Photonics and
Ultrafast Laser Science

puls

FAKULTÄT FÜR MASCHINENBAU
LEHRSTUHL FÜR HYDRAULISCHE STRÖMUNGSMASCHINEN
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Summary of "International Day of Light" Workshop

RUHR
UNIVERSITÄT
BOCHUM

RUB

United Nations
Educational, Scientific and
Cultural Organization

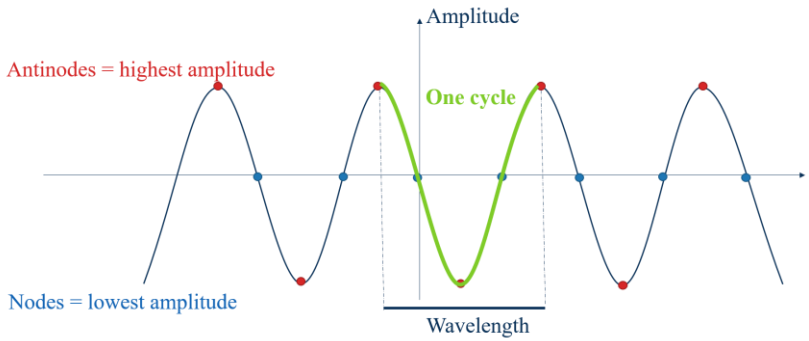
International
Day of Light

Photon: an electromagnetic wave and a particle

An electron oscillation generates an oscillating electric field and magnetic field: this electromagnetic field is also called light. Thus, light can be represented as a wave.

The wavelength of a wave is the spatial length of one oscillation. The frequency defines how many oscillations one can see within one second.

Light is made up of particles called photons; one cannot break them. Each photon carries an amount of energy that can be transferred/exchanged with matter.



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The electromagnetic spectrum and its frequencies

Light contains a big family of frequencies called the electromagnetic spectrum. Each member of the family is defined by its frequency range. Within the electromagnetic spectrum, one can find the range for visible light, which we can see in our everyday lives. There is also light that one cannot see; at lower energy than the visible light such as microwaves or higher energy such as X-ray.

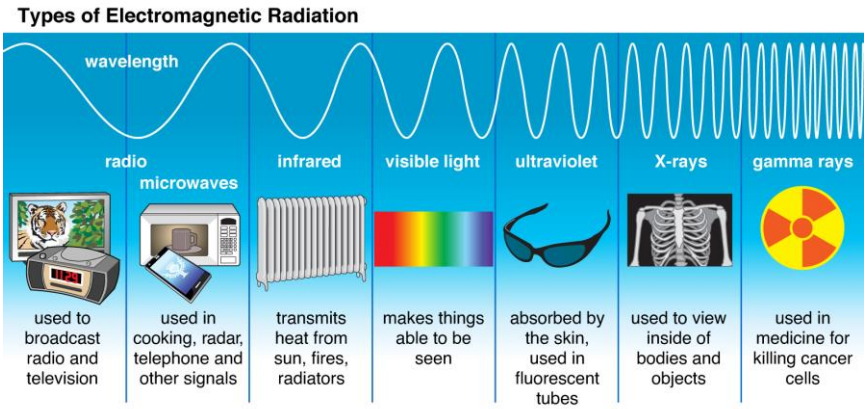

Image taken from: Encyclopeadia Britannica

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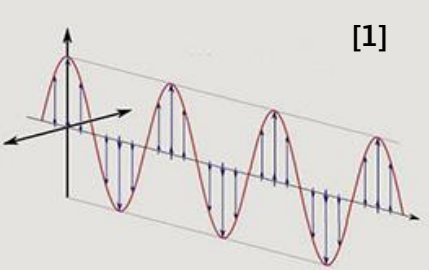
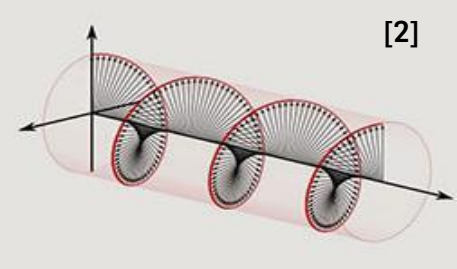
Polarization

Light is accompanied by oscillating electric and magnetic waves. These waves are perpendicular to each other. Polarization is the direction of the electric field of light. It can be linear [1], circular [2] or random depending on the light source.

We need special tools to see different polarizations since our eyes are not sensitive to it. It is also possible to filter certain polarizations or manipulate it as we wish.

For example, LCD screens work by changing the polarization of light using a polarizing filter. This way each pixel brightness is controlled.



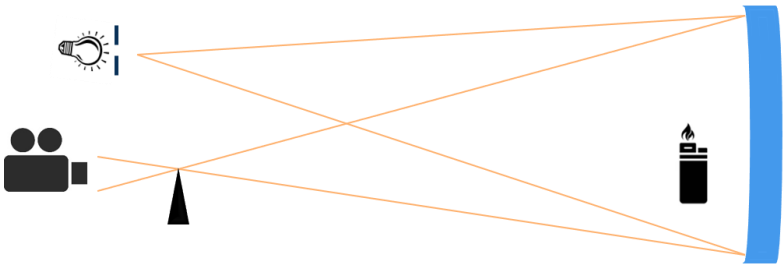


Images taken from: https://qrznow.com/antenna-polarization-arrl-podcast/

Schlieren Imaging

The refractive index of a medium defines how optically dense the medium is indicating the ability of the medium to bend light. Light bends more in a denser medium like water as compared to air.

Schlieren imaging is used to visualize changes in air flow that cannot be seen by human eyes. A light source is used to illuminate the object around which we want to observe the air flow. As the airflow varies, the density of air changes and this alters the refractive index of air. As a result, the intensity of light varies causing changes in the shadow of the object which are then captured by an ultrafast camera.



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Chair of Photonics and Ultrafast Laser Science (PULS) was delighted to welcome you to the International Day of Light.

Together, we observed some basic properties of light and understood how important lasers are in our everyday life. In this brochure, you will find the key words and highlights of your journey through light.

Hope you enjoyed the trip with us!

PULS Team

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