Nathalie Debaes – CEO EYESTvzw

Photonics explorer

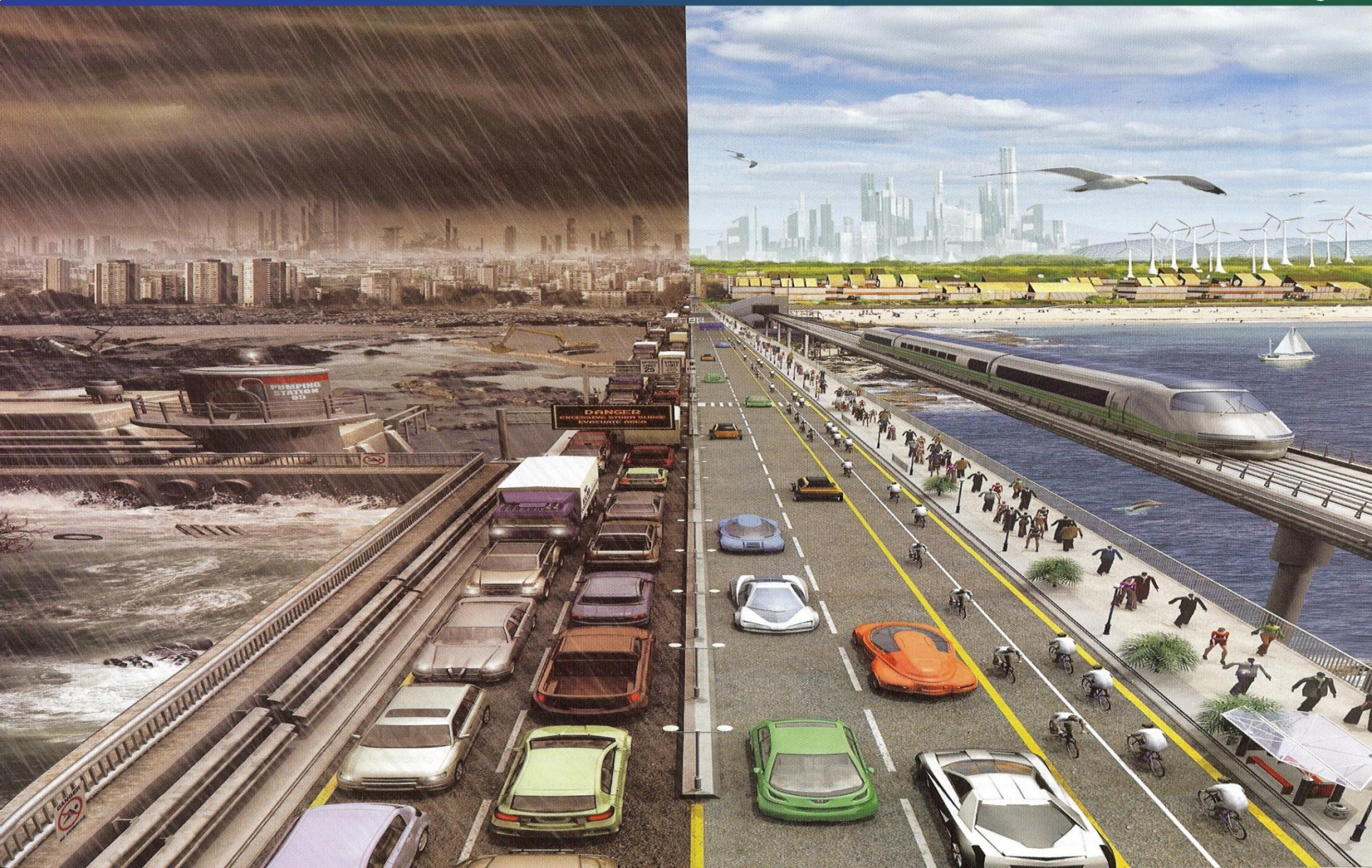
Vrije Universiteit Brussel

B-PHOT BRUSSELS PHOTONICS TEAM

Eyest VZW
Excite Youth for Engineering, Science and Technology

engage, excite, educate.

Scientists and Engineers are needed for economic and social sustainability

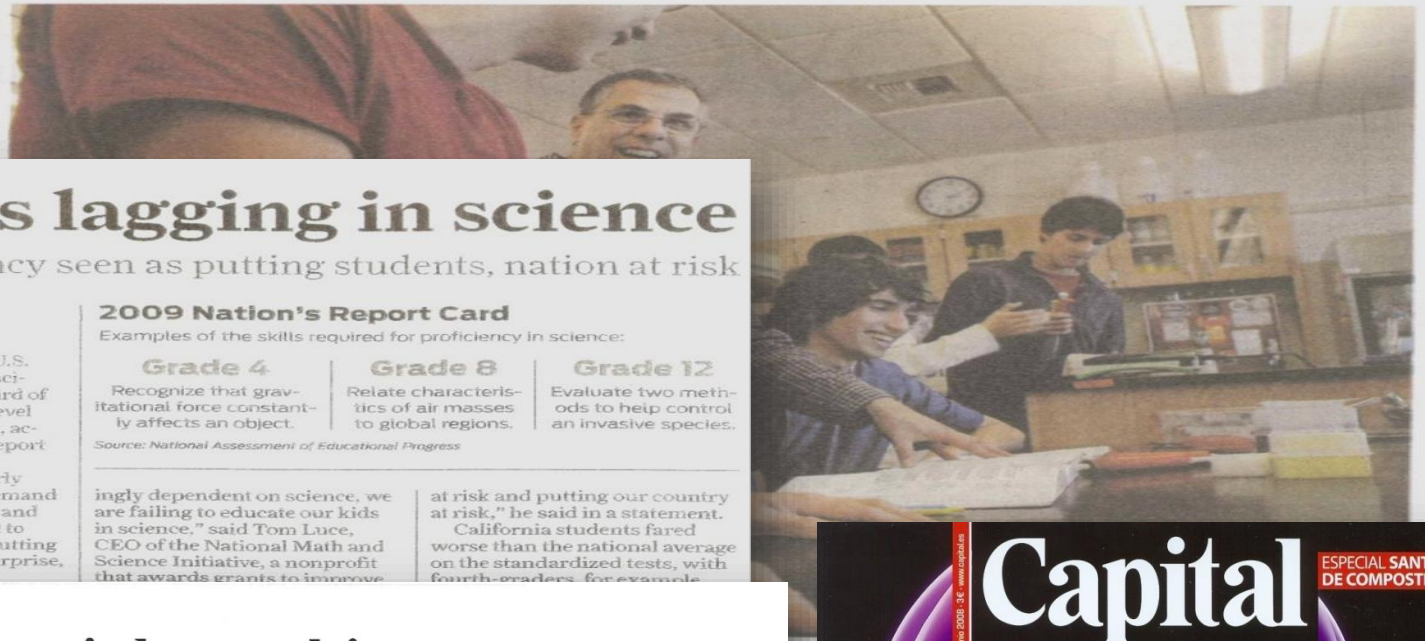


Poor science aptitude worries leaders

Test from page A1

lagging behind 43 jurisdictions — 42 states and the Department of Defense schools — on the science test and in a dead heat for last with three others: Hawaii, Arizona and Mississippi.

Four states did not participate in the voluntary testing



Youths lagging in science

Low proficiency seen as putting students, nation at risk

By Jill Tucker
CHRONICLE STAFF WRITER

Just 1 out of every 100 U.S. schoolchildren excels at science, while less than a third of their peers reach grade-level proficiency in the subject, according to the Nation's Report Card released Tuesday.

The scores are not nearly good enough given the demand for innovators, inventors and problem solvers required to keep the country on the cutting edge of industry and enterprise, education officials said.

2009 Nation's Report Card

Examples of the skills required for proficiency in science:

Grade 4	Grade 8	Grade 12
Recognize that gravitational force constantly affects an object.	Relate characteristics of air masses to global regions.	Evaluate two methods to help control an invasive species.

Source: National Assessment of Educational Progress

ingly dependent on science, we are failing to educate our kids in science," said Tom Luce, CEO of the National Math and Science Initiative, a nonprofit that awards grants to improve

at risk and putting our country at risk," he said in a statement.

California students fared worse than the national average on the standardized tests, with fourth-graders, for example

Ingenieurstudies minder populair

- zondag 20 september 2009 Bron: belga

BRUSSEL - Het aantal studenten industrieel en burgerlijk ingenieur stijgt minder snel dan bij andere richtingen. Beide opleidingen zijn ook beduidend minder populair bij meisjes dan vorig jaar. De richting industrieel ingenieur telt zelfs 25 procent minder vrouwelijke studenten.

Dat blijkt uit een enquête van Agoria, de federatie van de technologische industrie.

Nog nooit schreven zoveel studenten zich in aan de universiteiten en hogescholen als dit jaar. Zo noteren al onze universiteiten een stijging van hun eerstejaarsstudenten met 10 tot 15 procent en bij enkele hogescholen loopt de stijging op tot 25 procent. 'Maar ingenieursopleidingen genieten niet genoeg mee van het succes van het hoger onderwijs', betreurt directeur-generaal Wilson De Pril van Agoria.

De stijging van studenten die zich voor de eerste maal inschrijven in het hoger onderwijs in de opleiding industrieel en burgerlijk ingenieur bedroeg respectievelijk met 3 en 3,6 procent. Het aantal vrouwelijke generatiestudenten in beide richtingen liep drastisch terug: -25 procent bij de industrieel ingenieurs in spe en -12 procent bij de richting burgerlijk ingenieur.

De Pril merkt nog op dat vrouwelijke studenten zowel aan hogescholen als universiteiten in de meerderheid zijn. Bij de ingenieursopleidingen is de verhouding daarentegen 16 procent vrouwen en

Students are silent spectators

Nobody learns to ride a bike...

...by watching someone else

The Photonics Explorer: engage, excite, educate
A comprehensive , intra-curricular class kit

Photonics explorer

PHOTONICS 21

Vrije Universiteit Brussel

B-PHOT BRUSSELS PHOTONICS TEAM

SEVENTH FRAMEWORK PROGRAMME

Photonics explorer kit =

Inquiry Based Learning with experiments about light and light technology

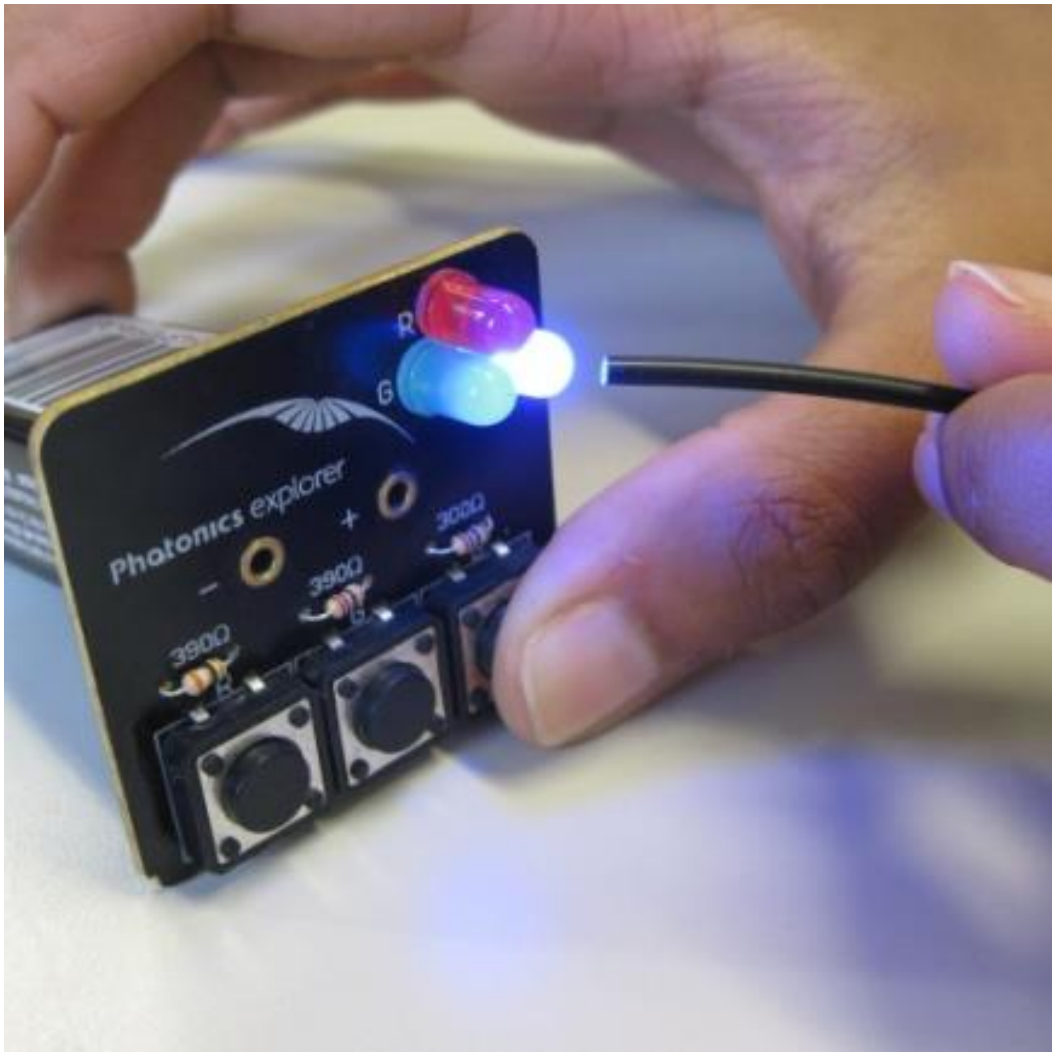
Central Aspects

Thinking: designing, planning, skills, motivation

Doing: groupwork, discussions, relevant experiments

Learning: conclusions, ‘Eureka!-moments’

experimental material for inquiry -based learning



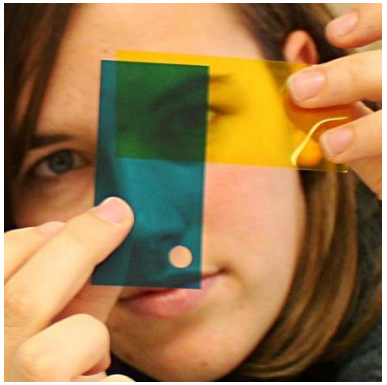
- Simple
- Versatile
- Robust
- Safe

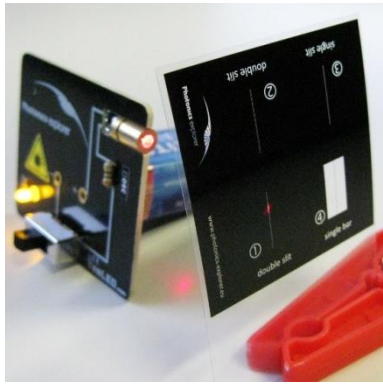
Class set of experimental material (for 10 groups)

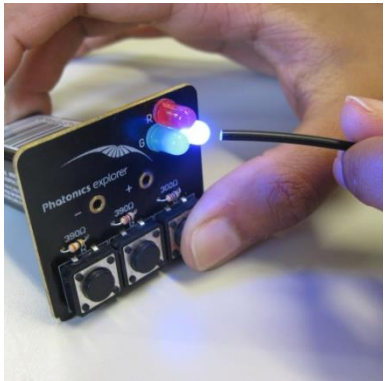
The Photonics Explorer: Experimental Components

Components in the kit

10 aluminium **mirrors** (7x7 cm)
20 **polarisers** (7x5 cm)
10 **colour filter** sets (7x4 cm) including
red, green, blue, cyan, magenta and yellow
10 **LED modules** with red, green and blue LEDs
10 sets of robust plastic **lenses** with the
focal lengths 30 mm, -30 mm, and 150 mm
10 foils with **slit and double slit**
for optical diffraction experiments
10 **diffraction gratings**
5 m **polymer optical fibre**
10 eyesafe **Lasers**







Didactive Framework

- **Didactic Framework (8 modules)**
  - Worksheets, Factsheets
  - Teacher-guides
  - Multimedia Material

  - Modular
  - Adaptable
  - Themes in concert with educational targets of the curricula
- Available in 10 languages

(English, German, Dutch, Spanish, Polish, Bulgarian, French, Italian, Czech, & Russian) and Swedish translation under way

The Educational Modules

Lower secondary level (12-14 years)

- **Light signals** – the properties of light and its use in telecommunication
- **Colours** – colour perception, additive and subtractive colour mixing
- **Lenses and telescopes** – refraction and imaging
- **Eye and vision** – comparison between human eyes and digital cameras, learning about accommodation in the eye

Upper secondary level (16-18 years)

- **Making light** – comparing light sources for efficiency and sustainability
- **Diffraction and interference** – diffraction on a slit, spectrometry
- **Polarisation** – applications in displays and life sciences
- **A scientist's job** – encouraging esp. young women to pursue careers in science and engineering

Inquiry Based Learning Techniques

- hands-on experiments
- links to current technologies
- scientific and analytical skills
- teamwork
- problem-solving
- critical thinking
- working as scientists and engineers

Successful EU wide field tests

50 kits successfully tested with over 1500 students in 7 EU countries;

- Belgium
- Bulgaria
- France
- Germany
- Poland
- Spain
- UK

Impact scientifically evaluated




Scientific evaluation of impact

- **Improvement of self-efficacy and interest** of students overall
- **Girls feel more confident** in their scientific ability and their self-efficacy rises.
- **Interest of male students in physics rises**
- The Photonics Explorer works especially well with **lower secondary students.**

Feedback from teachers

- 'It is a good concept, well designed with lots of **simple tools that can be easily used by students'**
- By doing the experiments it seems that the students **better understand the theory**
- Link to technological applications was well appreciated
- 'Working with the Photonics Explorer triggered the students' **interest.**
- Students were **more actively involved** in the lectures
- Students were triggered to raise much **more questions**

The core activities of EYESTvzw

- ***Manufacturing of the kits:***
  - Production in sheltered work place (Halle, Belgium)
  - We distributed more than 1200 kits

- ***Distribution:***
  - Decentralized distribution using Local Associated Partners (LAP)
  - First using existing networks (testing countries)
  - Expansion based on existing languages, interest and funding

- ***Teacher training:***
  - Representatives of the LAPs receive one-day introduction workshop about the content of the kit and EYESTvzw.
  - Teacher training always done by local professionals

- ***Dissemination and Communication***
  - intensive dissemination through general media to ensure a permanent visibility
  - internet based community platform for student, teacher and parent interaction

- ***Updating the content of the Photonics Explorer, spare parts***

- ***Fund Raising***

Sponsor Benefits

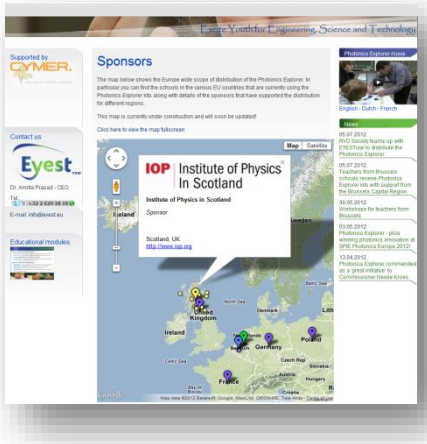
1 kit costs 150 €

Over its lifetime **each kit** will:

- reach at least **250 students** = **€0.60 per student**.
- serve **50 hands on lessons** = **€ 0.12 per lesson**

All sponsors receive:

- Choice of region of distribution within Europe
- Choice of distribution to schools in local community/schools selected by sponsor
- Sponsor logo on an insert inside every sponsored kit
- Exclusive publicity at large scale events (conferences, industry fairs, educational events)
- Publicity on EYESTvzw website and written communication (in English)
- PR material for corporate communications (in English)
- Sponsored schools indicated on an interactive map on website with sponsor logo



Teacher trainings

Distribution of the kit always in conjunction with teacher training !

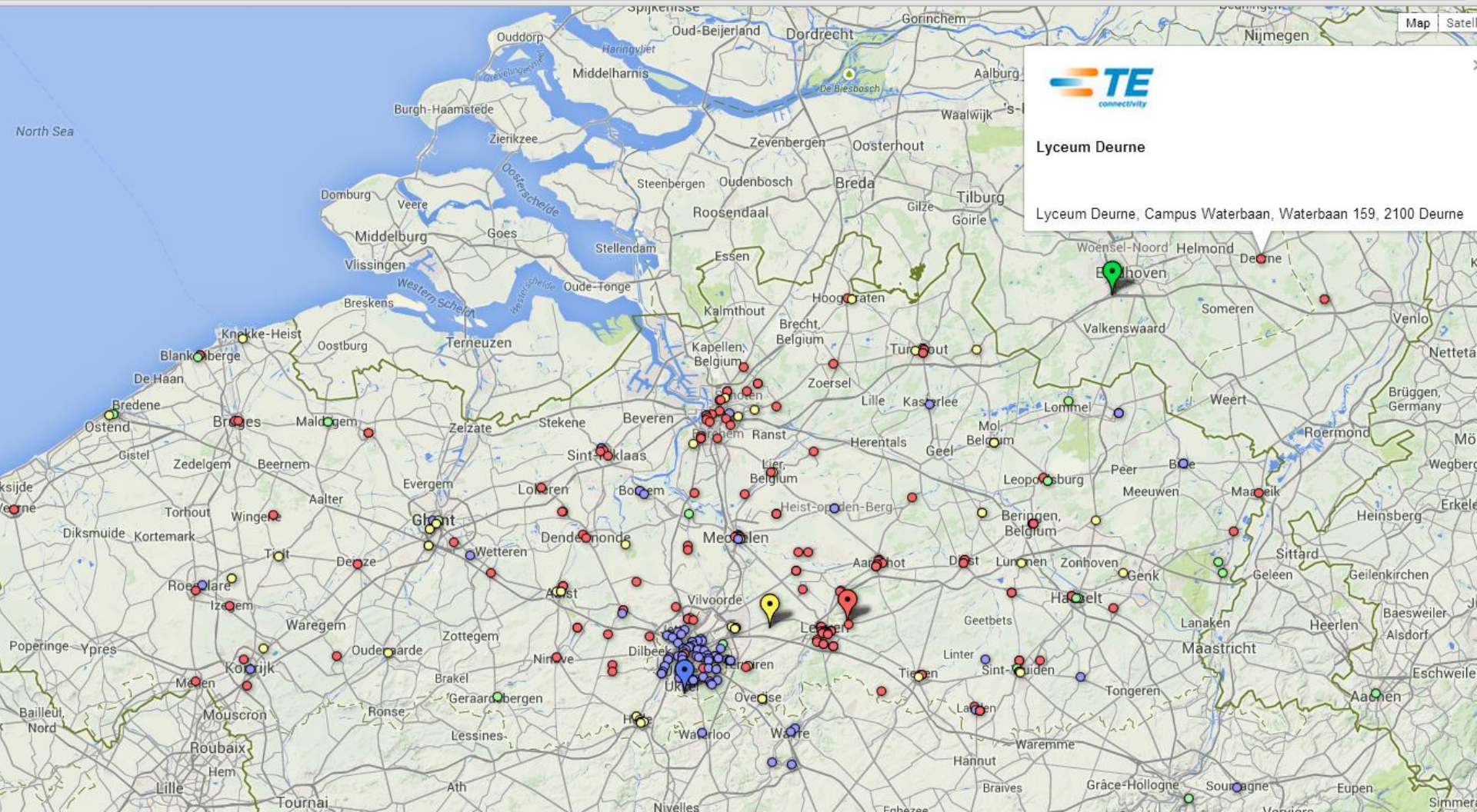
<u>Agenda of a typical teacher training</u>

-**Presentation** :
-Background information & idea behind the Photonics Explorer
-Overview on the content of the Photonics Explorer

-Time to do some **experiments** with the Photoncs Explorer kit

More than 1200 Photonics Explorer distributed

- Immediate overview of distribution: countries, schools and sponsors
- Scope of dissemination and impact
- Teachers know which neighbouring schools are using the kit for reference



Highly commended initiative

EYESTvzw and the Photonics Explorer was **commended by Vice-President of the European Commission**, Neelie Kroes at the Photonics21 Annual Meeting of Stakeholders 2012. [http://www.youtube.com/watch?v=08ts7i0WOII] as one that was '*making sense to fill in what is needed*' and was the '*future of industry and the future of Europe*'. She provided additional visibility on her blog, twitter and facebook accounts and urged companies to support EYESTvzw

The Photonics Explorer was **awarded a special innovation award at SPIE Photonics Europe 2012** and was invited to be a part of the 'Photonics for a Better World' exhibition during SPIE Optics+Photonics 2012 in San Diego.

Visibility

DMorgen.be

NIEUWS SPORT GELD MUZIEK OPINIE PLANET WATCH TECHNOCITY MAGAZINE CULTUUR & MEDIA

BINNENLAND | BUITENLAND | WETENSCHAP | GEZONDHEID | STAND DER DINGEN

Photonics Explorer: experimenteerkit voor secundair onderwijs

Bewerkt door: redactie – 12/12/12, 20u39 – Bron: belga.be

VERWANT NIEUWS


Vlaamse scholieren bij slechtste van Europa voor wetenschap - 11/12/12


"België moet kwaliteit van onderwijs hoog houden" - 26/11/12


KU Leuven maakt extra studieruimte vrij tijdens blokperiode - 12/12/12

MEER OVER

Onderwijs


Vlaamse scholieren bij slechtste van Europa voor wetenschap

DM VIDEO **Het Photonica Team van de VUB heeft vandaag in het bedrijf TE Connectivity in Kessel-lo haar 'Photonics Explorer' gelanceerd. Het betreft een kit met allerhande materiaal**

FIRSTPOST.

FRONT PAGE POLITICS SPORTS INDIA WORLD BUSINESS ECONOMY INVESTING LIFE BOLLYWOOD TECH BLOGS

PLUS IPL 6 Google I/O Conference Brands Real estate New Delhi Mumbai Photos eBooks

Firstpost > Topics > Organization > TE Connectivity > Videos

Photonics Explorer - Launch event at TE Connectivity - Teacher Testimonials

TE Connectivity Gallery >>

CORDIS Technology Marketplace Connecting people to technology

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home search

Feature Stories -A hands-on approach to physics in the classroom


© Vrije Universiteit Brussel B-PHOT

Remember high school physics class? Trawling through text books, grappling with complex theories and little, if any, hands-on experimentation. Many students across Europe could be forgiven for describing physics as a boring subject. But that is now set to change thanks to an EU-funded project that is bringing 'inquiry-based learning' (IBL) to the physics classroom.

Developed by a team of photonics researchers, teachers and experts in pedagogy from 11 EU countries, a new educational kit, filled with equipment for fun and interesting classroom experiments is being distributed free to schools across Europe. By 2015, its developers hope, the Photonics Explorer kit will be used by 2.5 million European high school students to conduct practical experiments in photonics - a key area of modern physics and technology - and raise their interest in physics and science in general. That, in turn, should encourage more young people to focus on careers in the sciences, helping Europe overcome a shortage of skilled workers in high-tech industries.

New ways to reach out

Physics outreach usually consists of appealing and fun demonstrations outside of the classroom. But Amrita Prasad and Hugo Thienpont argue that only "educational outreach" can have a deep impact on students' interest in science.


OPTICS | EDUCATION

Photonics Explorer:

Working within the Curriculum to Engage Young Minds

Amrita Prasad, Nathalie Debaes, Johan Vlekken, Nina Conde, Manfred Euler and Hugo Thienpont

The Photonics Explorer teaching kit is designed to work within the European secondary school curriculum. This approach allows teachers to easily incorporate optics and photonics into their lesson plans and introduces more students to this exciting field.

effect to engage students. They rely on the inner and motivation of enthusiastic scientists and usually have local and limited impacts. While such activities succeed in momentarily raising the interest of students, they seldom influence their future career choices or opinions of science. Therefore, it is important that

INTERNATIONAL YEAR OF LIGHT 2015

news | 2012-10-25

EYESTvzw now a partner in UNESCO supported International Year of Light in 2015!

The UNESCO Executive Board has enthusiastically supported the proposal to declare an International Year of Light in 2015. With the initiative and support of Prof. John Dudley, European Physical Society President-Elect, EYESTvzw is part of the International Steering Committee for this global initiative.

EPS

The International Year of Light is an initiative developed from 2009 by the European and African Physical Societies, on behalf of a global partnership of over 40 scientific societies, academies and other institutions, in collaboration with the UNESCO International Basic Sciences Programme (IBSP). A resolution in favour of the proclamation of 2015 as the International Year of Light was unanimously approved by the International Union of Pure and Applied Physics

Photonics Explorer and MEDEA (WP4-5)

- **Training of the Photonics Explorer**
  - At MEDEA networking meeting in Jan2016 , Milan
  - For all (ESR and ER) researchers of MEDEA
  - How to give workshops for teachers or for Students ?
- **Distribution of Photonics Explorer kits**
  - 2 to 3 Kits per researchers -> 45 kits
- **Use of Photonics Explorer kits in outreach activities**
  - kit to give workshop to secondary school students
  - Or train teacher to use it in their class

    ! Language ! (still missing Greek and Danish)
- **Collection of Feedback /measuring the impact**

Thank you!

The Educational Modules

Lower secondary level (12-14 years)

- **Light signals** – the properties of light and its use in telecommunication
- **Colours** – colour perception, additive and subtractive colour mixing
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Upper secondary level (16-18 years)

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- **Diffraction and interference** – diffraction on a slit, spectrometry
- **Polarisation** – applications in displays and life sciences
- **A scientist's job** – encouraging esp. young women to pursue careers in science and engineering

Didactic Framework

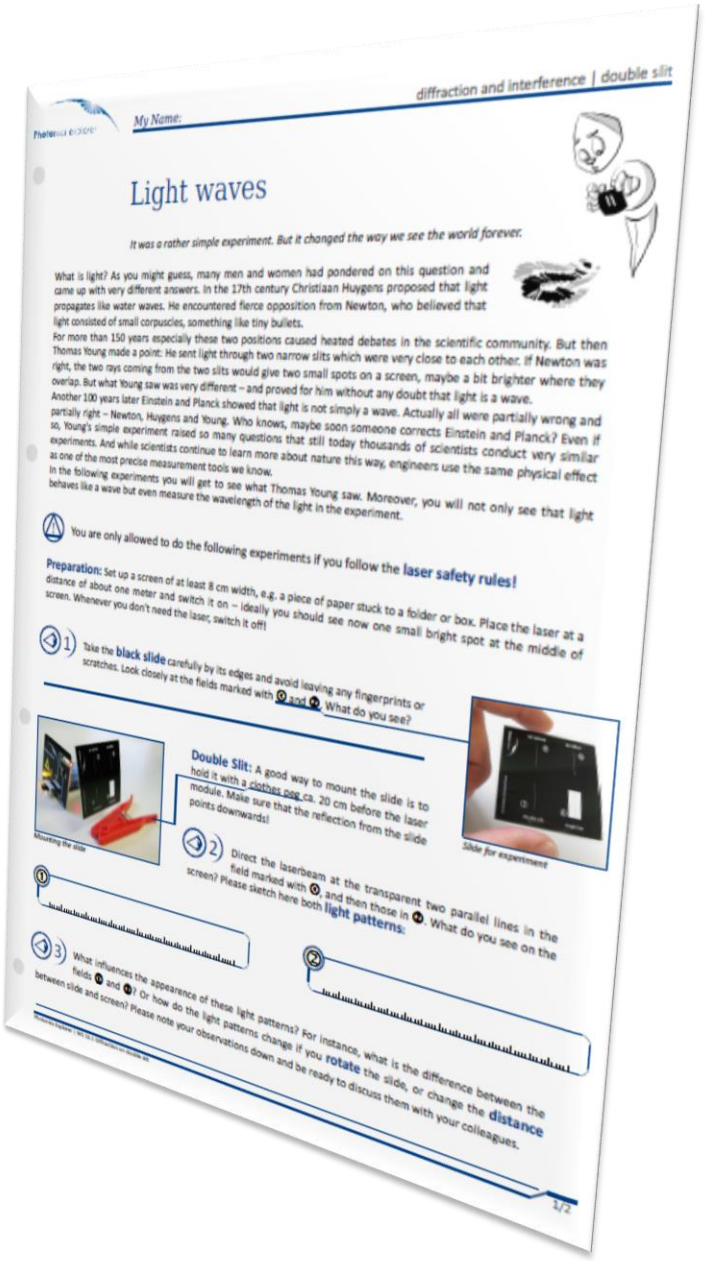
Worksheets

Factsheets

Notes for Teacher

Multimedia material

Inquiry Based Learning



diffraction and interference | double slit

My Name:

Light waves

It was a rather simple experiment. But it changed the way we see the world forever.

What is light? As you might guess, many men and women had pondered on this question and came up with very different answers. In the 17th century Christiaan Huygens proposed that light propagates like water waves. He encountered fierce opposition from Newton, who believed that light consisted of small corpuscles, something like tiny bullets.
For more than 150 years especially these two positions caused heated debates in the scientific community. But then Thomas Young made a point: He sent light through two narrow slits which were very close to each other. If Newton was right, the two rays coming from the two slits would give two small spots on a screen, maybe a bit brighter where they overlap. But what Young saw was very different – and proved for him without any doubt that light is a wave.
Another 100 years later Einstein and Planck showed that light is not simply a wave. Actually all were partially wrong and partially right – Newton, Huygens and Young. Who knows, maybe soon someone corrects Einstein and Planck? Even if so, Young's simple experiment raised so many questions that still today thousands of scientists conduct very similar experiments. And while scientists continue to learn more about nature this way, engineers use the same physical effect as one of the most precise measurement tools we know.
In the following experiments you will get to see what Thomas Young saw. Moreover, you will not only see that light behaves like a wave but even measure the wavelength of the light in the experiment.

You are only allowed to do the following experiments if you follow the **laser safety rules!**

Preparation: Set up a screen of at least 8 cm width, e.g. a piece of paper stuck to a folder or box. Place the laser at a distance of about one meter and switch it on – ideally you should see now one small bright spot at the middle of screen. Whenever you don't need the laser, switch it off!

1) Take the **black slide** carefully by its edges and avoid leaving any fingerprints or scratches. Look closely at the fields marked with ① and ②. What do you see?

Mounting the slide

Double Slit: A good way to mount the slide is to hold it with a clothes peg ca. 20 cm before the laser module. Make sure that the reflection from the slide points downwards!

Slide for experiment

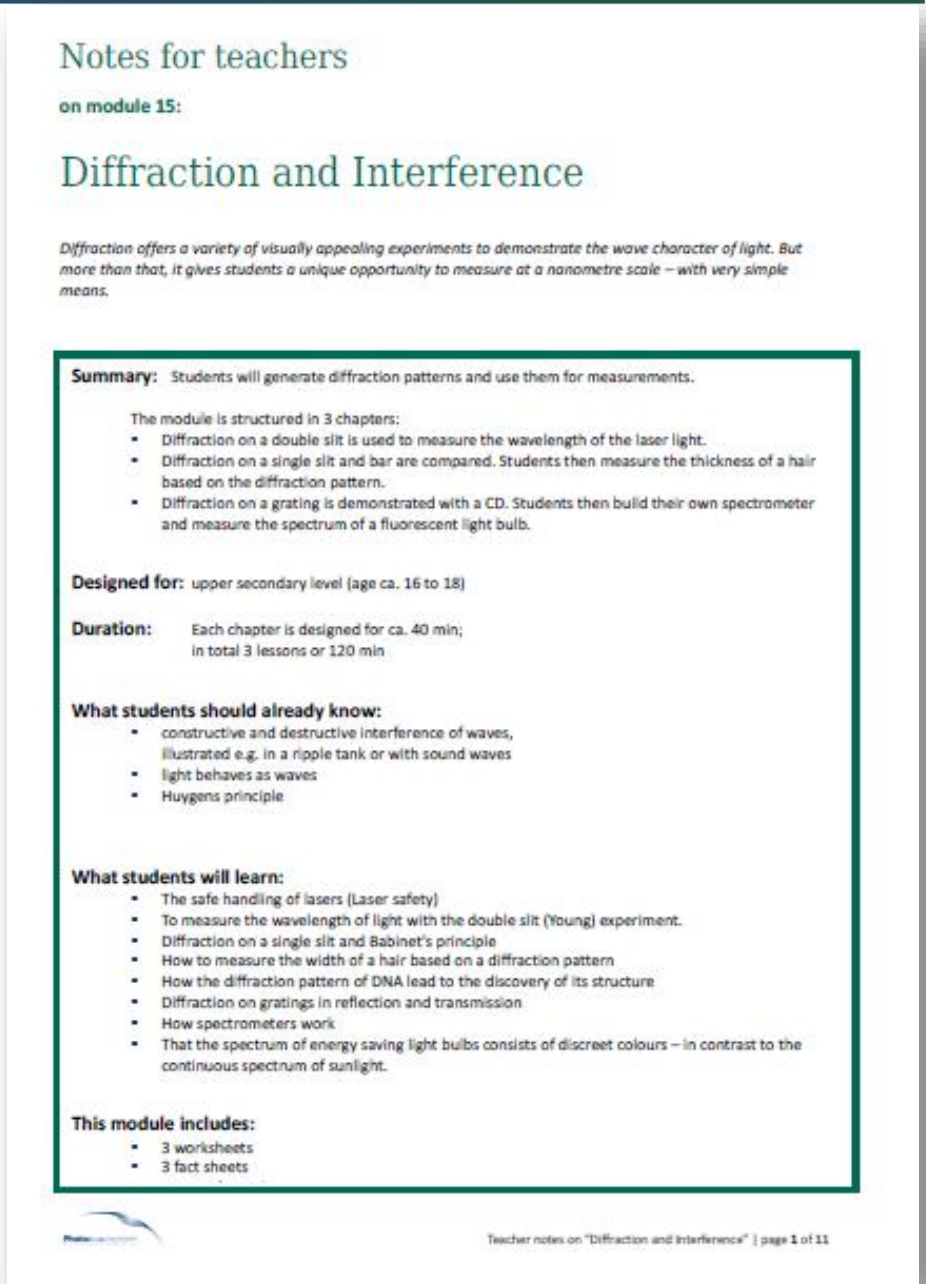
2) Direct the laserbeam at the transparent two parallel lines in the field marked with ① and then those in ②. What do you see on the screen? Please sketch here both **light patterns**:

3) What influences the appearance of these light patterns? For instance, what is the difference between the fields ① and ②? Or how do the light patterns change if you **rotate** the slide, or change the **distance** between slide and screen? Please note your observations down and be ready to discuss them with your colleagues.

1/2

Didactic Framework : Teacher Guide

-Lesson overview
- Summary of module
- Age group
- Duration
- Prior knowledge
- What students will learn
- Description of suggested lesson
- Background information
- Suggested answers



Notes for teachers

on module 15:

Diffraction and Interference

Diffraction offers a variety of visually appealing experiments to demonstrate the wave character of light. But more than that, it gives students a unique opportunity to measure at a nanometre scale – with very simple means.

Summary: Students will generate diffraction patterns and use them for measurements.

The module is structured in 3 chapters:
- Diffraction on a double slit is used to measure the wavelength of the laser light.
- Diffraction on a single slit and bar are compared. Students then measure the thickness of a hair based on the diffraction pattern.
- Diffraction on a grating is demonstrated with a CD. Students then build their own spectrometer and measure the spectrum of a fluorescent light bulb.

Designed for: upper secondary level (age ca. 16 to 18)

Duration: Each chapter is designed for ca. 40 min; in total 3 lessons or 120 min

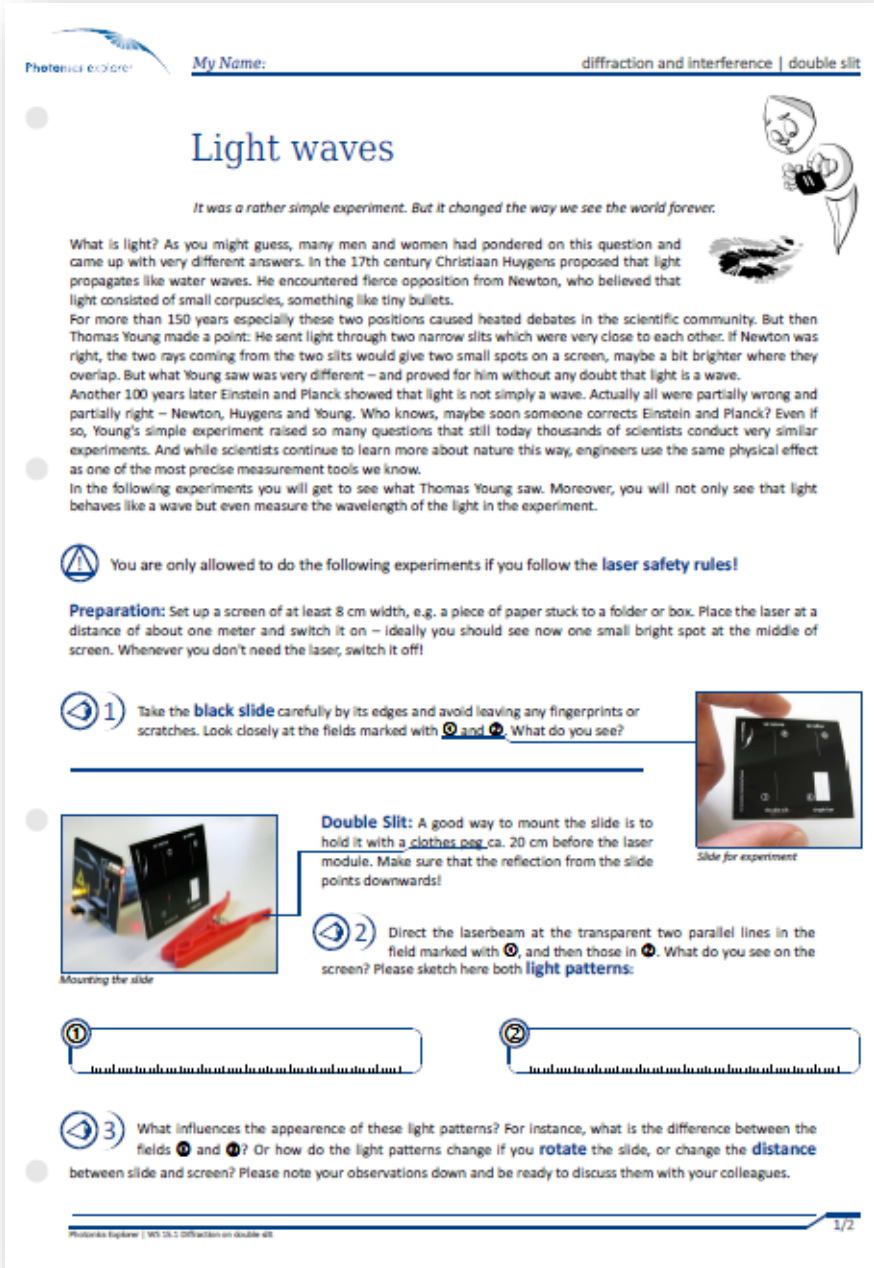
What students should already know:
- constructive and destructive interference of waves, illustrated e.g. in a ripple tank or with sound waves
- light behaves as waves
- Huygens principle

What students will learn:
- The safe handling of lasers (Laser safety)
- To measure the wavelength of light with the double slit (Young) experiment.
- Diffraction on a single slit and Babinet's principle
- How to measure the width of a hair based on a diffraction pattern
- How the diffraction pattern of DNA lead to the discovery of its structure
- Diffraction on gratings in reflection and transmission
- How spectrometers work
- That the spectrum of energy saving light bulbs consists of discreet colours – in contrast to the continuous spectrum of sunlight.

This module includes:
- 3 worksheets
- 3 fact sheets

Didactic Framework : Worksheets

- Motivation/ background
- Experiments:
  - Setup
  - Observation
  - Discussions
  - Conclusions
- Guiding questions
- Do, Observe, Reason



Photonics explorer

My Name: diffraction and interference | double slit

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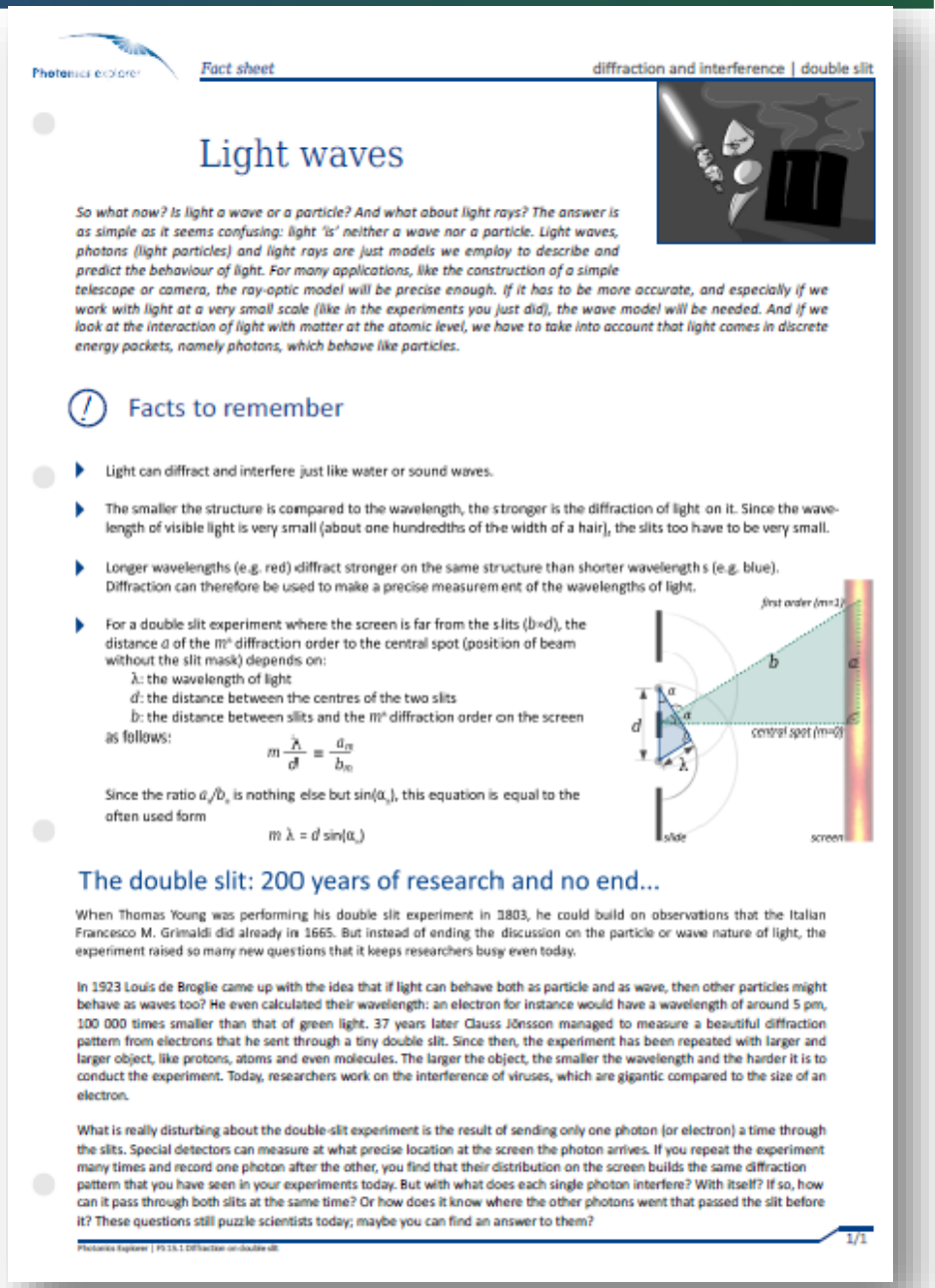
① ②

3) What influences the appearence of these light patterns? For instance, what is the difference between the fields ① and ②? Or how do the light patterns change if you **rotate** the slide, or change the **distance** between slide and screen? Please note your observations down and be ready to discuss them with your colleagues.

Didactic Framework : Fact Sheets

- given to take home at the end of lesson
- important facts to remember
- applications of the topic
- avoid incessant note taking



Photonics explorer

Fact sheet

diffraction and interference | double slit

Light waves

So what now? Is light a wave or a particle? And what about light rays? The answer is as simple as it seems confusing: light 'is' neither a wave nor a particle. Light waves, photons (light particles) and light rays are just models we employ to describe and predict the behaviour of light. For many applications, like the construction of a simple telescope or camera, the ray-optic model will be precise enough. If it has to be more accurate, and especially if we work with light at a very small scale (like in the experiments you just did), the wave model will be needed. And if we look at the interaction of light with matter at the atomic level, we have to take into account that light comes in discrete energy packets, namely photons, which behave like particles.

Facts to remember

- Light can diffract and interfere just like water or sound waves.
- The smaller the structure is compared to the wavelength, the stronger is the diffraction of light on it. Since the wavelength of visible light is very small (about one hundredths of the width of a hair), the slits too have to be very small.
- Longer wavelengths (e.g. red) diffract stronger on the same structure than shorter wavelengths (e.g. blue). Diffraction can therefore be used to make a precise measurement of the wavelengths of light.
- For a double slit experiment where the screen is far from the slits ($b \gg d$), the distance a of the m^{th} diffraction order to the central spot (position of beam without the slit mask) depends on:
  - λ: the wavelength of light
  - d: the distance between the centres of the two slits
  - b: the distance between slits and the m^{th} diffraction order on the screen

  as follows:

$$m \frac{\lambda}{d} = \frac{a_m}{b_m}$$

Since the ratio a_m/b_m is nothing else but $\sin(\alpha_m)$, this equation is equal to the often used form

$$m\,\lambda = d\,\sin(\alpha_m)$$

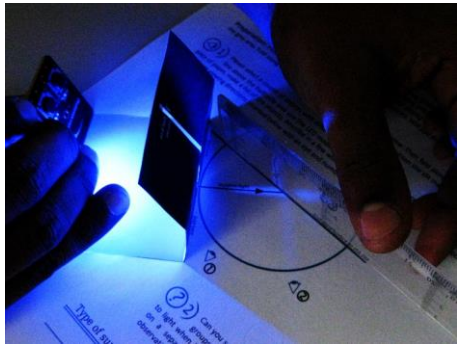
The double slit: 200 years of research and no end...

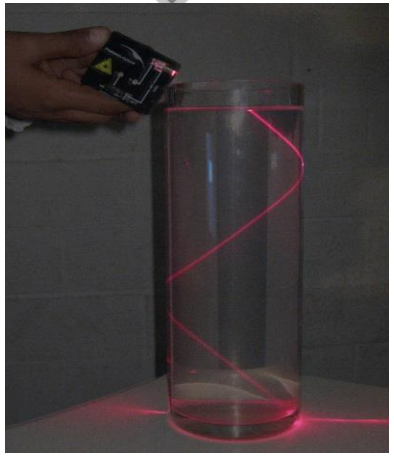
When Thomas Young was performing his double slit experiment in 1803, he could build on observations that the Italian Francesco M. Grimaldi did already in 1665. But instead of ending the discussion on the particle or wave nature of light, the experiment raised so many new questions that it keeps researchers busy even today.

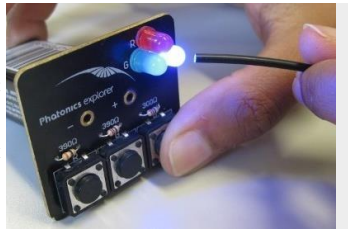
In 1923 Louis de Broglie came up with the idea that if light can behave both as particle and as wave, then other particles might behave as waves too? He even calculated their wavelength: an electron for instance would have a wavelength of around 5 pm, 100 000 times smaller than that of green light. 37 years later Clauss Jönsson managed to measure a beautiful diffraction pattern from electrons that he sent through a tiny double slit. Since then, the experiment has been repeated with larger and larger object, like protons, atoms and even molecules. The larger the object, the smaller the wavelength and the harder it is to conduct the experiment. Today, researchers work on the interference of viruses, which are gigantic compared to the size of an electron.

What is really disturbing about the double-slit experiment is the result of sending only one photon (or electron) a time through the slits. Special detectors can measure at what precise location at the screen the photon arrives. If you repeat the experiment many times and record one photon after the other, you find that their distribution on the screen builds the same diffraction pattern that you have seen in your experiments today. But with what does each single photon interfere? With itself? If so, how can it pass through both slits at the same time? Or how does it know where the other photons went that passed the slit before it? These questions still puzzle scientists today; maybe you can find an answer to them?

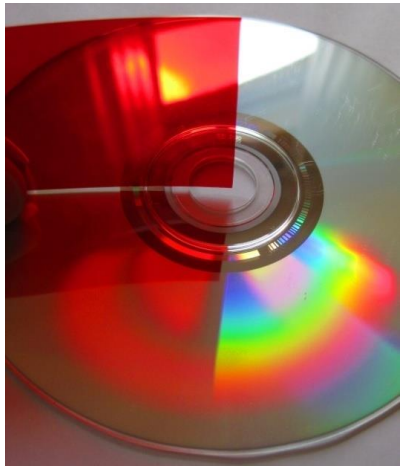
Communicating between 3 villages in a valley
Communicating with optical fibres

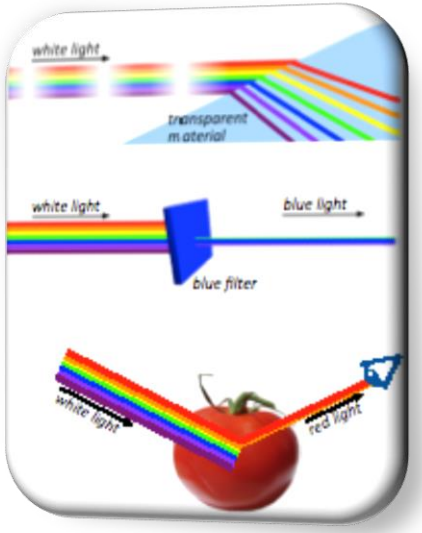


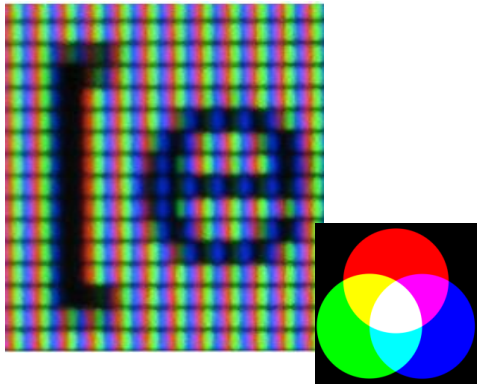


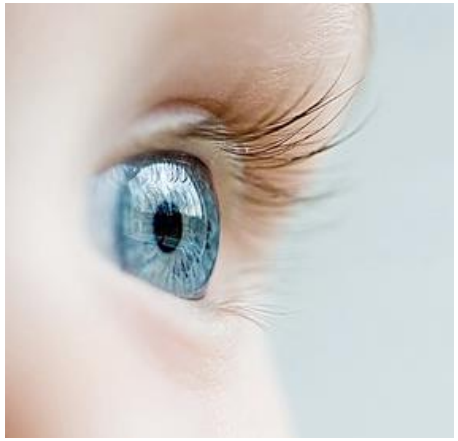


Colours of the rainbow
Colour Mixing



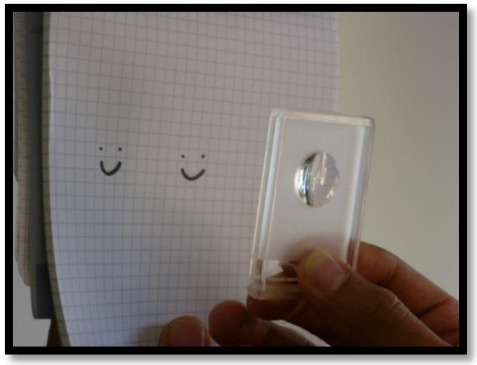


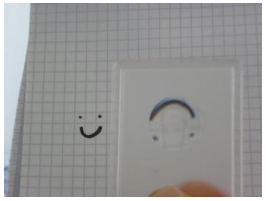




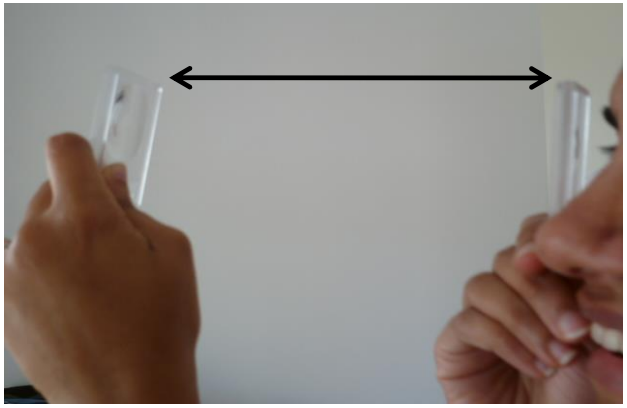
Module 3: Lenses and Telescopes

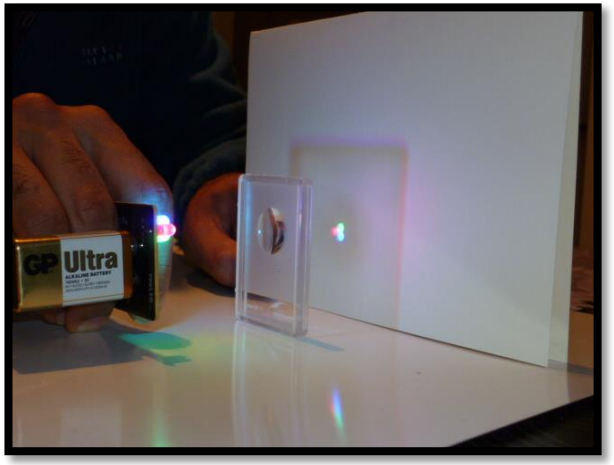
Refraction and imaging
Building Galilean and Kepler telescopes



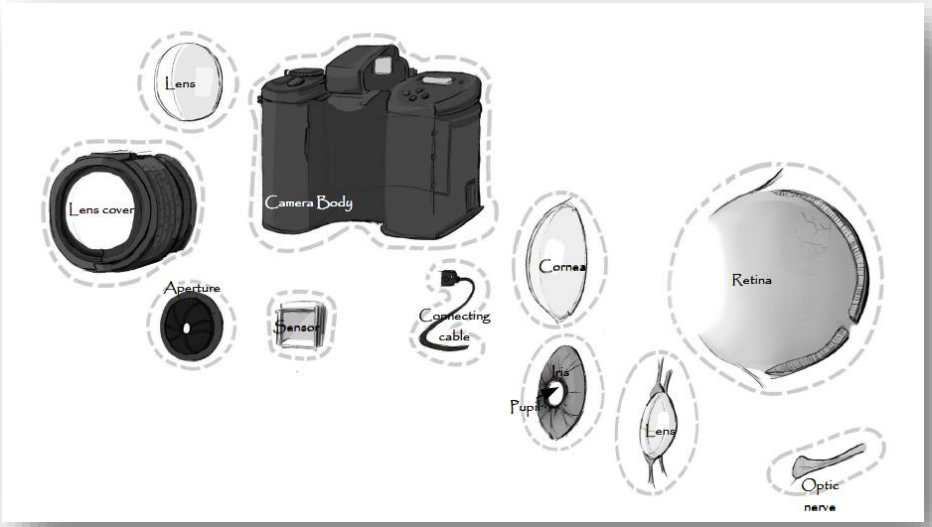


Type of lens	Focal length	Image distance	Image size	...
bi convex				
...				
...				

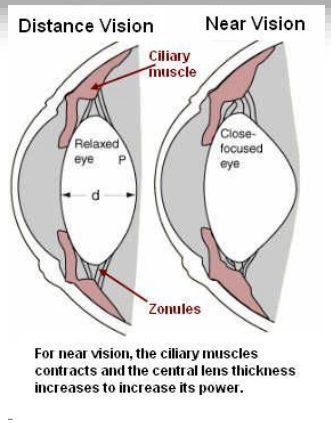


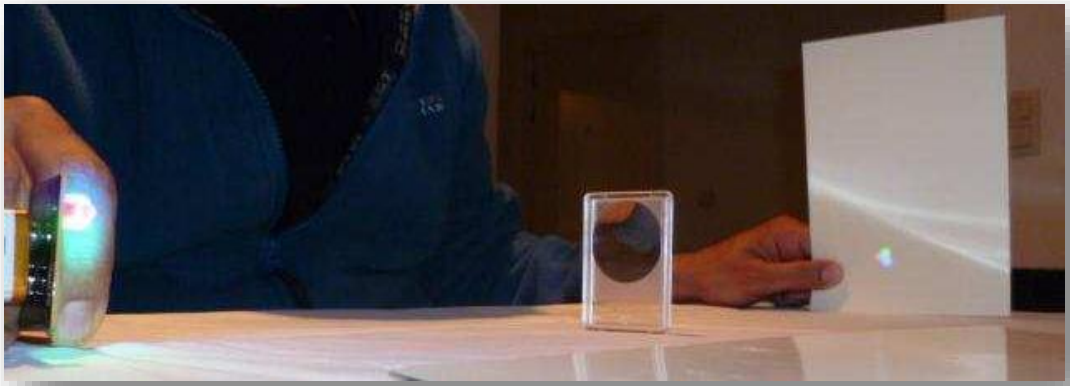


Comparing human eyes and digital cameras
Learning about accommodation in the eye

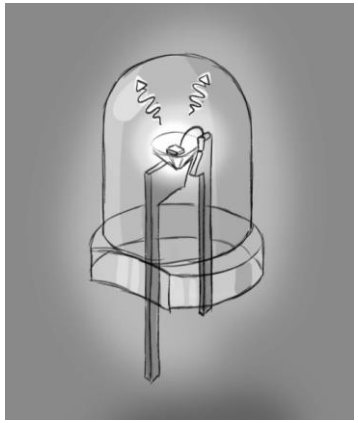


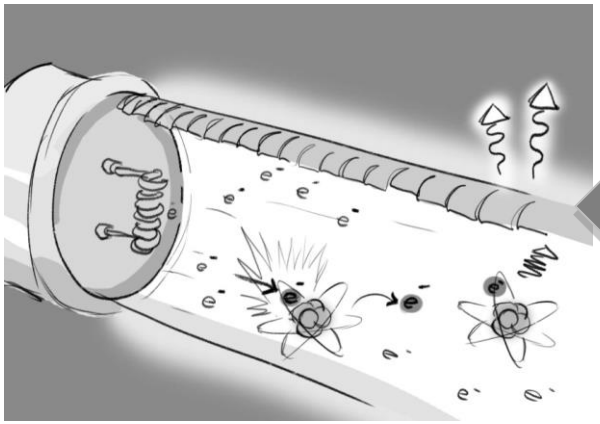
$$\frac{1}{\text{finger to eye}\ (S1)} + \frac{1}{\text{cornea to retina}\ (S2)} = \frac{1}{\text{focal length}\ (f)}$$



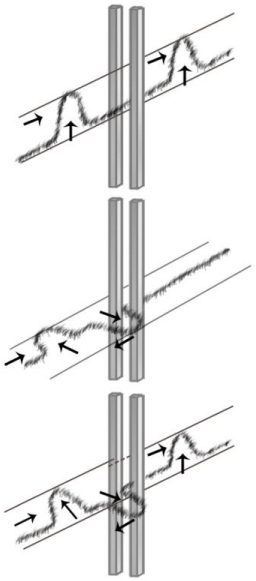


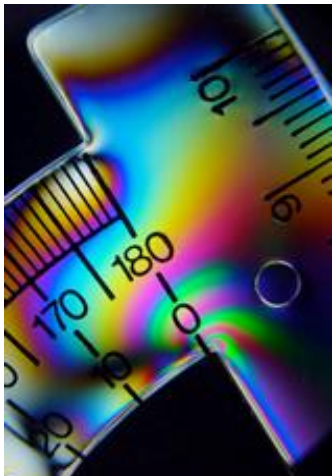
Analyzing the lighting situation in your school
Warm light and cold light (efficiency)

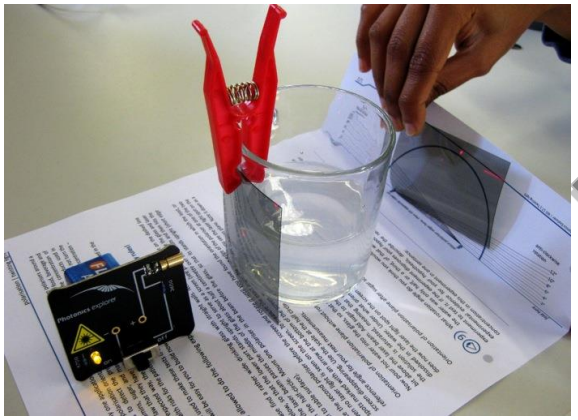




Building a polarimeter to measure sugar concentration
Application and displays and life sciences

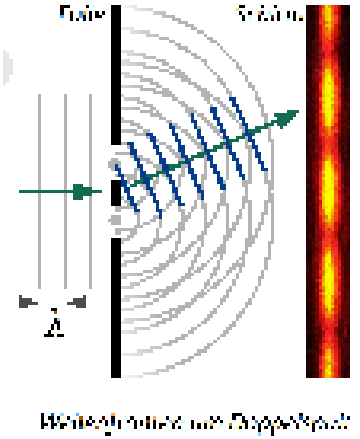


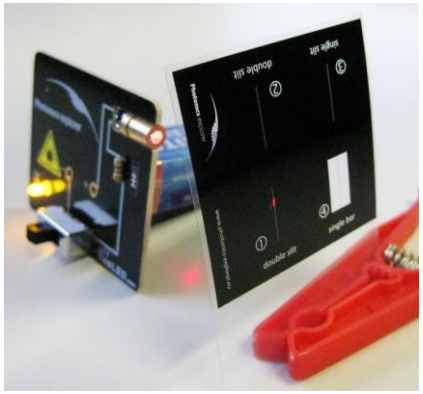




Module 7: Diffraction and Interference

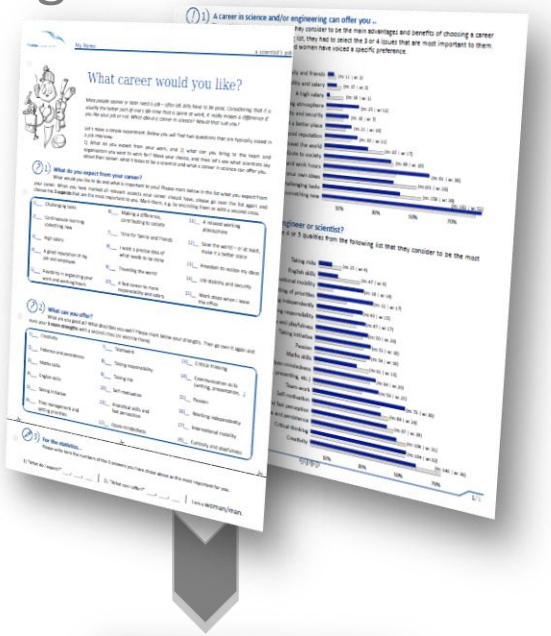
1. Double slit and single slit diffraction
2. Building a spectrometer





Module 8: A Scientist's Job

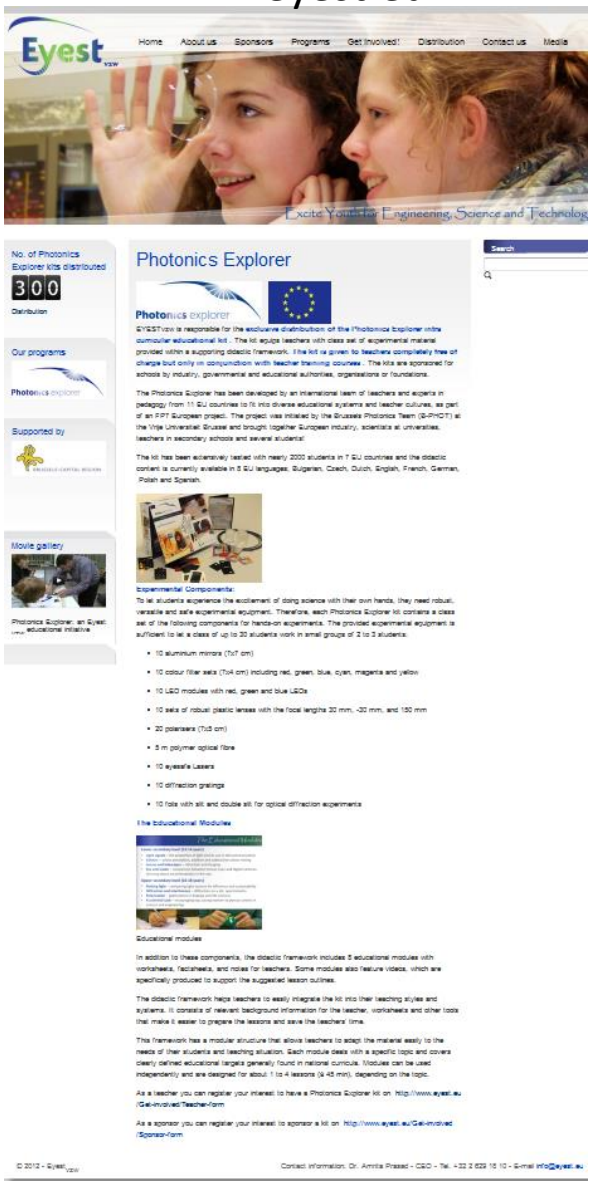
Breaking the stereotypes
Exploring what you want from a career
A day in the life of a scientist and engineer



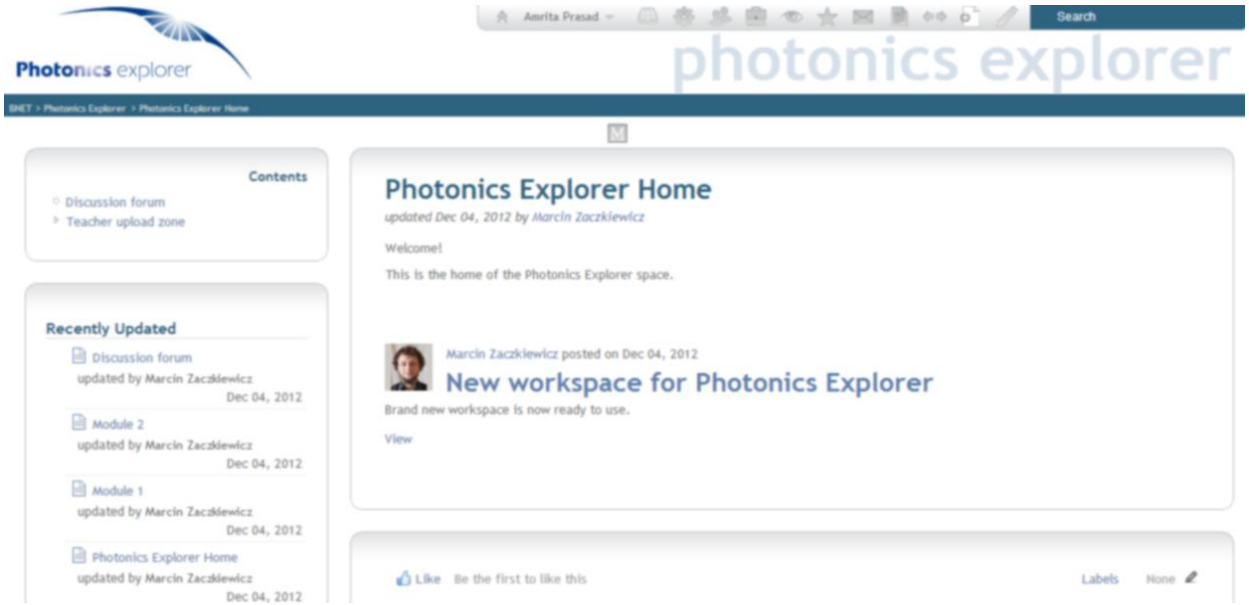
www.eyest.eu: Teacher login

Online Platform

www.eyest.eu



- Teachers receive an email to register with their details and serial number of their kit
- Online discussion forum in your language
- Updates (worksheets, videos etc.)
- Feedback
- Component replacements

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The Educational Modules

Lower secondary level (12-14 years)

- **Light signals** – the properties of light and its use in telecommunication
- **Colours** – colour perception, additive and subtractive colour mixing
- **Lenses and telescopes** – refraction and imaging
- **Eye and vision** – comparison between human eyes and digital cameras, learning about accommodation in the eye

Upper secondary level (16-18 years)

- **Making light** – comparing light sources for efficiency and sustainability
- **Diffraction and interference** – diffraction on a slit, spectrometry
- **Polarisation** – applications in displays and life sciences
- **A scientist's job** – encouraging esp. young women to pursue careers in science and engineering

Thank you!