DLR

DLR_School_Lab

Oberpfaffenhofen

Infrared Measurement Technology

Seeing what is invisible

Why do we see what we see the way we see it? Although this question may sound almost philosophical, there is a simple physical explanation: the sensitive receptors in our eyes send nerve signals to our brain whenever they detect certain frequencies; the images are only then formed in our head, so to speak.

However, the human eye can detect only a very small part of the electromagnetic spectrum. Most of it is "out of sight." But as usual people strive to compensate for such disadvantages with the help of technical equipment. Ever since the discovery of infrared radiation by Friedrich Wilhelm Herschel in 1800 scientists have developed numerous measurement technologies and then also made them available to the general public.

Infrared Measurement Technology

Fig. 1: An "Infrared Wildlife Finder" detected this fawn

Applications

Infrared measurement technologies now have a firm position in both civilian and military fields. DLR plays a decisive role in civilian developments in the area of infrared measurement technology.

Fawns have a guardian angel
In their first few days of life, fawns spend much of their time alone in the high grass where they are well protected from observation and natural enemies. But as soon as the hay harvest begins, they are at the mercy of the knives of power mowers. Infrared sensors can improve their odds and thereby save the life of many animals.

Heat-detection cameras and night vision equipment
The police are also increasingly dependent on so-called night vision equipment. Whether they are hunting down criminals, searching for people lost in the wilderness or observing situations, thanks to infrared measurement technology the police can work efficiently also at night.

Help from space
The idea almost suggests itself - small fires can be detected with satellites so they can be prevented from later developing into major conflagrations. This is the reason why a small DLR satellite was sent into orbit in 2001. On board is a highly precise measuring apparatus which works with a newly developed two-channel infrared sensor system, among other equipment.

Fig. 2: Infrared image of students

Fig. 3: In space since 2001 – the BIRD satellite

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SCIAMACHY
Data from the SCIAMACHY sensor, which was launched into space already in 2002 on the ENVISAT satellite, are also being analyzed at DLR. This highly sensitive equipment measures the light scattered by the earth's atmosphere. In addition, absorption measurements from the UV to the IR spectral range are taken against the rising or setting sun. By this means scientists gain new insights about the distribution of important trace gases, aerosols and clouds in the stratosphere and troposphere.

The Experiment

The DLR_School_Lab experiment begins with Herschel's historic investigation which led him to the discovery of infrared radiation over 200 years ago. Herschel thereby laid the foundation for all the modern radiation measurement instruments which followed.

Many scientists after Herschel investigated the concept of "radiation" and made important contributions toward understanding it as a physical phenomenon. The procedures followed in experimental investigations are introduced in several thermometry experiments.

In the DLR_School_Lab you also have the opportunity to work with highly sensitive measuring instruments. Find out how they work and get acquainted with a number of applications. With an infrared camera you can even convert heat radiation into visible images.

And finally, you can make heat images of yourselves - showing you with or without your heads, that's up to you!

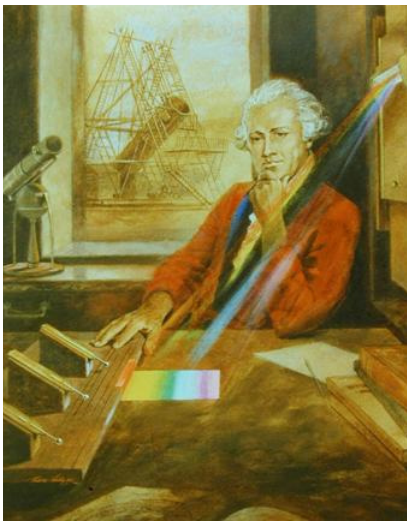

Fig. 4: Wilhelm Herschel, the discoverer of infrared radiation, and his idea to split the solar spectrum into its different colors with the help of a prism

Questions to Think About

How is it that some animals can perceive UV light?

To what extent does our planet influence our awareness of light? In other words: what would be our sense of light if we lived on Jupiter?

What additional opportunities are possible with infrared monitoring by satellite?

Glossary

Infrared radiation
Electromagnetic waves which are located in the spectrum between visible light and microwave radiation are called infrared radiation (IR radiation) in physics. This wavelength range is between about 780 nm and 1 mm. It is also popularly known as heat radiation.

Prism
Different wavelengths (colors) are bent to different extents by a prism. We make use of this fact at the DLR_School_Lab to split up sunlight into its spectral colors.

Receptors
Receptors are devices comparable to biological sensors. The receptors in our retina make it possible to perceive light entering our eyes.

Thermometry
Thermometry is the science of temperature measurement.

Fig. 5: "Headless person"

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DLR at a Glance

DLR is Germany's national aeronautics and space research center. Its extensive research and development activities in the fields of aeronautics, space, transportation and energy are integrated in national and international cooperative ventures. In addition to this research, as Germany's space agency the federal government has given DLR the responsibility to plan and implement the German space program and to represent German interests internationally. DLR is also the umbrella organization for Germany's largest project management agencies.

Approximately 6,500 people are employed at DLR's 13 locations, which include Köln (headquarters), Berlin, Bonn, Braunschweig, Bremen, Göttingen, Hamburg, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stuttgart, Trauen and Weilheim. DLR also operates offices in Brussels, Paris and Washington D.C.

DLR Oberpfaffenhofen

Aerospace, environment and transportation are DLR's primary fields of interest in Oberpfaffenhofen. Some 1,500 people work there in nine different institutes and facilities, making DLR Oberpfaffenhofen the largest DLR location.

DLR **Deutsches Zentrum für Luft- und Raumfahrt** e.V.
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