



LAB 2

A game of shadows!

LET'S DO IT!

What do we need?



MATERIALS

- ☐ Cardboard shoe box
- ☐ 3 types of objects to project (they can have different colours and shapes):
 - Type 1: opaque objects (scissors, apple, etc.)
 - Type 2: translucent or transparent objects (tracing paper, translucent plastic, etc.)
 - Type 3: objects that reflect light (mirror, CD, mobile phone screen, etc.)
- ☐ Piece of card or white surface sized DIN A4



SAFETY MEASURES

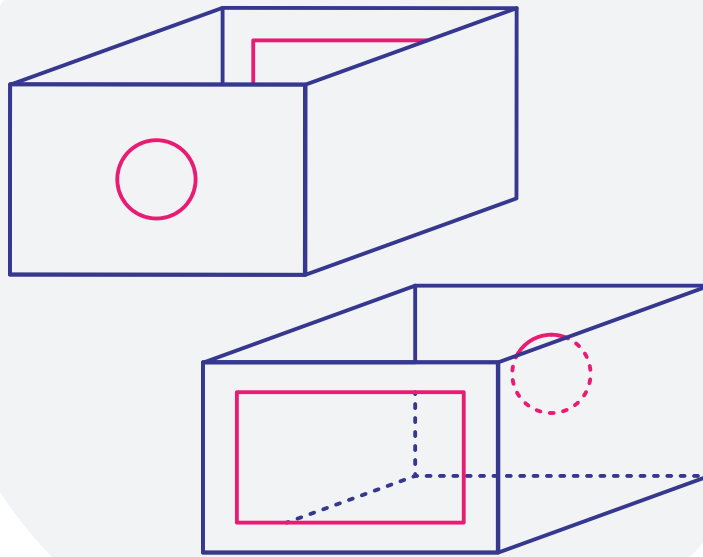
- ☐ This experiment must be carried out under the supervision of an adult.
- ☐ Cuts with the cutter on the cardboard must be performed by the teacher.
- ☐ It is important to wear protective gloves when using the cutter and to protect the tables to avoid scratching them.

TOOLS

- ☐ White-light LED flashlight (you can use a mobile phone flashlight)
- ☐ Cutter
- ☐ Scissors
- ☐ Ruler
- ☐ Compass
- ☐ Pencil
- ☐ Protective gloves (gardening or similar)
- ☐ A piece of cloth to cover the box (you can use the shoe box lid)
- ☐ A magnifying glass (it is preferable, but not necessary, that it is 50 mm in diameter with 75 mm of focal distance)

PHASE 1

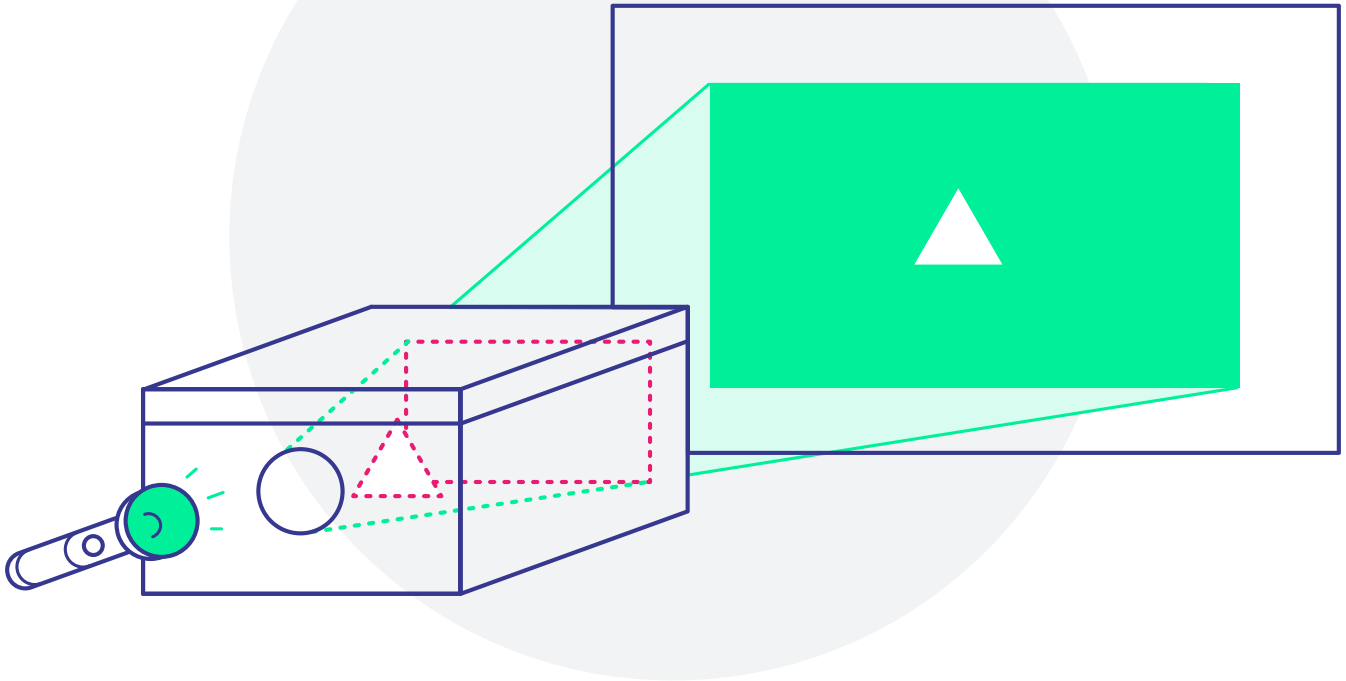
ASSEMBLING THE OBSERVATION BOX



- 1/** Put the shoe box lid away to use it later in Lab 3.
- 2/** Take the box and, on one of the short sides, draw the two diagonals.
- 3/** Measure the diameter of the magnifying glass, divide it by two to find the value of the radius, subtract 3 mm and get the radius of the hole to be made on the observation box.
- 4/** With the compass, draw a circle centred on the point where the two diagonals intersect. This circle must have the radius of the hole calculated in the previous point.
- 5/** Take the other short side and draw a rectangle on it with a 1.5 cm margin from the border.
- 6/** Put on the gloves and carefully use the cutter to cut the circle drawn in point 4 and the rectangle drawn in point 5.
- 7/** There you have your observation box!

PHASE 2

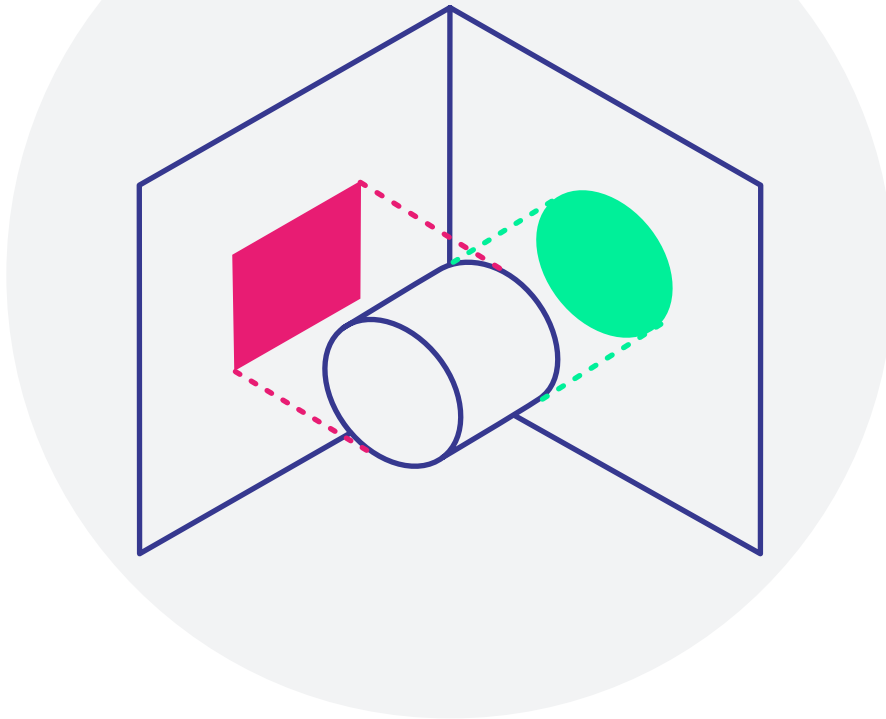
PREPARING THE OBJECTS FOR OBSERVATION



- 1/ We divide the class in two groups.
- 2/ Each group must select at least one object of each type to be projected in the observation box and the other group will have to guess what it is:
 - A Type 1: an opaque object
 - B Type 2: a translucent object
 - C Type 3: an object that reflects light
- 3/ It is important that each group does not see the other's objects.

PHASE 3

OBSERVING AND DEDUCING



- 1/ Place a table against a white wall or a wall covered with white card.
- 2/ Place the box on the table.
- 3/ Point the side with the cut-out rectangle towards the wall.
- 4/ Place the observation box so that you can make the light from the flashlight enter through the round hole, go through the object placed inside the box and project its shadow on the wall or white card.
- 5/ Stand on the sides of the box to be able to see the projected image.
- 6/ Make the classroom lights dimmer to facilitate observation (roll down the blinds and turn off the lights), although you don't need total darkness.
- 7/ In the first round of observation, group A will project and group B will observe.

PHASE 3

- 8 /** Group A places the first object inside the box, covers it with a piece of cloth (or the shoe box lid) to hide the object inside it, and lights the object by pointing the flashlight through the round hole.
- 9 /** Group B observes the projected image and draws what they see in the work plan dossier (see the following page).
To ensure that the shadow of the object is fully observable, we should place, on its base, some kind of wedge about 2 cm high (e.g. a book).
In order to facilitate that group B may guess which object it is, we can change the position of the object so that it projects the shadow of another side (frontal and lateral projection) thus allowing to reconstruct the tridimensional object from bidimensional projections.
- 10 /** We repeat the same process with other objects and then exchange the group roles and do another round.
- 11 /** Finally, each group gathers and answers the questions in the table (What object is there inside the box? Why do we think it is that object?).

PHASE 3

Does light go through the object or does it generate an opaque shadow?

What is the shape of the shadow?

Can we see any colour?

If we change the object's position, does the shadow change?

Is the object opaque, translucent or does it reflect light?

What is the object inside the box?

Object
n°1

Object
n°2

Object
n°3

Object
n°4

Object
n°5

Object
n°6

LET'S SOLVE IT!

The science of light has helped us understand and know what certain objects we could not see were like. Thanks to the interaction of objects with light we can know their shape and, on certain occasions, the material of which they are made up. The ALBA Synchrotron uses a very bright light, called synchrotron light, to study matter, like you have just done yourselves. But it uses devices much more complicated than a flashlight to generate it!

CAN YOU SEE THE DIFFERENCE BETWEEN THE SHADOWS PROJECTED BY OPAQUE, TRANSLUCENT AND REFLECTIVE OBJECTS?

WRITE THE ANSWER BELOW 

HOW DOES LIGHT HELP US KNOW ABOUT OBJECTS THAT WE CANNOT OBSERVE DIRECTLY?

WRITE THE ANSWER BELOW 

