

Worksheet 1:

To the left and to the right of the visible spectrum

The Sun's radiation is more than just visible light. We all know that the Sun generates lots of heat and emits radiation that can tan or even burn your skin. What types of invisible radiation does this involve? How can they be physically detected and studied?

The short video "Light and optics II: What is light? – The electromagnetic spectrum (2019)" gives a good introduction to this topic: www.mediatheque.lindau-nobel.org/videos/38179/light-and-optics-ii-en. Watch the video and write down the seven regions into which we usually divide up the **electromagnetic spectrum**.

Exercises:

Infrared (IR) radiation (thermal radiation) and **ultraviolet (UV) radiation** are located directly to the left and to the right of the visible spectrum of the Sun, respectively.

1. IR radiation

- a) The infrared region of the Sun's spectrum was discovered by the natural scientist **Friedrich Wilhelm Herschel**. Look up this discovery on the internet and describe the experiment performed by Herschel in **1801** to detect heat radiation from the Sun. Where is this radiation in the Sun's spectrum?
- b) Infrared radiation is not visible to the eyes – but can be detected by most smartphone cameras. Many remote controls for TVs, CD players, and other devices send command codes via infrared light generated by special infrared LEDs.

Try the following experiment to see whether your phone can pick up IR radiation:

- Take a remote control, press one of the buttons, and check whether you can see the transmitter diode with the naked eye.
 - Now look at the remote through your phone camera while pressing one of the buttons. You should be able to see the transmitter diode light up brightly or flash rhythmically. If not, your smartphone probably has a built-in IR blocker. Try again with one of your classmates' phones.
- c) The thermal radiation emitted by an object can be captured using special cameras and converted into (artificial) colours so that we can see it. These thermal imaging cameras are widely used by energy consultants for homeowners, as well as for medical applications. Look up some common applications of this technology on the internet and write down the aspects of this topic that you find most interesting.

2. UV radiation

- a) UV radiation was detected for the first time in **1801**, the same year that Herschel discovered IR radiation. It was discovered by **Johann Wilhelm Ritter**, who used paper soaked in a silver chloride solution to detect the radiation. Look up this discovery on the internet and describe briefly how Ritter was able to detect the UV radiation. Where is this radiation found in the Sun's spectrum?
- b) UV radiation from the Sun is harmful to the skin, so we should always protect ourselves from it. Tanning beds are widely discouraged for good reason – in some countries, you have to be at least 18 to use them. Look up on the internet and describe how UV rays from the Sun or a tanning bed affect the skin (and the eyes), what health risks are involved, and how best to protect yourself against them.
- c) In the light spectrum, low-energy UV radiation is right next to blue and violet light. This soft UV radiation, also known as “black light”, has many interesting applications. Look up the keyword “black light” on the internet, give some typical examples of applications, and explain the physical relationships involved to the best of your understanding.