

WL 362

Energy transfer by radiation



Description

- investigation of thermal and light radiation
- influence of distance and angle of incidence
- broad range of experiments

Thermal radiation is a non-material-bound energy transport by means of electromagnetic oscillations in a certain wavelength range. Any body with a temperature above zero Kelvin emits radiation known as thermal radiation. Thermal radiation includes UV radiation, light radiation and infrared radiation. Light radiation covers the wavelength range visible to the human eye.

The WL 362 experimental unit contains two radiation sources: a heat radiator and a light emitter. Thermal radiation is detected by means of a thermopile. Light radiation is recorded by means of a luxmeter with photodiode. Various optical elements such as apertures, absorption plates or colour filters can be set up between the emitter and the detector. All components are mounted on an optical bench. The distance between the optical elements can be read from a scale along the optical bench.

Luxmeter, thermopile and light emitter can be rotated to study how the angle of incidence affects the radiation intensity. The angles are read off the angular scale.

The optical elements are used to investigate the reflection, absorption and transmission of different materials at different wavelengths and temperatures. The radiant power of both emitters can be adjusted. The aim of the experiments is to check optical laws: e.g. Kirchhoff's law of radiation, the Stefan-Boltzmann law, Lambert's distance and direction law.

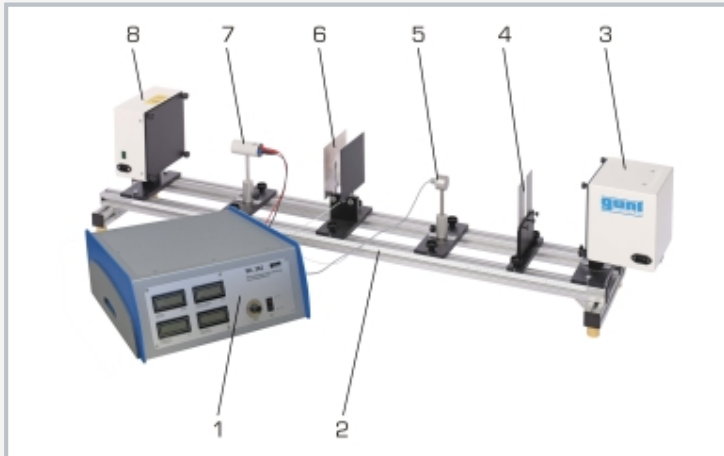
The measured values are displayed digitally on the measuring amplifier. The measured values are transmitted directly to a PC via USB where they can be analysed using the software included.

Learning objectives/experiments

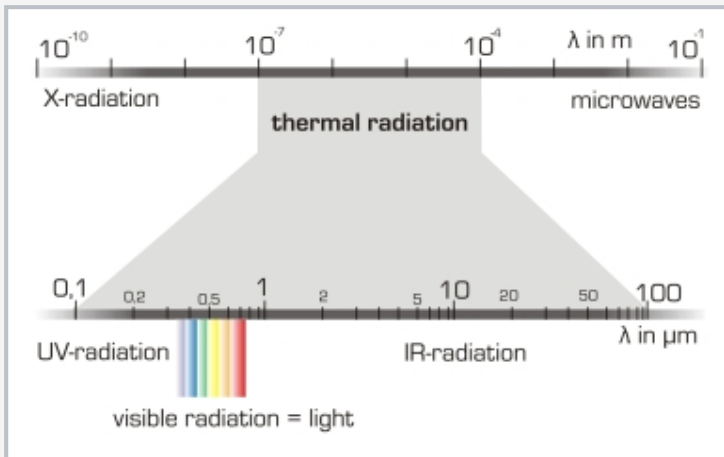
- Lambert's direction law
- Lambert's distance law
- Stefan-Boltzmann law
- Kirchhoff's laws
 - ▶ radiation absorption
 - ▶ radiation reflection
 - ▶ radiation emission

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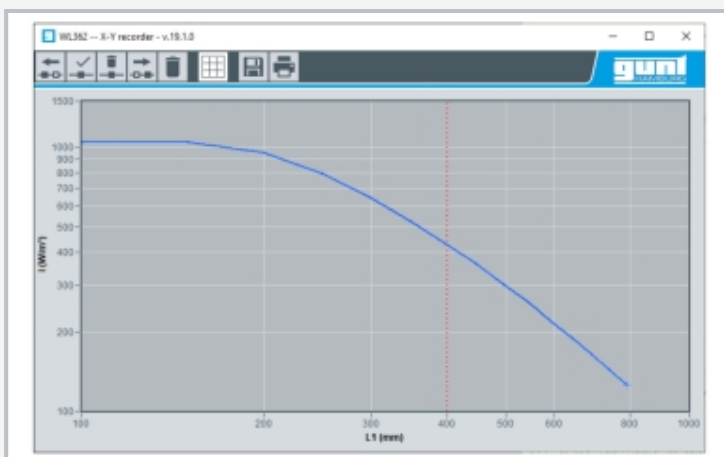
Energy transfer by radiation



1 measuring amplifier, 2 optical bench with scale for reading the distances, 3 pivoting light source as light emitter, 4 holder for slit diaphragm or optional colour filter (red, green, infrared), 5 luxmeter, 6 absorption plates and reflection plate each with temperature measuring point, 7 thermopile, 8 thermal radiator



Spectrum of thermal radiation
top scale wavelength λ in m, bottom scale wavelength λ in μm



Software screenshot: investigations on the distance to the radiation source

Specification

- [1] thermal radiator and thermopile for the investigation of thermal radiation
- [2] light source and luxmeter for the investigation of illuminance
- [3] absorption plate and reflection plate with thermocouples for the investigation of Kirchhoff's laws
- [4] adjustable radiant power of thermal radiator and light source
- [5] 3 colour filters with holder (red, green, infrared), slit diaphragm
- [6] luxmeter for measuring illuminance
- [7] thermocouple for measuring the temperature
- [8] thermopile for measuring radiant power
- [9] GUNT software for data acquisition via USB under Windows 10

Technical data

Thermal radiator

- material: AlMg_3 , black anodized
- output: 400W at 230V, 340W at 120V
- max. achievable temperature: 300°C
- radiant area, LxW: 200x200mm

Light source as light emitter

- halogen lamp
 - ▶ output: 50W
 - ▶ luminous flux: 1185lm
 - ▶ colour temperature: 2950K
- range of rotation on both sides: 0... 90°
- optional illuminated surface
 - ▶ diffusing lens, LxW: 193x193mm or
 - ▶ orifice plate, \varnothing 25mm

Optical elements to insert

- slit diaphragm
- 3 colour filters: red, green, infrared
- absorption plate and reflection plate with thermocouple type K, matt black lacquered

Measuring ranges

- illuminance: 0...1000 lux
- temperature: 2x 0...200°C
- radiant power: 0...1000W/m²

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 1460x310x390mm

LxWxH: 420x400x170mm (measuring amplifier)

Weight: approx. 27kg

Required for operation

PC with Windows recommended

Scope of delivery

- 1 experimental unit
- 1 set of accessories
- 1 GUNT software + USB cable
- 1 set of instructional material

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Optional accessories

for Remote Learning

GU 100 Web Access Box

with

WL 362W Web Access Software

Other accessories

WP 300.09 Laboratory trolley