OPTICS

Optics can be useful to introduce students to the methodology of investigating phenomena at a very early stage with simple experiments. Due to the flexible use of the LED lamp, light beams can be observed and described using various objects in simple experiment set-ups on the table. Additionally, more complex content, such as interference and diffraction phenomena, can be compiled in a comprehensible framework in advanced classes/lectures.

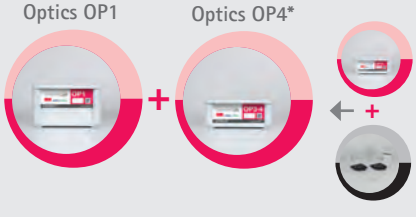
Two Optics Sets provide *four* topic areas with 72 experiments. Measured values can either be recorded in the classic way or, in some experiments, with the help of the Mobile-CASSY 2 WiFi and the lux sensor M.

HIGHLIGHT

LP5.3.2.2 Complementary crossed gratings (Babinet's principle)

Students will learn that complementary screens produce the same diffraction images. In comparison with the gap and web experiment, the crossed gratings represent a much more complex structure.
For this experiment you will need the sets **Science Lab Optics OP1 (207 141S)** and **Science Lab Optics OP3 (207 143S)**.

Overview of topics and sets

EXPERIMENT TOPICS		REQUIRED SETS	NO. EXPERIMENTS	DETAILS
LP5.1	**RAY OPTICS AND GEOMETRICAL OPTICS**			
LP5.1.1	PROPAGATION OF LIGHT AND SHADOW FORMATION	Optics OP1  207 141S	46	PAGE 110
LP5.1.2	LIGHT AND SHADOW IN NATURE			
LP5.1.3	REFLECTION IN MIRRORS			
LP5.1.4	LIGHT REFRACTION			
LP5.1.5	DISPERSING LIGHT AND RECOMBINATION OF THE SPECTRUM			
LP5.1.6	LENSES AND LENS ABERRATIONS			
LP5.1.7	OPTICAL INSTRUMENTS FOR ANGULAR MAGNIFICATION			
LP5.1.8	OPTICAL INSTRUMENTS AND THE EYE			
LP5.2	**CHROMATICS**			
LP5.2.1	EXAMINATION OF THE LIGHT PATHS THROUGH A PRISM	Optics OP1 Optics OP2  207 141S 207 142S	11	PAGE 116
LP5.2.2	SPECTRAL COLOURS			
LP5.2.3	COLOUR MIXING			
LP5.3	**WAVE OPTICS**			
LP5.3.1	DIFFRACTION ON DIFFRACTION OBJECTS	Optics OP1 Optics OP3  207 141S 207 143S	7	PAGE 122
LP5.3.2	DIFFRACTION ON COMPLEMENTARY APERTURES			
LP5.4	**POLARISATION**			
LP5.4.1	POLARISATION FILTERS	Optics OP1 Optics OP4*  207 141S 207 144S	8	PAGE 128
LP5.4.2	PHOTOELASTIC DOUBLE REFRACTION			
LP5.4.3	POLARISATION DUE TO REFLECTION AND DIFFRACTION			
LP5.4.4	POLARISATION DUE TO SCATTERING			
LP5.4.5	OPTICAL ACTIVITY			

*Optic Set OP3 is not required.

Further information about our curriculum-compliant topics and student experiments as well as the corresponding sets can be found on the following pages.

OPTICS – OP1

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LP5.1	RAY OPTICS AND GEOMETRICAL OPTICS	
	LP5.1.1	Propagation of light and shadow formation	
	LP5.1.1.1	Propagation of light	
	LP5.1.1.2	Can light pass through all matter?	
	LP5.1.1.3	Shadows	
	LP5.1.1.4	Illuminance	
●	LP5.1.1.4C	Illuminance (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP5.1.2	Light and shadow in nature	
	LP5.1.2.1	Day and night	
	LP5.1.2.2	The seasons	
	LP5.1.2.3	The phases of the moon	
	LP5.1.2.4	Lunar and solar eclipses	
	LP5.1.3	Reflection in mirrors	
	LP5.1.3.1	Reflection in a plane mirror	
	LP5.1.3.2	Mirror image in a plane mirror	
	LP5.1.3.3	Optical paths in a concave mirror	
	LP5.1.3.4	Focal length of the convex mirror	
	LP5.1.3.5	Focal length of the concave mirror	
	LP5.1.3.6	Images in a concave mirror	
	LP5.1.3.7	Images in a convex mirror	
	LP5.1.4	Light refraction	
	LP5.1.4.1	Light refraction on a semicircular body	
	LP5.1.4.2	Refraction on a plane-parallel plate	
	LP5.1.4.3	Total internal reflection	
	LP5.1.4.4	Retroreflector prisms and dove prisms	
	LP5.1.4.5	Refraction in various media on a semicircular trough and semicircular body	
	LP5.1.5	Dispersing light and recombination of the spectrum	
	LP5.1.5.1	Dispersion of white light with a prism	
	LP5.1.5.2	Recombination of the spectrum	
	LP5.1.6	Lenses and lens aberrations	
	LP5.1.6.1	Optical path of a plano-convex lens	
	LP5.1.6.2	Optical path of a bi-convex lens	
	LP5.1.6.3	Images of convex lenses	
	LP5.1.6.4	Spherical aberration of lenses	
	LP5.1.6.5	Focal length determination of a convex lens via autocollimation	
	LP5.1.6.6	Optical path of a plano-concave lens	
	LP5.1.6.7	Optical path of a bi-concave lens	
	LP5.1.6.8	The image formula	
	LP5.1.6.9	Pincushion and barrel distortion	
	LP5.1.6.10	Optical path of lens combinations	
	LP5.1.6.11	Optical path of a lens system	
	LP5.1.7	Optical instruments for angular magnification	
	LP5.1.7.1	Magnification with a magnifying glass	
	LP5.1.7.2	The microscope	
	LP5.1.7.3	Changing the magnification of a microscope	
	LP5.1.7.4	Telescope models	
	LP5.1.7.5	Magnification in a Galilean telescope	
	LP5.1.7.6	Magnification in a Keplerian telescope	
	LP5.1.8	Optical instruments and the eye	
	LP5.1.8.1	The camera	
	LP5.1.8.2	Depth of field of a camera	
	LP5.1.8.3	The slide projector	
	LP5.1.8.4	The human eye	
	LP5.1.8.5	Refractive errors and vision correction	
	LP5.1.8.6	Optical illusions	

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi. ● Lux sensor M

46 EXPERIMENTS

HIGHLIGHT

LP5.1.1.4C Illuminance

In this experiment, students will discover that the illuminance E of a "point source" decreases with $1/r^2$ and thus is subject to the law of distance. For this experiment you will need the set **Science Lab Optics OP1 (207 141S)**.

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP5.1 RAY OPTICS AND GEOMETRICAL OPTICS

TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Optics OP1	Mobile-CASSY 2 WiFi	Science Lab Optics digital
		

Detailed information on the above listed and **additionally required products** are available on the following pages.

Science Lab Optics OP1 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray. With the equipment set OP1, 46 experiments at school, college and university level for worldwide curriculums can be performed. The students deal with the topics ray path optics and geometrical optics. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
1	Tape measure 2 m / 1 mm
1	Rubber rings, set of 8
1	Light box housing, LED
1	LED lamp
1	Plug-in power supply USB 5 V DC (A socket)
1	Cable USB (USB Type A - Mini-USB)
1	Translucent screen on rod
1	Plate holder on rod
1	Diaphragm and slide holder on rod
1	Plane mirror 7.5 cm x 5 cm
1	Earth-moon model on rod
1	Combined mirror model
1	Trapezoidal body 60/45 x 30 mm
1	Semicircular body r = 30 mm
1	Right-angled prism h = 30 mm
1	Plano-convex lens

Count	Name
1	Plano-concave lens
1	Semi-circular cell r = 30 mm
1	Lens on rod f = +50 mm
1	Lens on rod f = +100 mm
1	Lens on rod f = +300 mm
1	Lens on rod f = -100 mm
1	Convex-concave mirror on rod
1	Precision metal rail, 50 cm
5	Clamp rider
1	Set of 2 slit diaphragms
1	Set of 4 different diaphragms
1	Set of 4 aperture diaphragms
1	Objects for investigating images, pair
1	Transparencies, optical illusions, set of 6
1	Tray, high

207 141S	Science Lab Optics OP1 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	524 444	Lux sensor M	

Additionally recommended per working group

Count	Cat.-No.	Name	Description
1	459 40	Disc with angular Scale	Mirror reflection & light refraction experiments (LP5.1.3, LP5.1.4)

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 714	LIT: LP5 Science Lab Optics, digital	

leylab.de/207141S

OVERVIEW OF ADVANTAGES

- Includes basic optical devices and all other devices for ray optics and geometrical optics
- The LED lamp can be used both for experiments on the work bench (light box) and on the precision metal rail
- Easy-to-use 50 cm precision metal rail, e.g. for mounting a telescope or as an optical bench (can also be used in mechanics)
- Digital measurement of light intensity with the Mobile-CASSY 2 WiFi and the lux sensor M
- LED lamp can be connected to Mobile-CASSY 2 WiFi or power bank – no power supply needed

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

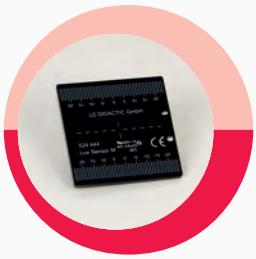
Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

SENSORS



Lux sensor M

For measuring the illuminance of visible light with Mobile-CASSY 2 WiFi (524 005W). The lux sensor has a flat design so that it can, for example, be inserted directly into the holder for diaphragms and slides (459 33). With the lux sensor, measurements can be performed along and orthogonal to the optical axis. A printed millimetre scale is used to position the sensor on the optical axis and also enables the recording of intensity distributions of different diffraction objects (e.g. 469 731) without additional equipment.

524 444	Lux sensor M	

You can find detailed information on this and other sensors from page 229.

EXTERNAL POWER SUPPLY

USB power bank 2200 mAh

Power bank with 2200 mAh suitable for LED lamp (459 094), triple LED lamp (459 098) and laser class 1, red (459 097). The 5V DC USB plug-in power supply unit (459 095) can be used to charge the power bank.

459 099	USB power bank 2200 mAh	

You can find detailed information on the USB power bank on page 232.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP5.1 Ray optics and geometrical optics

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set OP1 (207 141S).
Describes 46 experiments from the fields of ray path optics and geometrical optics.

Topics:
Propagation of light and shadow formation; Light and shadow in nature; Reflection in mirrors; Light refraction; Dispersing light and recombination of the spectrum; Lenses and lens aberrations; Optical instruments for angular magnification; Optical instruments and the eye

520 7141EN	LIT: LP5.1 Ray optics and geometrical optics	

SUBJECT AREA

LIT: LP5 Science Lab Optics, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of optics for the Science Lab.
Contains 72 experiments on ray optics and geometrical optics, chromatics, wave optics and polarisation.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 714	LIT: LP5 Science Lab Optics, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

Includes all interactive experiment instructions (Lab Docs) as html file.

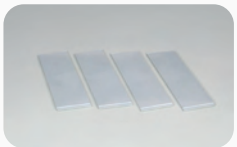
520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES

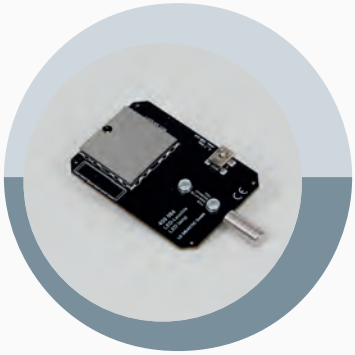



You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

Just one light source! For experiments with the light box on the table and on the precision metal rail



LED lamp

FOR EXPERIMENTS IN RAY OPTICS WITH THE LIGHT BOX ON THE TABLE

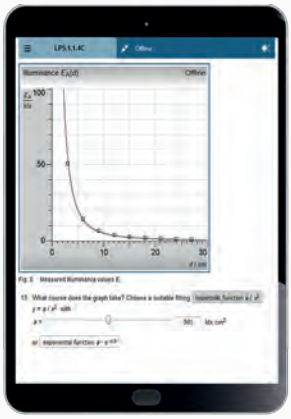
LP5.1.3.1 Reflection in a plane mirror

FOR EXPERIMENTS IN GEOMETRICAL OPTICS ON THE PRECISION METAL RAIL

LP5.1.1.4C Illuminance

EXPERIMENT SAFELY

- Our LED lamp is classified according to DIN EN 62471 in risk group 1
- No risk of danger to students' eyes when performing the experiments
- Minimal heat generated compared to halogen lamps
- Sturdy housing and easy operation



Lab Doc for the experiment of the illuminance

OPTICS – OP2

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

LP5.2	CHROMATICS
LP5.2.1	Examination of the light paths through a prism
LP5.2.1.1	Light paths through a prism
LP5.2.1.2	Deflections in a prism
LP5.2.2	Spectral colours
LP5.2.2.1	Dispersion of white light
LP5.2.2.2	Colour defects in illustrations
LP5.2.2.3	Examination of spectral colours
LP5.2.2.4	Spectra of different slits
LP5.2.3	Colour mixing
LP5.2.3.1	Recombination of the spectrum
LP5.2.3.2	Light and body colours
LP5.2.3.3	Additive mixing of two light colours
LP5.2.3.4	Additive mixing of three light colours
LP5.2.3.5	Subtractive mixing

11 EXPERIMENTS

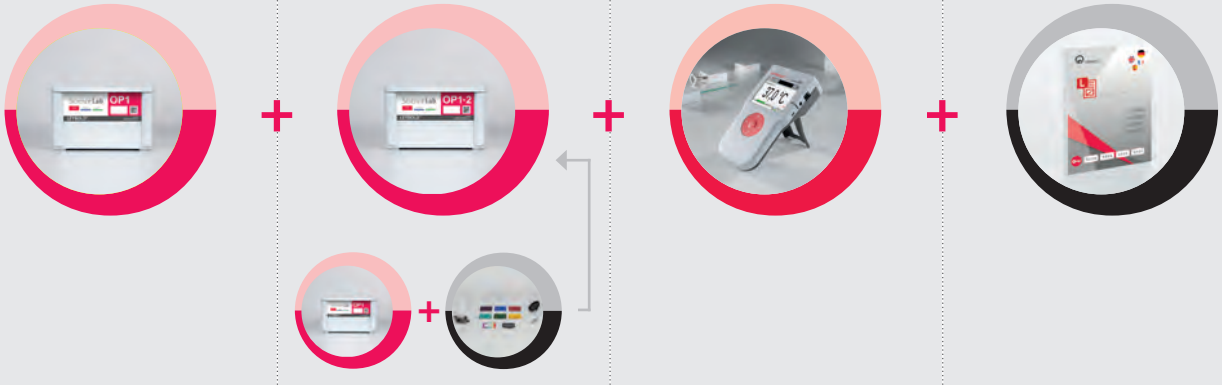
LP5.2.2.1 Dispersion of white light

LP5.2.3.4 Additive mixing of three light colours

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP5.2 CHROMATICS

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Optics OP1	Optics OP2	Mobile-CASSY 2 WiFi	Science Lab Optics digital



Detailed information on the above listed and **additionally required equipment** is available on the following pages.

Science Lab Optics OP2 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group.
The equipment is stored in Science Lab Optics OP1 (207 141S). With the supplementary equipment set OP2, together with the Science Lab Optics OP1, 11 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topics chromatics. While working out the curriculum required topics, they are also trained in communication and assessment skills.

Scope of delivery:

Count	Name
1	Triple LED lamp
1	Candle holder
1	Prism, plastic
1	Colour filter set, primary
1	Colour filter set, secondary

Count	Name
1	Triple colour filter
1	Diffraction grating 500/mm
1	Extension pin

207 142S	Science Lab Optics OP2 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	207 141S	Science Lab Optics OP1 (Set)	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 714	LIT: LP5 Science Lab Optics, digital	

leylabde/207142S

OVERVIEW OF ADVANTAGES

- Experiments from colour mixing to basics of diffraction
- Ingenious and easy-to-use triple LED lamp can be used to mix three or two colours by simply switching one of the built-in LED chips on and off
- With the included diffraction grating, students start discussing their first thoughts on diffraction as well as colour decomposition

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

MOBILE-CASSY 2 WIFI

With the Mobile-CASSY 2 WiFi, voltage *(U)*, current *(I)*, power *(P)* and energy *(E)* can be measured via 4 mm safety sockets.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP5.2 Chromatics

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set OP2 (207 142S) in conjunction with Science Lab Set OP1 (207 141S). Describes 11 experiments from the fields of chromatics.

Topics:
Examination of the light paths through a prism; Spectral colours; Colour mixing

520 7142EN	LIT: LP5.2 Chromatics	

SUBJECT AREA

LIT: LP5 Science Lab Optics, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of optics for the Science Lab.
Contains 72 experiments on ray optics and geometrical optics, chromatics, wave optics and polarisation.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 714	LIT: LP5 Science Lab Optics, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

Includes all interactive experiment instructions (Lab Docs) as html file.

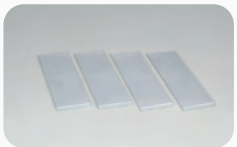
520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES




You can find detailed information on additional storage accessories from page 228.

INTRODUCING THE TOPIC

Triple LED lamp
Well thought out features for practical experience

Operation using a power bank

FLEXIBLE POWER SUPPLY

- The triple LED lamp can be operated via the USB output on the Mobile-CASSY 2 WiFi, via a power bank or the USB AC adapter
- All experiments can be performed with the triple LED lamp without a power supply with the Mobile-CASSY 2 WiFi or a power bank

Operation using the Mobile-CASSY 2 WiFi

Operation using an AC adapter

COLOUR MIXING

If the triple LED lamp is switched from two to three light sources, colour mixing experiments can be performed with either two or three colours.

OPTICS – OP3

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LP5.3	WAVE OPTICS	
	LP5.3.1	Diffraction on diffraction objects	
●	LP5.3.1.1	Diffraction at a slit	
●	LP5.3.1.1C	Diffraction at a slit (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP5.3.1.2	Diffraction at a double slit	
	LP5.3.1.3	Diffraction at multiple slits	
	LP5.3.1.4	Diffraction at gratings	
	LP5.3.2	Diffraction on complementary apertures	
	LP5.3.2.1	Slit and bar (Babinet's principle)	
	LP5.3.2.2	Complementary crossed gratings (Babinet's principle)	

7 EXPERIMENTS

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi. ● Lux sensor M

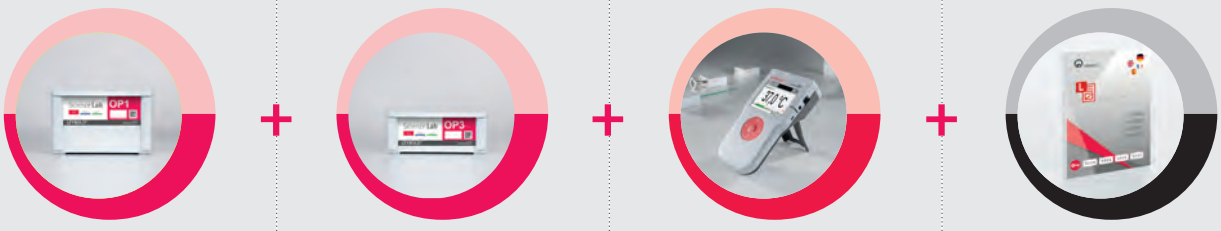
LP5.3.1.1C Diffraction at a slit

LP5.3.2.2 Complementary crossed gratings (Babinet's principle)

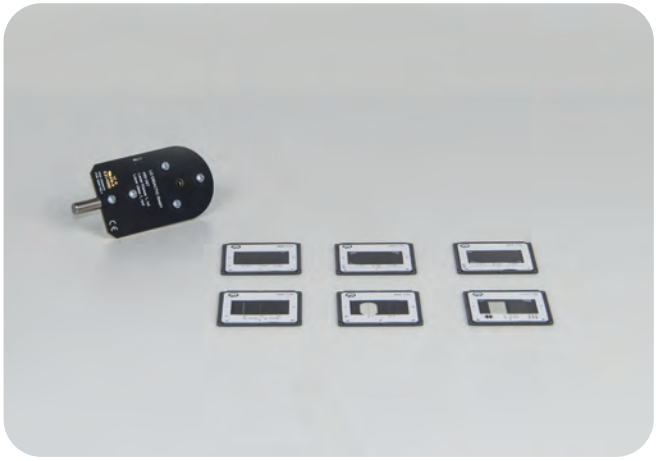
OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

LP5.3 WAVE OPTICS

BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Optics OP1	Optics OP3	Mobile-CASSY 2 WiFi	Science Lab Optics digital



Detailed information on the above listed and **additionally required equipment** is available on the following pages.



Science Lab Optics OP3 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group in pre-formed tray.
With the equipment set OP3, together with the Science Lab Optics OP1 (207 141S), 7 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topic wave optics. While working out the curriculum required topics, they are also trained in communication and assessment skills.
In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
1	Laser class 1, red
1	Diaphragm with single slits
1	Diaphragm with double slits (b=const.)
1	Diaphragm with double slits (d=const.)
1	Diaphragm with multiple slits

Count	Name
1	Diaphragm with slit and wire
1	Diaphragm with wire-mesh gratings
1	Tray, low
207 143S	Science Lab Optics OP3 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	207 141S	Science Lab Optics OP1 (Set)	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	524 444	Lux sensor M	
1	459 33	Diaghragm and slide holder on rod	Diffraction experiment (LP5.3.1)

Additionally recommended per working group

Count	Cat.-No.	Name	Description
1	471 09	Fresnel biprism	Diffraction experiment (LP5.3.1)
1	471 04	Fresnel's mirror, on board	
1	471 08	Apparatus for Newton's rings	

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 714	LIT: LP5 Science Lab Optics, digital	

leylabde/207143S

OVERVIEW OF ADVANTAGES

- Student-safe laser, class 1
- New, improved diffraction objects
- Diffraction phenomena can be visualised with a simple set-up on the precision metal rail (50 cm)
- The lux sensor M can record intensity distributions for different diffraction objects so the students can develop the topic on a deeper level

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

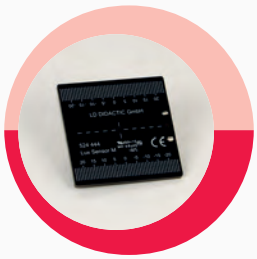
Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

SENSORS



Lux sensor M

For measuring the illuminance of visible light with Mobile-CASSY 2 WiFi (524 005W). The lux sensor has a flat design so that it can, for example, be inserted directly into the holder for diaphragms and slides (459 33). With the lux sensor, measurements can be performed along and orthogonal to the optical axis. A printed millimetre scale is used to position the sensor on the optical axis and also enables the recording of intensity distributions of different diffraction objects (e.g.469 731) without additional equipment.

524 444	Lux sensor M	

You can find detailed information on this and other sensors from page 229.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP5.3 Wave optics

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set OP3 (207 143S) in conjunction with Science Lab Set OP1 (207 141S). Describes 7 experiments from the fields of wawe optics.

Topics:
Diffraction on diffraction objects; Diffraction on complementary apertures

520 7143EN	LIT: LP5.3 Wave optics	

SUBJECT AREA

LIT: LP5 Science Lab Optics, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of optics for the Science Lab.
Contains 72 experiments on ray optics and geometrical optics, chromatics, wave optics and polarisation.

Includes all interactive experiment instructions (Lab Docs) as html file.

520 714	LIT: LP5 Science Lab Optics, digital	

SUBJECT

LIT: LP Science Lab Physics, digital

includes ALL subject areas

Comprehensive physics experiment instructions for the Science Lab. Contains 450 experiments in the fields of mechanics, energy, electricity and electronics, optics, atomic and nuclear physics.

Includes all interactive experiment instructions (Lab Docs) as html file.

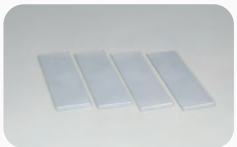
520 71	LIT: LP Science Lab Physics, digital	

Technical data of the digital version:

- Product key for literature (activation & selection of one literature language in LeyLab)
- Can then be used in LeyLab and Document Center (school/institute licence)
- System requirements:
  Document Center:
  - PC with Windows 7 or higher; internet access during installation; local network for distribution to students
  LeyLab:
  - PC, tablet or smartphone with a current browser; internet access

ADDITIONAL STORAGE ACCESSORIES




You can find detailed information on additional storage accessories from page 228.

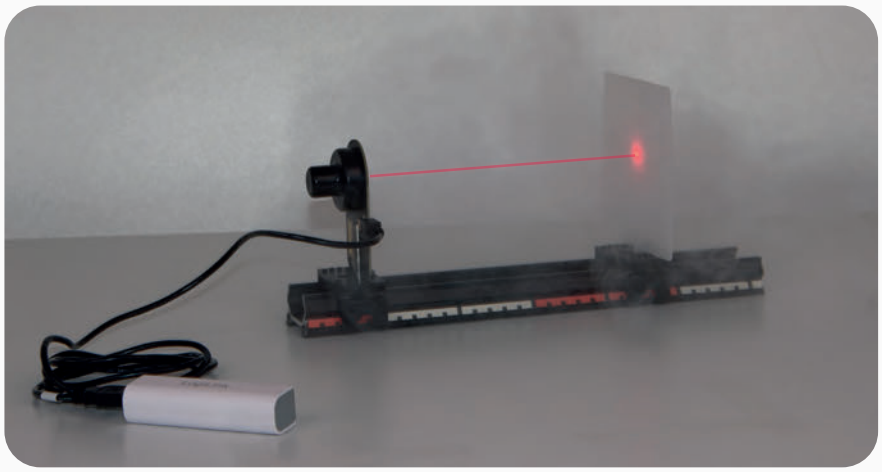
INTRODUCING THE TOPIC

Our laser - Your safety

SAFE

- Laser complies with safety regulations (class 1 in accordance with DIN EN 60825-1:2015-07)
- In comparison, most commercially available laser pointers are categorised in class 2 and their suitability for student experiments is limited

DIFFRACTION AND INTERFERENCE - EXCITING TOPICS



OBSERVE, UNDERSTAND & MEASURE DIGITALLY

- Simple performance of diffraction experiments in a confined space
  - By providing suitable diffraction objects
  - No additional or complicated observation lenses needed
  - Only a few devices are needed
- With the lux sensor M, intensity distributions can also be recorded quantitatively
- Flexible power supply to the laser using a
  - Power bank
  - Mobile-CASSY 2 WiFi USB output
  - USB AC adapter

OPTICS – OP4

OVERVIEW OF OUR CURRICULUM-COMPLIANT EXPERIMENTS

Sensors	LP5.4	POLARISATION	
	LP5.4.1	Polarisation filters	
●	LP5.4.1.1 LP5.4.1.2C	Applying polarisation filters Malus's law (with Mobile-CASSY 2 WiFi)	DIGITAL
	LP5.4.2	Photoelastric double refraction	
	LP5.4.2.1	Chromatic polarisation	
	LP5.4.3	Polarisation due to reflection an diffraction	
	LP5.4.3.1 LP5.4.3.2	Polarisation due to reflection Brewster's law	
	LP5.4.4	Polarisation due to scattering	
	LP5.4.4.1	Tyndall effect on an emulsion	
	LP5.4.5	Optical activity	
●	LP5.4.5.1 LP5.4.5.1C	Polarimetry (saccharimetry) Polarimetry (saccharimetry) (with Mobile-CASSY 2 WiFi)	DIGITAL

For experiments marked with „C", the measurements are carried out **digitally** with the Mobile-CASSY 2 WiFi. ● Lux sensor M

8 EXPERIMENTS

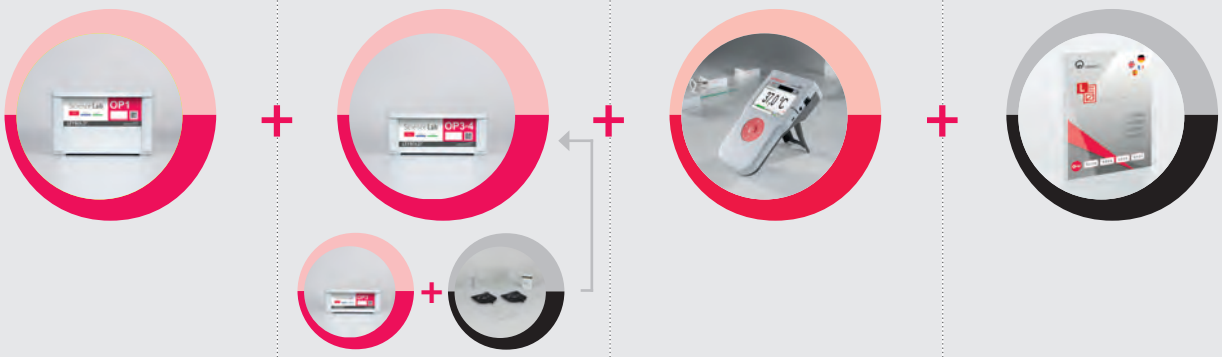
LP5.4.1.2C Malus's law

LP5.4.5.1 Polarimetry (Saccharimetry)

OVERVIEW OF EQUIPMENT REQUIRED FOR PERFORMING EXPERIMENTS

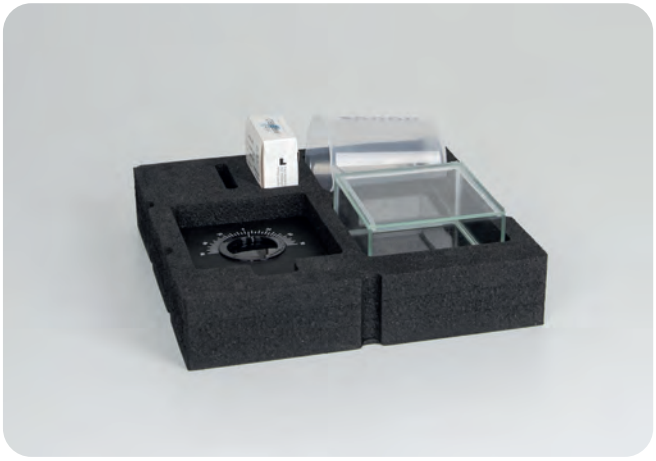
LP5.4 POLARISATION

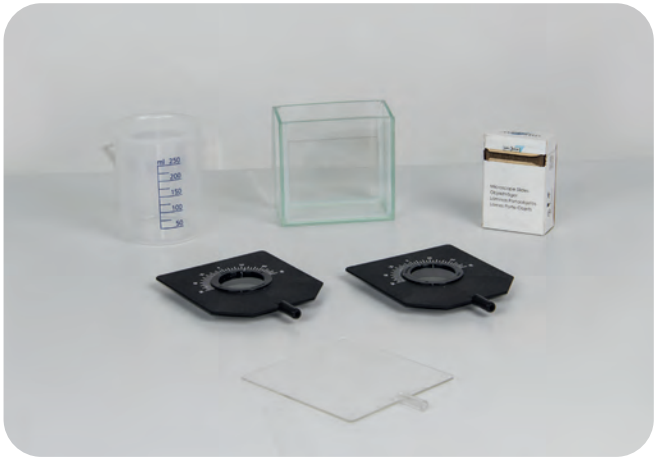
BASIC SET	TOPIC SET	DIGITAL MEASURING DEVICE	LITERATURE
Optics OP1	Optics OP4*	Mobile-CASSY 2 WiFi	Science Lab Optics digital



Detailed information on the above listed and **additionally required equipment** is available on the following pages.

*Optic Set OP3 is not required, but OP4 can be stored in the tray of OP3 or OP4 can be ordered separately.





Science Lab Optics OP4 (Set)

Student experiment set of the student experiment system Science Lab in the field of physics. Set-up material for one working group. The equipment can be stored in Science Lab Optics OP3 (207 143S). With the equipment set OP4, together with the Science Lab Optics OP1 (207 141S), 8 experiments at school, college and university level for worldwide curriculums can be performed.
The students deal with the topic polarisation. While working out the curriculum required topics, they are also trained in communication and assessment skills. In combination with the Mobile-CASSY 2 WiFi (524 005W), there are additional evaluation options which enable the students digital learning.

Scope of delivery:

Count	Name
1	Acrylic glass screen on rod
2	Polarisation filter on rod
1	Glas box (cuvette), 100 x 50 x 93 mm

Count	Name
1	Microscope slides 76 mm x 26 mm x 1 mm, set of 50
1	Beaker, PP, 250 ml, squat
207 144S	Science Lab Optics OP4 (Set)

ADDITIONALLY REQUIRED TO PERFORM ALL EXPERIMENTS

Additionally required per working group

Count	Cat.-No.	Name	Description
1	207 141S	Science Lab Optics OP1 (Set)	
1	524 005W	Mobile-CASSY 2 WiFi	for digital experiments
1	524 444	Lux sensor M	Malus's law and polarimetry experiments (LP5.4.1, LP5.4.5)

Additionally required per class

Count	Cat.-No.	Name	Description
1	520 714	LIT: LP5 Science Lab Optics, digital	

Additionally required for storage per working group

Count	Cat.-No.	Name	Description
1	647 001	Tray, low	for storage of Science Lab OP4, if set OP3 is not available
0	207 143S	Science Lab Optics OP3 (Set)	if Science Lab OP3 (set) already exists, OP4 can be stored in the tray

OVERVIEW OF ADVANTAGES

- Experiments about the polarisation of light
- Malus's law can be easily and vividly demonstrated with the Mobile-CASSY 2 WiFi and the lux sensor M

STUDENT MEASURING DEVICE

DIGITAL CLASS / EDUCATION

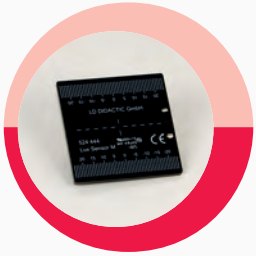
Mobile-CASSY 2 WiFi

The universal student measuring device with WiFi for all measuring tasks in physics, chemistry and biology.

524 005W	Mobile-CASSY 2 WiFi	

You can find detailed information on the Mobile-CASSY 2 WiFi on page 228.

SENSORS



Lux sensor M

For measuring the illuminance of visible light with Mobile-CASSY 2 WiFi (524 005W). The lux sensor has a flat design so that it can, for example, be inserted directly into the holder for diaphragms and slides (459 33). With the lux sensor, measurements can be performed along and orthogonal to the optical axis. A printed millimetre scale is used to position the sensor on the optical axis and also enables the recording of intensity distributions of different diffraction objects (e.g.469 731) without additional equipment.

524 444	Lux sensor M	

You can find detailed information on this and other sensors from page 229.

LITERATURE PACKAGES

Here you will find an overview of our literature packages.
You can find detailed information on our literature on the internet at www.leybold-shop.com.

TOPIC

LIT: LP5.4 Polarisation

Printed version available in ring file

Detailed experiment instructions relating to Science Lab Set OP4 (207 141S) in conjunction with Science Lab Set OP1 (207 141S). Describes 8 experiments from the fields of polarisation.

Topics:
Polarisers; Photoelastic double refraction; Polarisation due to reflection and refraction; Polarisation due to scattering; Optical activity

520 7144EN	LIT: LP5.4 Polarisation	

SUBJECT AREA

LIT: LP5 Science Lab Optics, digital

includes only ONE subject area

Comprehensive physics experiment instructions in the field of optics for the Science Lab.
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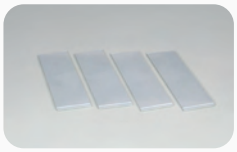
ADDITIONAL STORAGE ACCESSORIES

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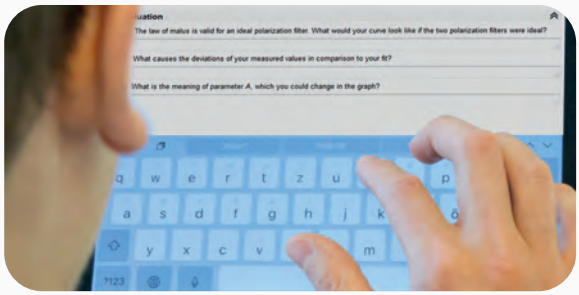
INTRODUCING THE TOPIC

Digital media makes experiences more intense

MALUS'S LAW (LP5.4.1.2C)



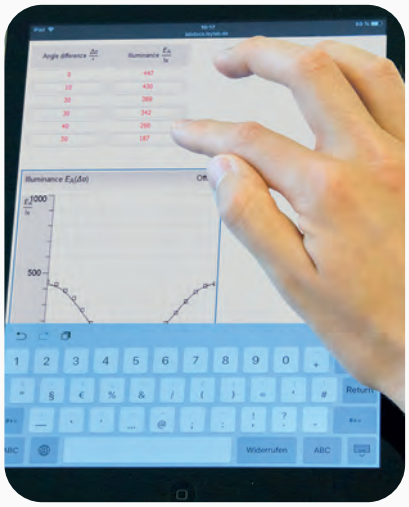
LAB DOC - ANSWER QUESTIONS

Students answer questions in their own Lab Doc.

LAB DOC - ENTER MEASURED VALUES

- When not connected to the Mobile-CASSY 2 WiFi, the measured values read can be entered manually
- The diagram is then automatically completed

The student is currently entering the sixth measuring value for illuminance

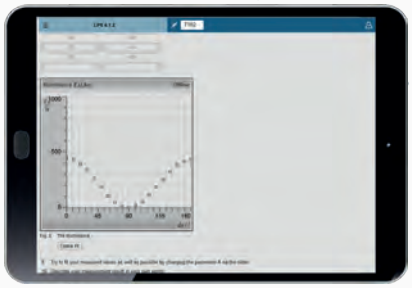


MOBILE-CASSY 2 WIFI

LUX SENSOR M

- Lux sensor M, is automatically recognised by the Mobile-CASSY 2 WiFi
- Interactivity between measuring device and Lab Doc
- Illuminance is measured directly by using the lux sensor M

LAB DOC



PERFORMING THE EXPERIMENT