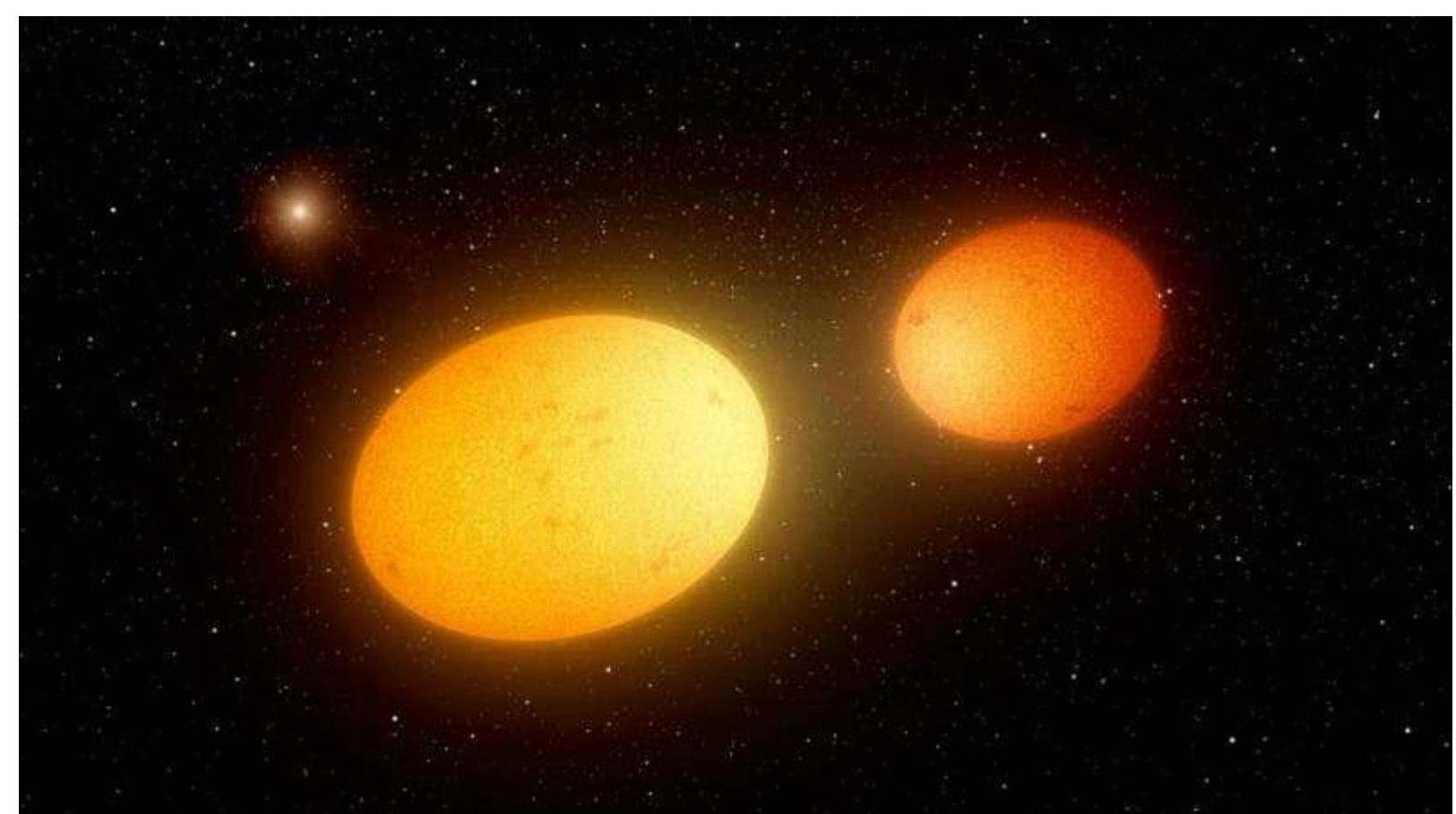
Solar system fruit basket



The sizes and distances in the Solar system are hardly imaginable even when we know the appropriate numbers. Let's make a model of the Solar system to scale! Let's go to the market! The Sun is symbolized now with a huge umbrella, the planets are represented with different fruits available in the market. Let's equip ourselves with rulers and a GPS receiver. Let's take the fruits to the proper distances from the Sun compared to their sizes. Now we have to make a little walking tour to discover our eatable Solar system to scale.

Eclipsing binary eggs

If components in binary star systems are close enough they can gravitationally distort their mutual outer stellar atmospheres. Their shapes become like to eggs headed towards each other. Therefore, in our model, we represent the binary system with two eggs. The red giant star is a hen egg and a white dwarf star which is modeled with a quail egg. The eggs are even colored in the proper way (we know Easter is still far away).



There is a theory which states that if ever anyone discovers exactly what the Universe is for and why it is here, it will instantly disappear and be replaced by something even more bizarre and inexplicable.

There is another theory which states that this has already happened.

Douglas Adams: Hitchhiker's Guide to the Galaxy

Georg Knittelfelder | Akademisches Gymnasium Graz | Austria
Karin Hecke | University of Graz | Austria

Do cockroaches say *HELLO*? Biology Masterclass

The "ForscherInnenwerkstatt Biologie - Biology Masterclass" aims to enhance personal talents and interests. This extracurricular course offers pupils of the 6th and 7th grade the opportunity to pursue their own interests in biology with an individual research question, which is based on the pupil's curiosity. Thus, there are no guidelines, no intervention in hypothesis creation and no additional instructions during research. On the contrary, the pupils work independently and are only supported by students of the University of Graz. This means, that the pupils solve problems on their own and do not get the correct solution.



Indeed, the students just offer help by discussing problems, carefully implementing new ideas and focusing on the research question. After intensive work, the pupils present their research results and receive a diploma.

observing vs. teaching
discovering vs. showing
asking vs. getting answers
interest vs. explanations
coaching vs. leading



Let's make young people feel enthusiastic about doing research!

6 Steps to Success!

1 Find your research question
students part: feedback on feasibility



2 Form your hypothesis – no intervention by adults!



3 Plan your research including all experiments – ask for support in handling equipment, buying material



4 Do research
students will help check if all steps are listed



5 Sum up your results, the only support allowed in: how to summarise and help with pictures



6 Interpret and present your results



Miguel Ángel Queiruga Dios | Jesús-María | Burgos | España

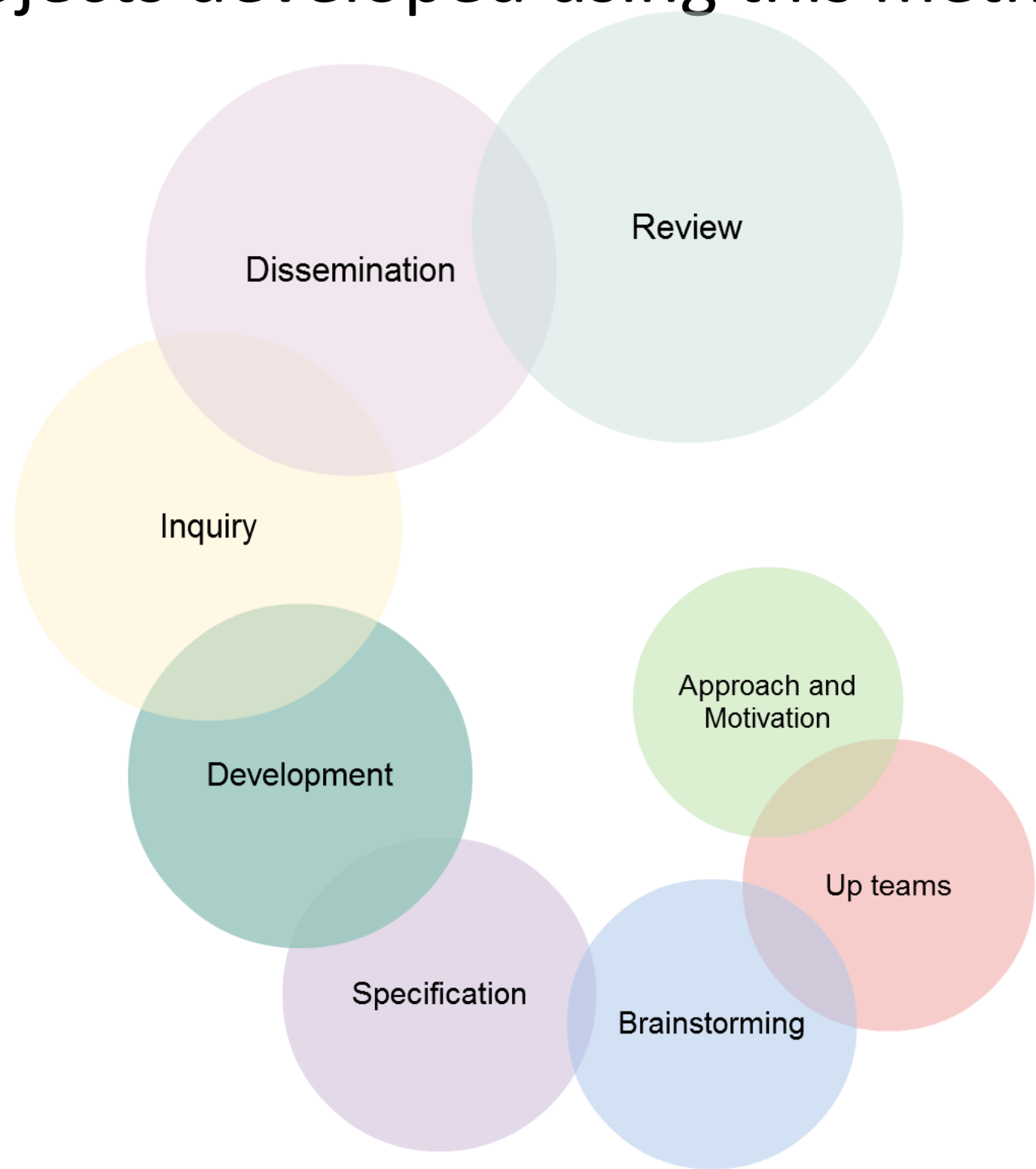
Adaptive and Creative PBL

What do you want to investigate? Do it!

The acPBL (*Adaptive and Creative Project-Problem Based Learning*) methodology suggests an attention to the diversity of the students, responding to their needs and concerns.

To implement this methodology, an essential role of the teacher as project manager is to raise both engaging and insightful questions to support the students learning.

This document shows some multidisciplinary projects developed using this methodology.



Stages diagram of an acPBL process

Title	Contents	public product / dissemination
The air we breathe	The atmosphere. Environmental problems and solutions. Homemade experiences.	Web page Digital Animation
Minerals	Rocks. Minerals. Classification. Dichotomous key. Interactive games.	Web page Digital Animation
Mathematical Photography	Mathematical perspective of our daily environment. Geometric relationships. Other geometries: fractals. Mathematical software.	Blog Podcast Video Conferences Book
Multi Topic	Magazine of varieties with topics of interest for the youngest. Interviews.	Blog Podcast Video Web 2.0 tools: presentations, animations, etc.
Electrochemicallying	Electrochemistry. Homemade experiences. Interactive games.	Web page Digital Animation
Leonardo Da Vinci	Life. Work. Art. Science. Construction of inventions.	Web page Digital Animation
Free software. Is it really an alternative?	Free software. Applications. Comparative analysis. Usage statistics.	Web page Video Animation Online statistical graphs Social networks Conferences Book
Searching for life... the game	Astrobiology. The origin of the universe. The origin of life.	Poster Blog Board game Presentation at scientific fairs
1, 2, 3, 4, ... iiiHiggs!!!	Subatomic particles. Mass and energy. Forces in nature. Elementary particles. The Higgs boson. Questionnaires. Interactive games. Interviews.	Web page Blog Animation Social networks Book
Mars: weather and life	Solar system. Habitability conditions. Meteorology. Analysis of meteorological data. The origin of life. Extremophiles. Interviews.	Blogs Video Posters Conferences Articles Social networks Presentation at scientific fairs
Mindstorms: Water detection on Mars	Mars and life. Water on Mars. Robotics with Lego.	Posters Articles Social networks Presentation at scientific fairs
2016 Space. Conquering space ...	Science and fiction. Exoplanets. Institutions. Space exploration.	Blog Animation Articles Social networks Presentation at scientific fairs Book

A vital role of the teacher is to know how the students are completing their tasks, and to understand the methods they are utilizing in order to do so. To achieve this, preparation on the teacher’s part is essential regarding both scientific issues and pedagogical methodologies.

Nurcan Turan Candan | Atatürk Art School | ESKİŞEHİR | TURKEY

Chemistry Teaching with Apple Candy

Food additive colors are harmful. Our children and young people tend to consume these foods constantly. A product that is said to be able to eat once in the week consumes every breath. The health risk factor increases. There is also an adhesion and cohesion unit in the 9th grade chemistry curriculum. Adhesion (Adhesion), which exists between two different substances and provides the adhesion of these two substances to each other, is called Adhesion. Cohesion is the attraction between molecules of the same sex. Molecular attraction. In our apple sugar study, natural food coloring was made in 10th grade, natural emulsifier was applied and in 9th grade, adhesion and cohesive forces were applied.



Conclusion: We made sugar candy using sugar beet as a natural food coloring. We understand the issues of adhesion, cohesion and surface tension. We did an experiment after adding a try before adding lemon lemon. It was observed that lemon juice is a natural regulator of. 9 and 10 in the preparation of the syrup was repeated solution unit located in chemistry class curriculum.

Orbán Sándor | BMSzC Neumann János Secondary School | Budapest | Hungary

Complex 3+T Method

The role of parallel development of physical, emotional, and intellectual abilities in talent management

The aim of Complex 3+T method, is to develop the students' physical, emotional and intellectual abilities in a **parallel way**. The method is based on three pillars: sports, arts and research and aims to promote the coordinated operation of the two hemisphere of the brain.

Sport (physical abilities)

Analytical, planing and executionary abilities as well as concentration, attention, endurance and creativity.



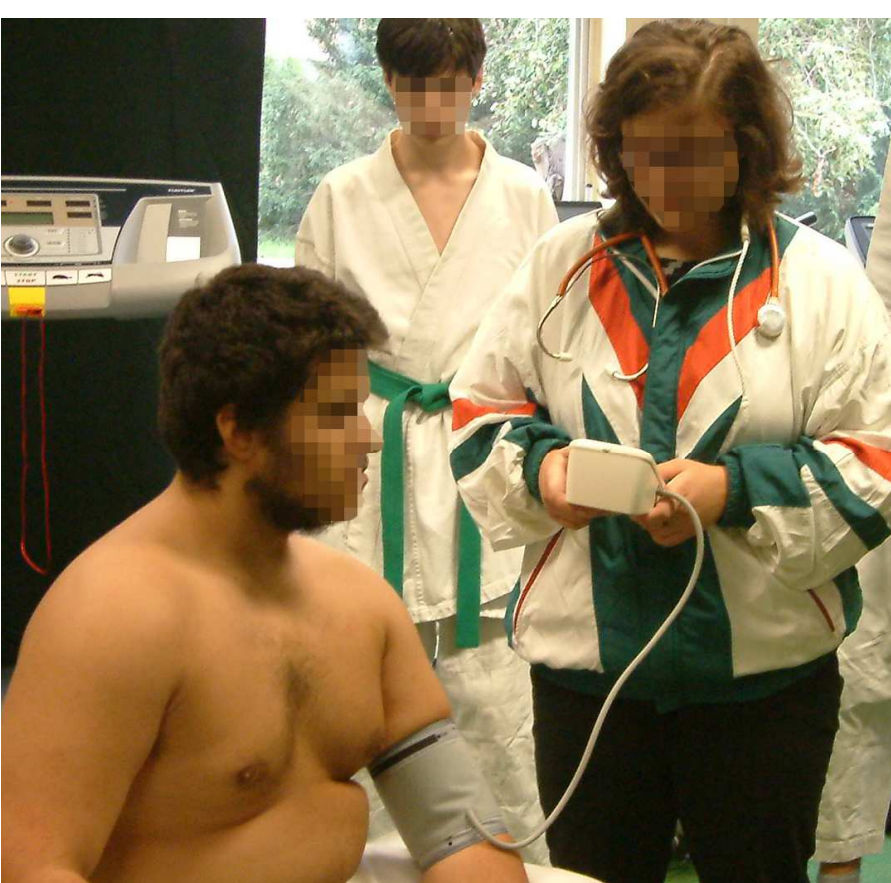
Arts (emotional abilities)

Proactive thinking, imagination, concentration, analytical logical thinking as well as analytical, planing and executionary abilities and creativity.



Research (intellectual abilities)

Thinking in systems, attention, concentration, endurance as well as analytical, planing and executionary abilities and creativity.



The effectiveness of the method

During the two and a half decades of application of the method the students involved have achieved numerous prominent sports, art, research and study results.



The success of the method

The Ministry of Human Resources in Hungary, based on the results achieved, rewarded the method with the prize of "Bona Bonis – For the talented people of the nation".



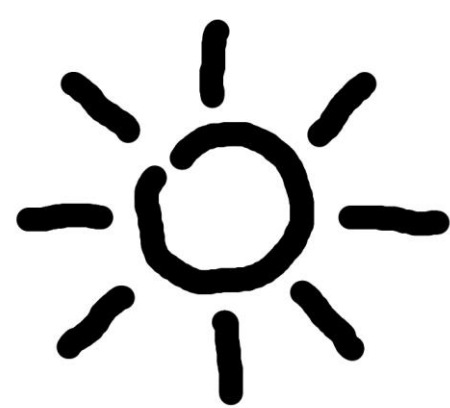
Angelika Renz | Karl-Franzens-Universität | Graz | Austria

The Radiation Surrounding Us

A Student Lab

Motivation

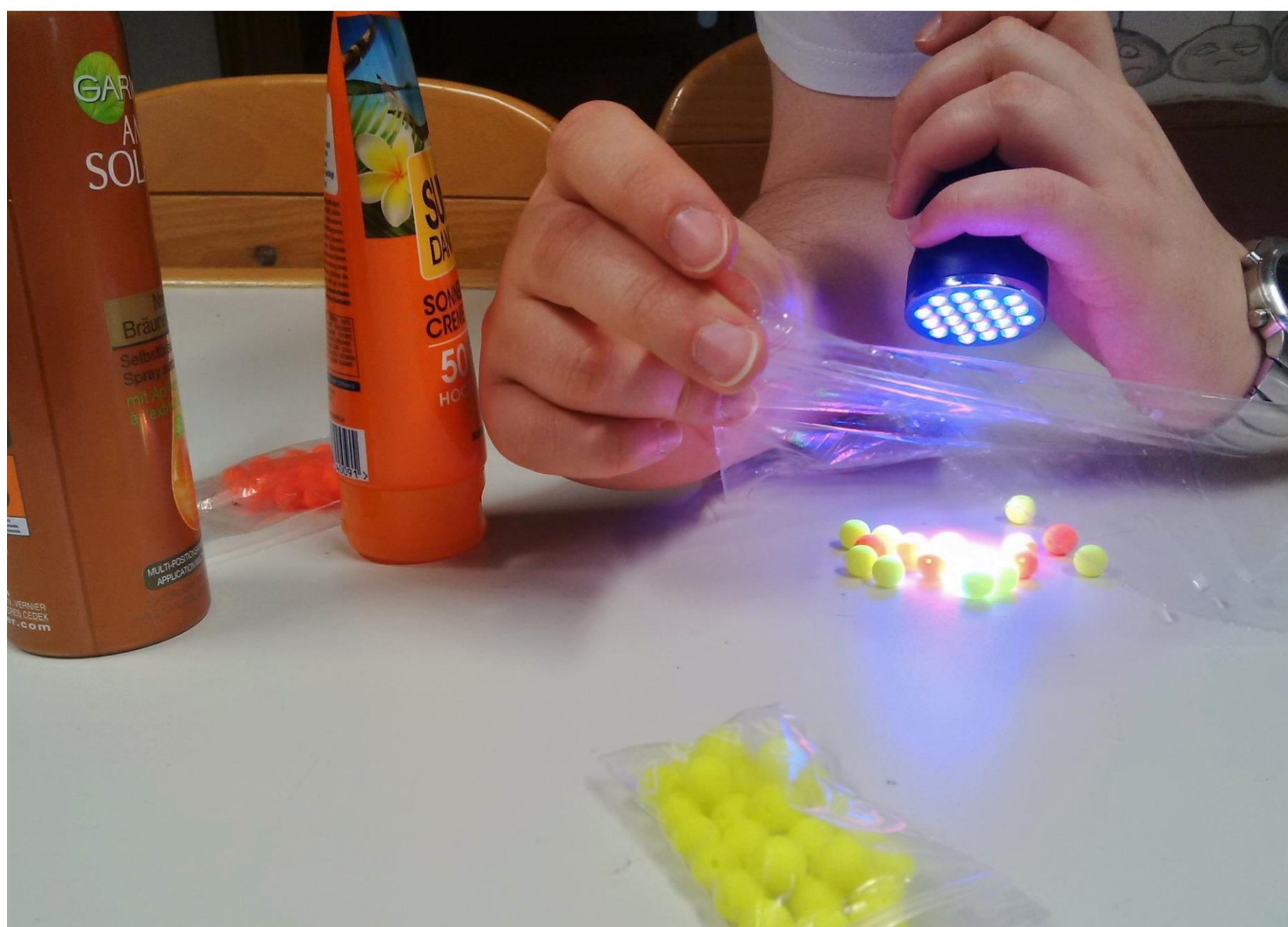
Is it possible to survive without water and food – just by using the sun's energy?



I turn off my mobile phone at night, but the WIFI is constantly switched on – will this kill me anyway?



Questions like these are rarely being addressed during formal instruction. Now they were integrated in the newly installed student laboratory at the Karl-Franzens-Universität Graz.



Concept

Teachers and their students visit the students lab when discussing radiation in class.

5 stations of group work

4 types of radiation
(visible light, UV-,
infrared and microwave radiation)

≥ 16 experiments in one lab

15 years and older



Aim

The aim of the student lab is to address possible **questions and misconceptions about radiation** and its danger. Students should understand what ionising radiation is and what its effects on the human body are.

Even low-intensity ionising radiation is dangerous! So, sunscreen is **your** friend.

100%
Radiant!

Daniela Schwarz - Neues Gymnasium Rüsselsheim
Jun.-Prof. Dr. Amitabh Banerji - University of Cologne
Germany

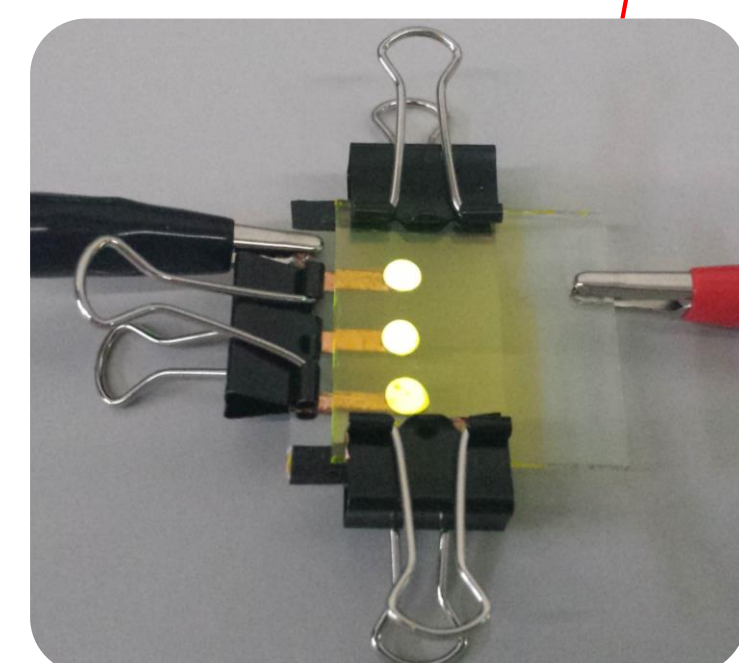
Organic LED - Introducing a Future Technology into Chemistry Classes

Chemistry basic class (secondary school, age 16-17)



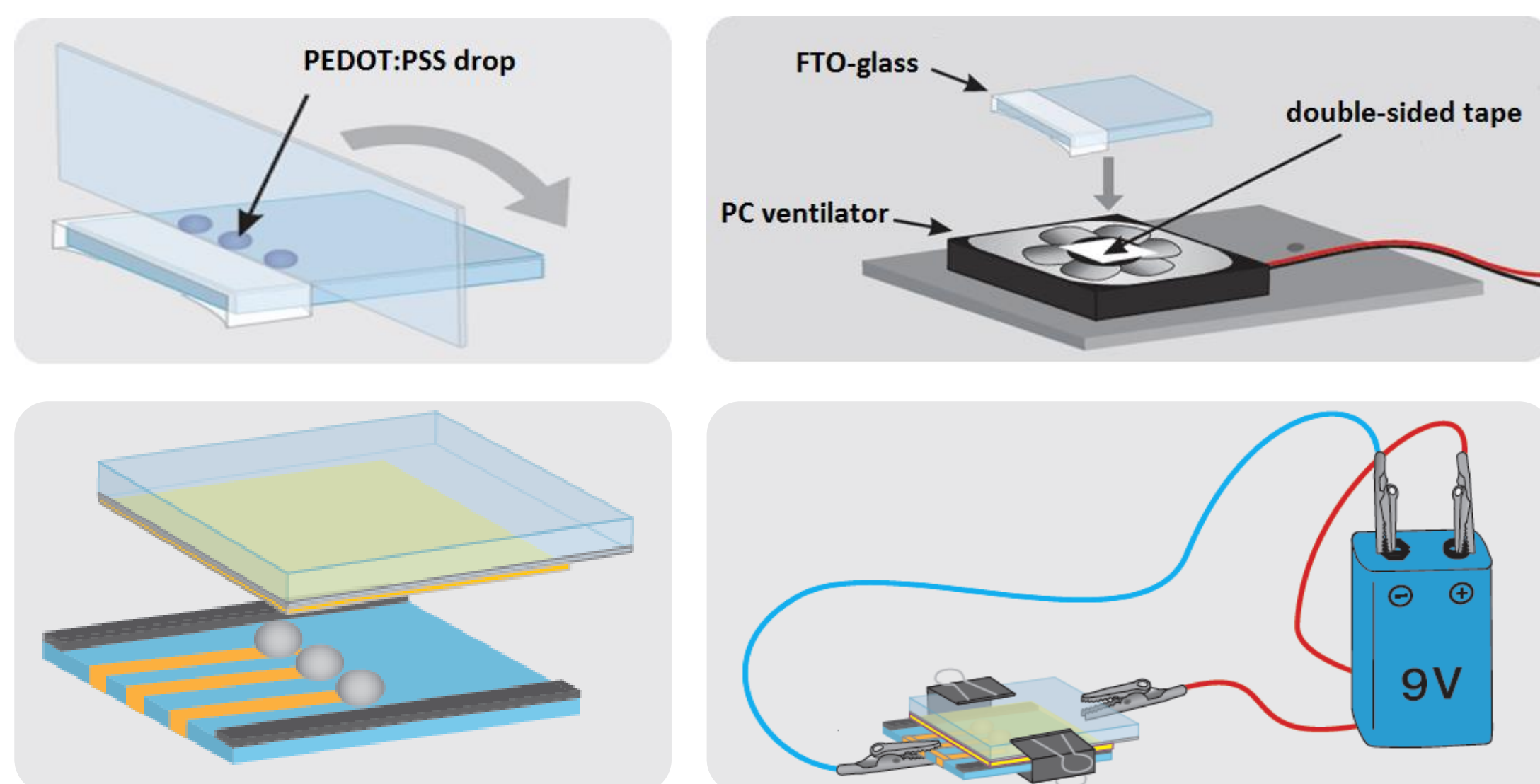
<http://www.samsung.com> (13.11.2016)

Organic Light Emitting Diodes (OLEDs) are innovative illuminants which are already being applied in the displays of modern smartphones and TVs. OLEDs use organic semiconductors, e.g. conjugated polymers, for light emission. This future orientated topic has been theoretically and experimentally introduced into a chemistry class at the secondary school Neues Gymnasium in Rüsselsheim (Germany).



Self made OLED

How to build an OLED – A Students' Experiment



Step 1 – Preparation of the Anode:

Clean and mask the FTO-glass.

Coat the FTO-glass with PEDOT:PSS.

Step 2 – Application of the Emitter:

Spincoat the FTO-glass with Superyellow.

Step 3 – Application of the Cathode:

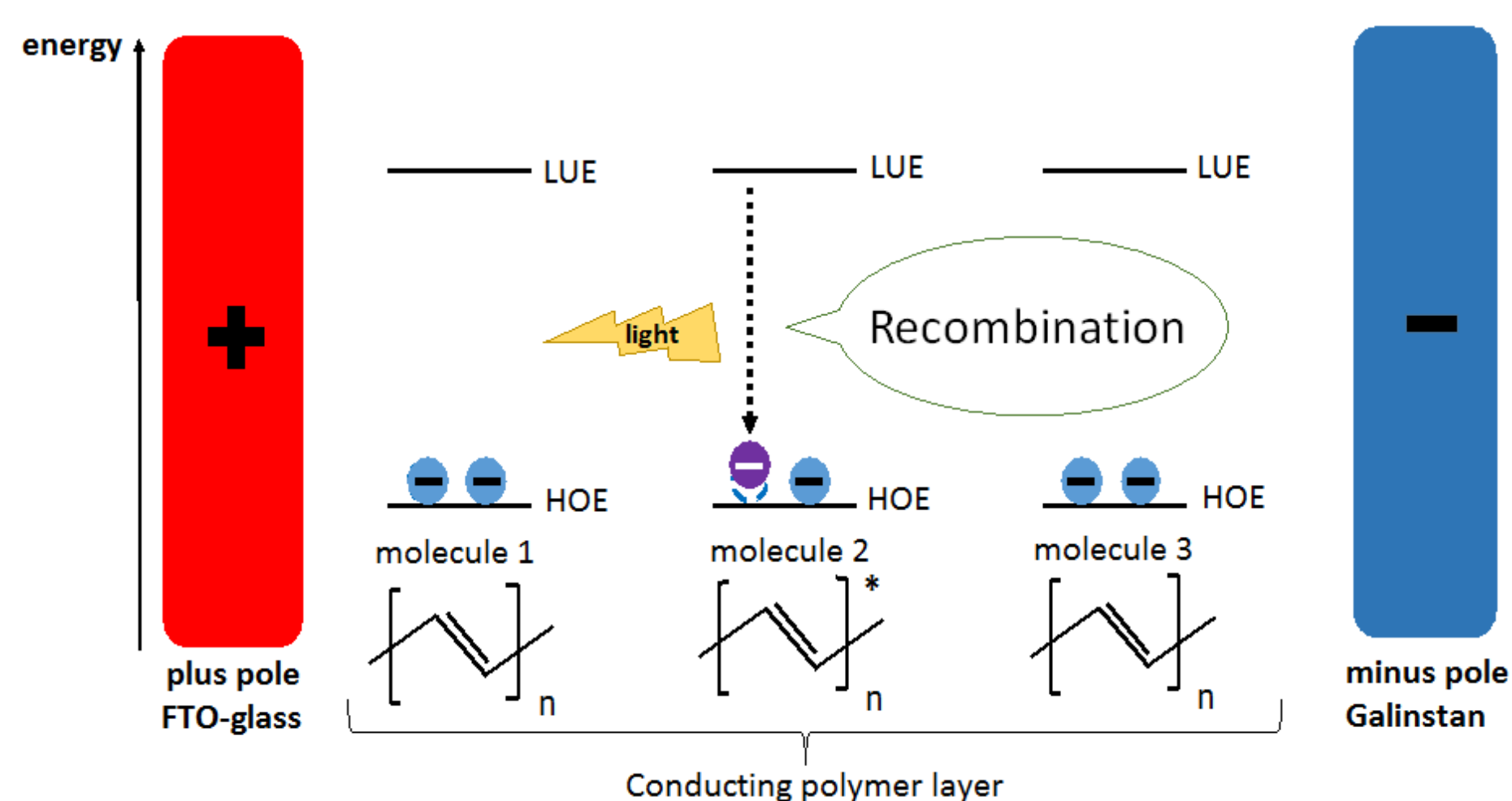
Apply Galinstan and assemble the OLED.

Step 4 – Operation of the OLED:

Connect the OLED to a 9V battery.

How does an OLED work?

The electroluminescence in an OLED can be explained by the model of energy levels.



Impressions from the school project

