



FM21 Network for Light Pollution education at secondary level

Network for Light Pollution education at secondary level: the local solutions

(Kit of practical activities – 2015 ¹⁾)

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1. This material is available at:

<http://itedamza.frm.utn.edu.ar/wp-content/uploads/2014/07/KIT-PL-2015-V2.pdf>

Summary: NASE STATISTICS

country	period	NASE LWG	teachers	students
Argentina	2010-2015	5	508	343 600
Bolivia	2012-2015	2	317	155 800
Brazil	2013-2015	3	123	73 800
China	2013-2015	1	45	27 000
Colombia	2009-2015	3	326	239 200
Cuba	2014-2015	1	24	9 600
Ecuador	2009-2015	1	155	126 200
Ghana	2013-2014	1	50	24 800
Guatemala	2012-2015	1	163	97 200
Honduras	2011-2015	1	199	151 600
Kenya	2013-2015	1	20	12 000
Nicaragua	2010-2015	1	192	168 000
Mexico	2013-2015	1	51	30 600
Panama	2011-2015	1	48	48 000
Paraguay	2011-2015	1	110	80 400
Peru	2009-2015	2	238	200 300
Romania	2014- 2015	1	43	17 200
Uruguay	2012-2015	1	69	20 800
18		28	2 681	1 826 100

Summary: NASE STATISTICS

NASE organized (until July 1st, 2015)

- 67 international courses, in 18 countries,
- 28 NASE local working groups had been created involving 284 NASE members
(34 IAU members and 250 non IAU members)

NASE prepared (until July 1st, 2015)

- 2681 teachers involving 1 826 100 students
(in average a teacher has 200 students per year)



Light pollution IYL2015

DIFFERENT ASPECTS

Sky GLOW: associated to public illumination which is projected to the sky. Produce a "bubble" that covers the city and it is visible at a great distance

Cut-off lamps.

- We can not see the stars!

GLARE: connected to the lights at the streets, signs, signals and cars. The light enters suddenly, directly to the eyes

INTRUSION: produced by exterior artificial light

Which enters the house and it is not needed

Black out installation.

- We can not sleep!

CONNECTIONS

Connection Scheme



from: J. Esquivias, A.M. Jiménez, B. Troughton, S. Cardenete, "Unidad didáctica sobre contaminación lumínica"
Editado por Junta de Andalucía (España), 2012.

Activity 1: Sky glow

Objetives

Show the effect of the light without cut-off.

Recognize the effects of a good luminary.

Reconognize the bennefits of a good practices in illumination, illuminating the places where it is not possible complete darkness, to **see the stars**.



Preparation of a dark box



Test with luminaries without cut-off

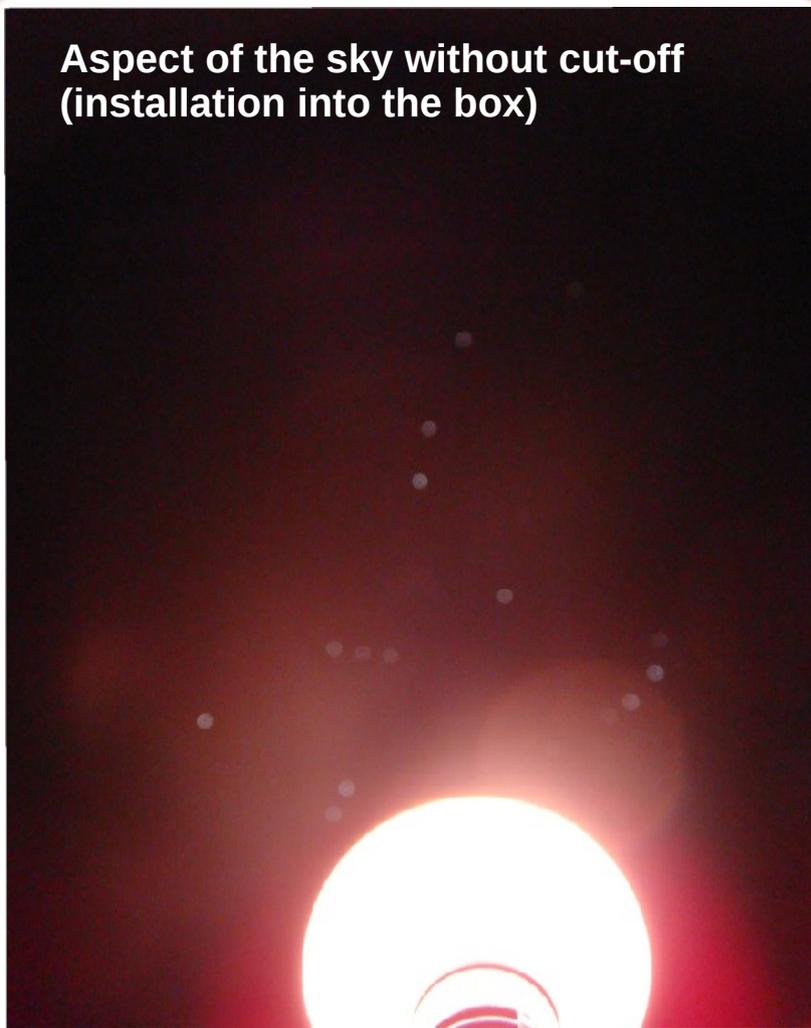


Test of cut-off installations.

light pollution controlled!

Demostration: take a photo of your sky!

Aspect of the sky without cut-off
(installation into the box)



Aspect of the sky with cut-off devices
(into the box)



Activity 2: Intrusion

Objetives

Show the effect of the street lights with a bad design.

Recognize the benefit of a good shaped luminary.

Remark the improvement of **life quality** if we avoid the intrusion (insomnia).

Show that the historical buldings can be iluminated without LP.

A C H L 1

F J Y M 2

P O E V 3

R T G W 4

Q S U K 5

N B C X 6

Ñ R H I 7

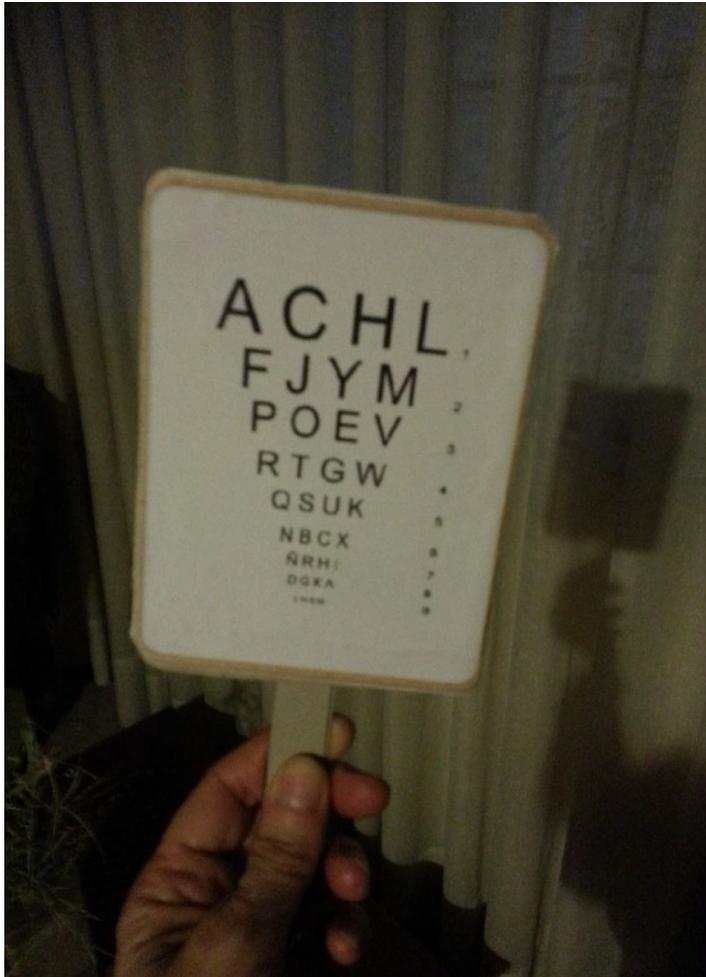
D G K A 8

L N Q M 9

INTRUSIMETER

Check with light if you can see all letters with the Intrusimeter, reaching out everything you can.

Turn out the lights, draw the curtains and blinds up. Wait a few minutes for your eyes to adjust. Look the Intrusimeter again to see the letters. The smaller you distinguish you indicate the level of light intrusion in place that you come across. The maximum is 9 and the minimum is 0, if you can not read any letters.



1. Check if you can see all the letters with the intrusimeter at your hand and the arm extended.
2. Open the courtins, turn off all the light at the room.

Wait a few mintes (between 10 and 15) to adapt you eye to night vision.



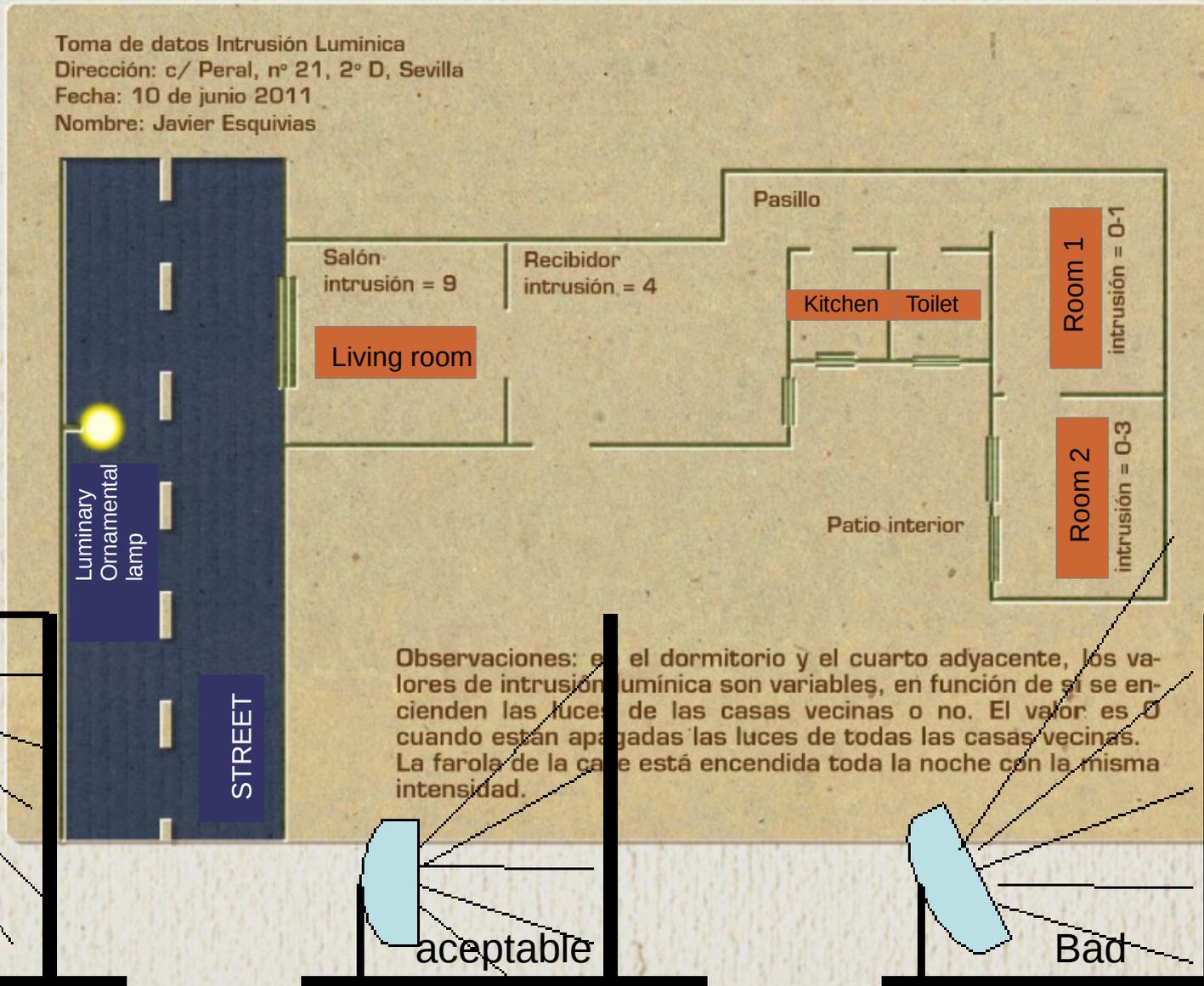
3. Check again the intrusimeter.

The smaller letter that you can see, will indicate the level of light pollution by intrusion inside the room.

Maximum value is 9 (you can see all the letters): **High** Light contamination.

minimum is 0 (you can not see any letter): the intrusion is the **lower** that you can have

Example of Data acquisition for Light Pollution at home: disruption of biological clock



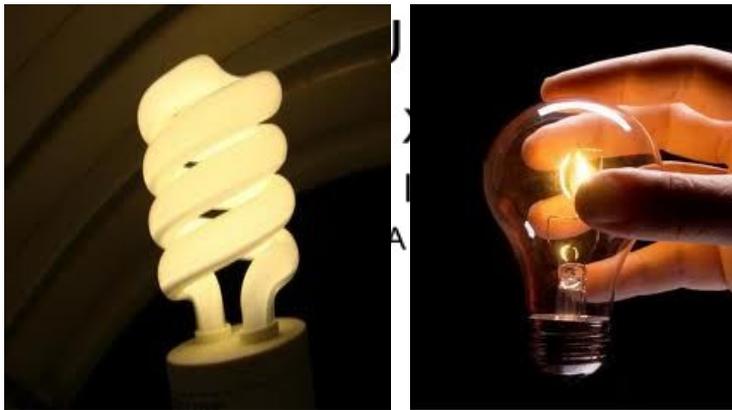
Activity 3: Consumption-Energy

Objetives

Study the contaminating effect if we choose a bad luminary.

Shows the benefic effect of a well selected luminary: **reduction in the electric energy consumption** and production of heat.

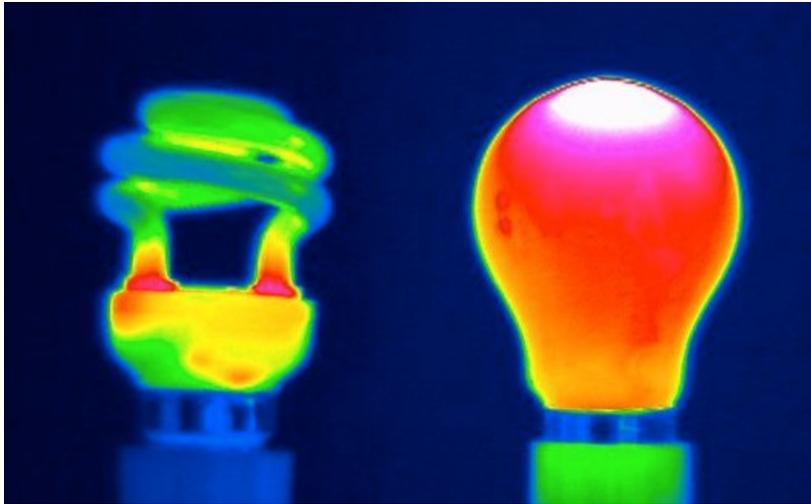
Recognize the improvement in the life quality if we avoid the contaminating lights.



The inadequate use of light sources means economic loss and waste of millions of dollars a year.

The energy which is not transformed in light, is transmitted to the environment as heat

The incandescent lamps have an efficiency of 5%: **only 5% is transformed into light, the 95% of the electric energy is transformed in heat**



IR images: low consumption, incandescent



Según Bios Argentina

The electric energy that we use to illuminate which is not transformed into light, is transmitted to the environment as heat.

The low consumption lights (as fluorescents) has a better efficiency than the incandescent lampst, but....the light is produce by Mercury (Hg).



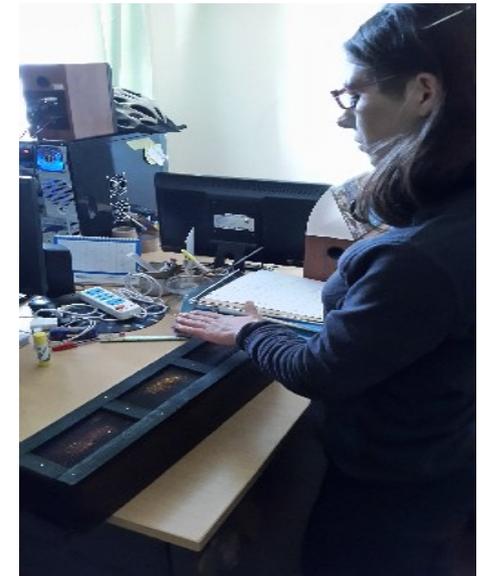
Which one I must choose?



LEDs... yes, but avoid the blue ones! (see next activity)

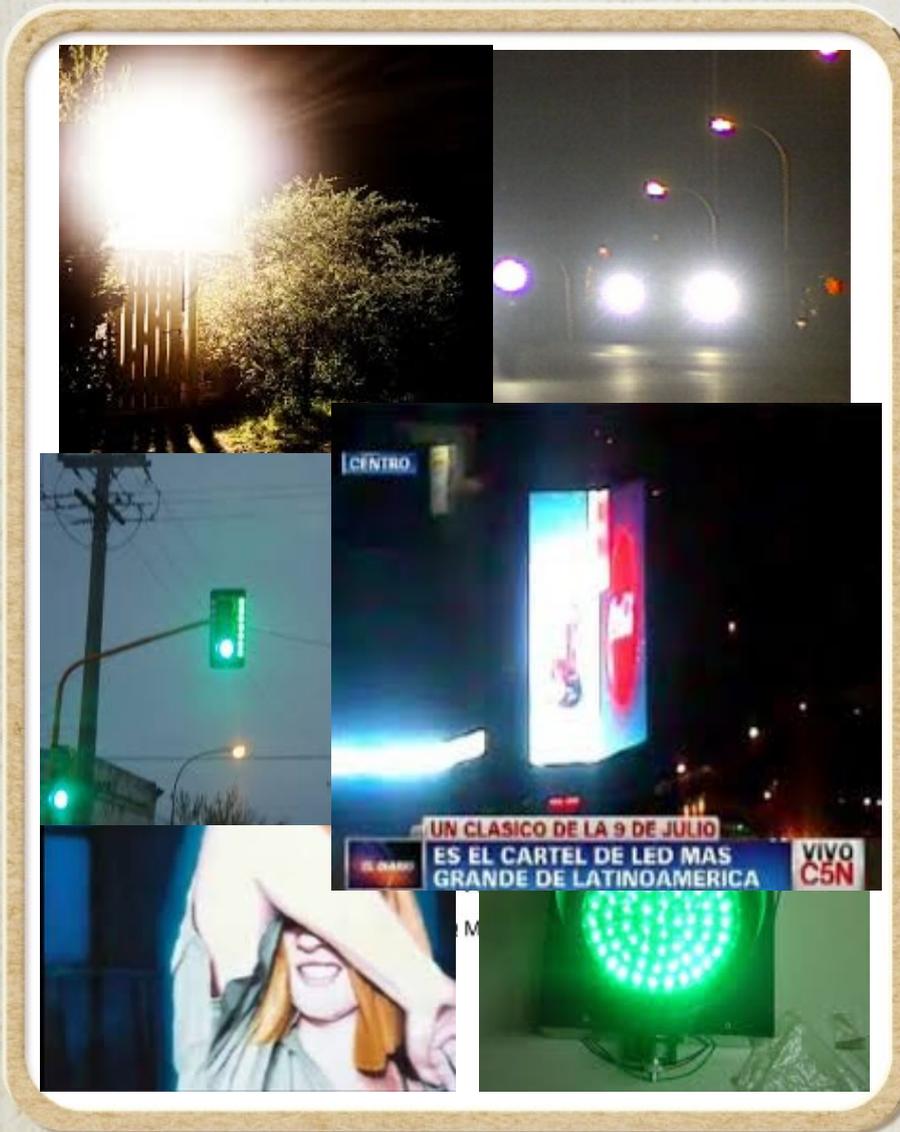


The Magic Box



Detect the heat using your hand.

Can you discover which is the best for the environment?



This kind of light pollution can be produced for any light source.

Is more evident in a city with hills, different levels or slopes

Use LED technology can represent a risk if they are not well calibrated, because they have high intensity and directionality

Study the street lights at your town or city and discuss about the way to avoid the glare.

Activity 5: Chemical composition of the public luminaries

Objetives

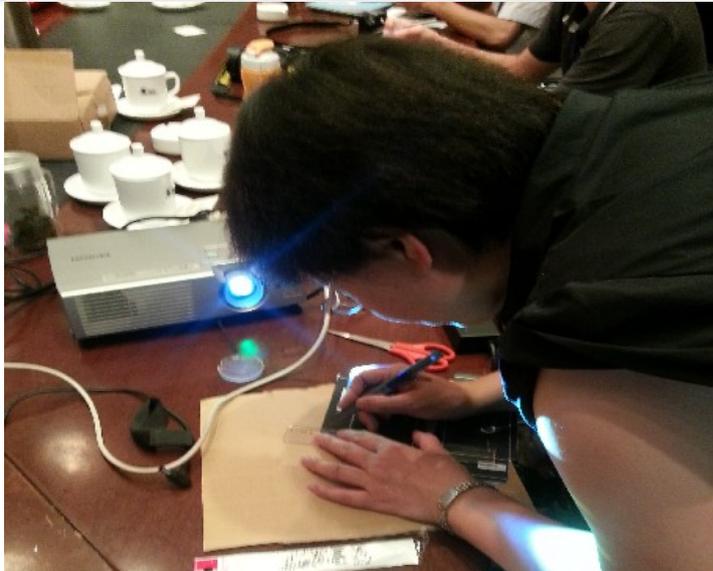
Recognize different light spectra.

Analyze differences between light spectra produce by incandescent lamps (solid filament), LED (diodes), fluorescent tubes, low consumption and Sodium lamps (gases).

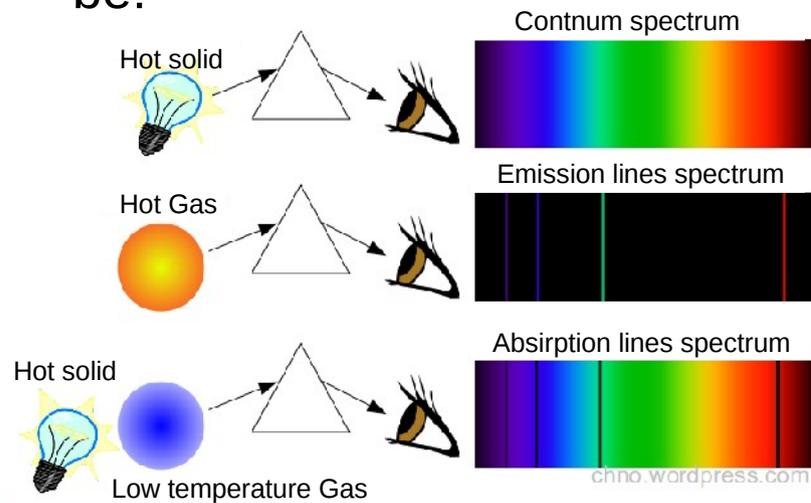
Identify some **chemical elements** wich are used at the street lights.

Compare risks and benefits of each lighth source.

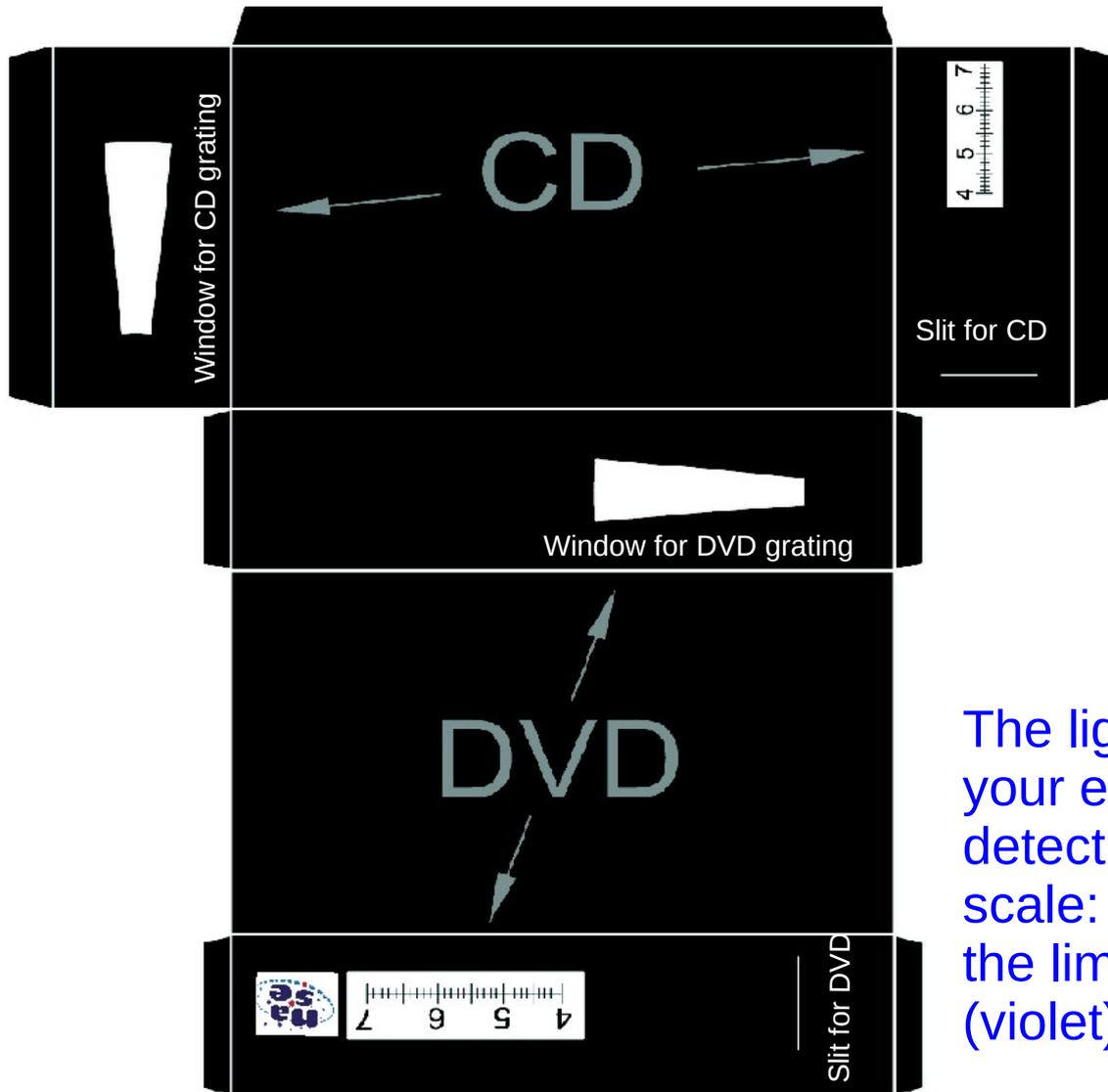
DIFFERENT SPECTRA



- To disperse the white light into the constituent colors, and obtain the spectrum in the visible region, we use a prism or a diffracting red.
- According to the material that emits light, the spectra can be:



NASE SPECTROMETER



Cut the model.

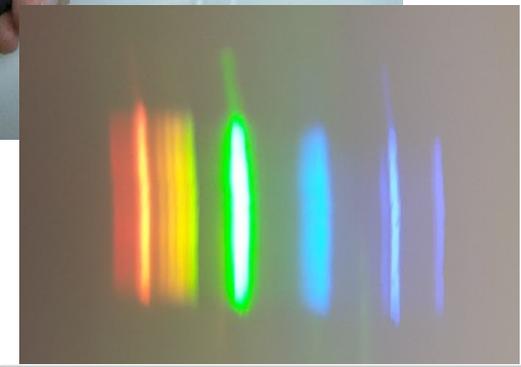
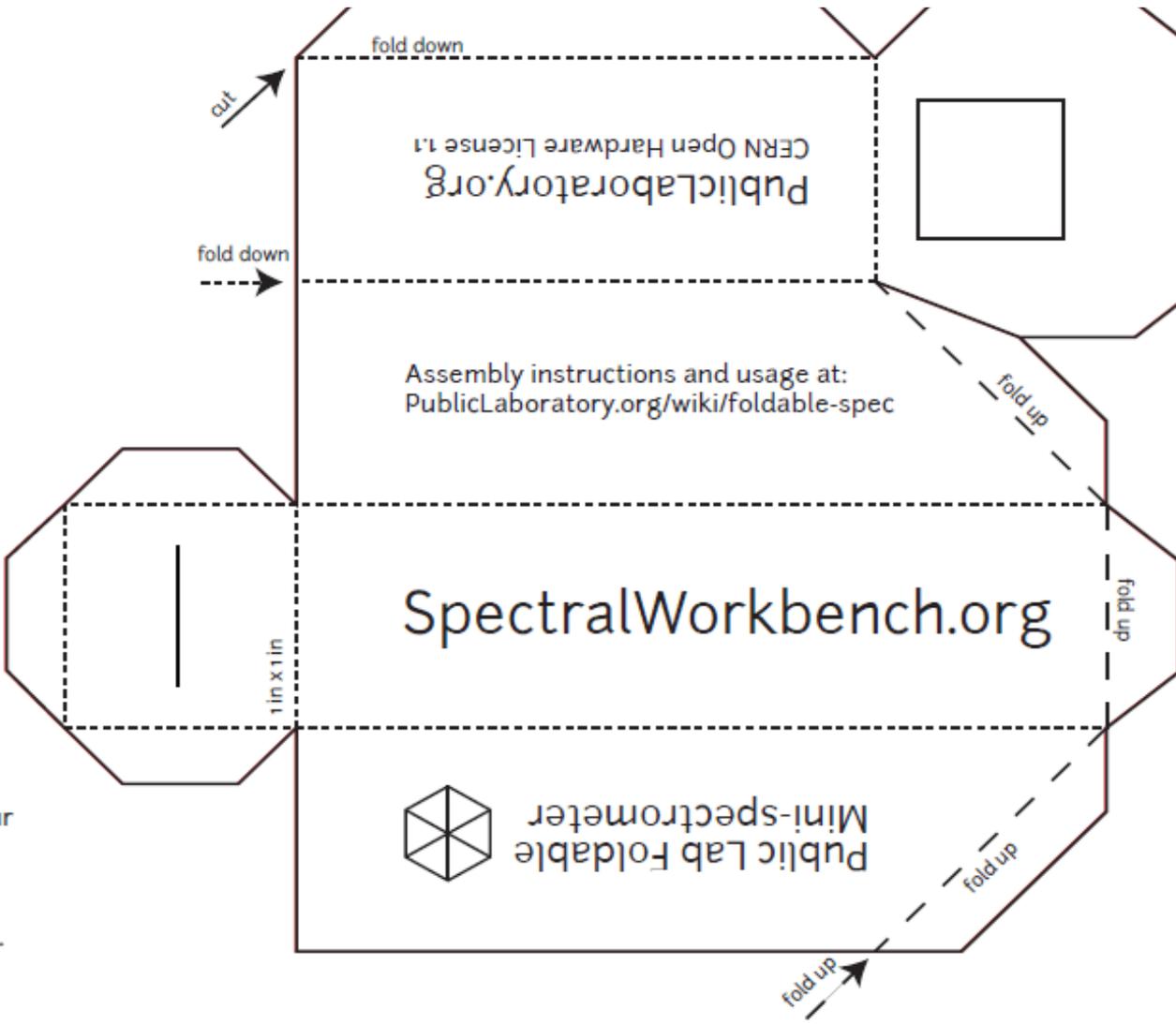
Choose the “diffraction grating” (CD or DVD)

Cut the correspondent “window” (only one), on it you must glue the grating.

Cut the slit.

Construct the instrument, with the black inside.

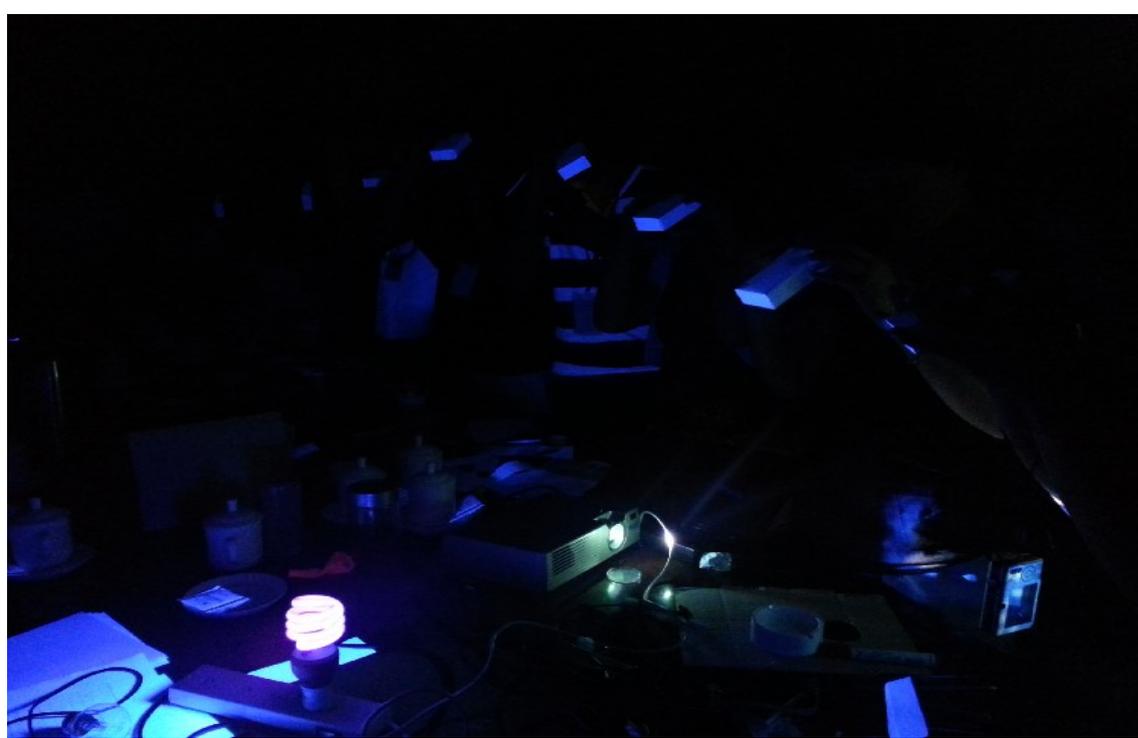
The light must enter throught the slit; your eye must see the window and detect the spectrum projected on the scale: the numbers (4 to 7) represent the limits of the visible spectrum: 400 (violet) to 700 (red) nanometers.



This open hardware design was developed by Public Lab contributors; You are free to reproduce, share, & distribute

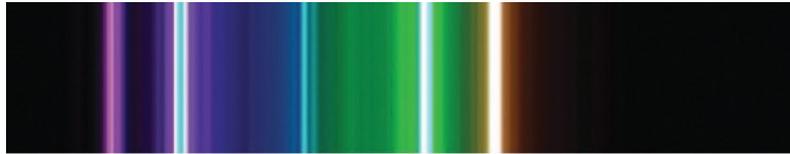
Instructions at:
<http://publiclab.org/wiki/foldable-spec>



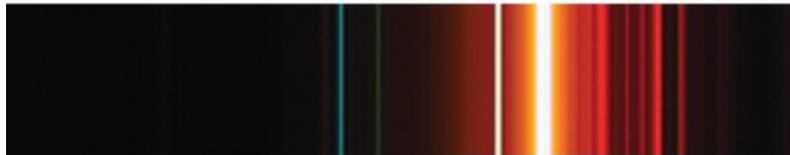


Use the spectrometers to:

1. Observe different light sources in order to identify different spectra.
2. Determine the wavelength of the spectral lines.
3. Compare the spectra from known sources with those from the street light to deduce the chemical composition of it.



Hg vapor spectrum (350-700 nm)

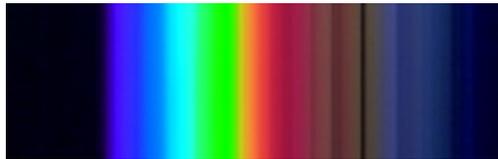


Low-pressure Na spectrum
(350-700 nm)



High-pressure Na spectrum
(350-700 nm)

- In general, the street lamps have Mercury, Sodium or a combination of gases.
- The spectra of Act. 5.3 must be similar to some of the figures at the left.

RELEVAMIENTO DE
LUMINARIAS

Sky



LED



Na

¿Which is the primary component of the street lights at your neighborhood?

- If you detect Mercury...

DANGER:

The Hg contaminates water and soil if the lamp breaks.

His light alters the behavior of insects and modifies the human biological clock.

- If there are LED, and they are withe..

DANGER:

They can affect biological rhythms

Kit LP-IYL2015-NASE-NOC.ARG

Low cost materials

✓ **Activity 1. Blow**

Cardboard box (black inside).

knitting needle or punch (to create a constellation on one side of the box).

1 to 2 headlights (single bulbpr single LED).

Two ping pong balls (one painted on top with synthetic enamel of any color, both must be pierced at the bottom to fit into the flashlight).

✓ **Activity 2. Intrusion**

Intrusimeter (cut the template, fold it in half and put together the instrument as in the figure).

Scissors.

Glue.

Kit PL-IYL2015-ARG

Materialiales

- ✓ **Activity 3. Consumption**

- 1 box divided into 3 sections.

- 1 incandescent or halogen lamp.

- 1 Lamp low consumption.

- 1 LED lamp (may be a flashlight).

- Socket.

- Scissors or cutter.

- Glue.

- ✓ **Activity 4. Glare**

- Street Lights.

Kit PL-IYL2015-ARG

Materialiales

✓ Activity 5. Chemical composition of luminaries

Templates for the spectrographs (cut the paper of the printer)

To NASE-Spectrograph

1 CD or DVD in use or used

Packaging tape (CD, only a small piece of tape used)

Scissors and utility knife.

Glue stick.

To mini cell-phone spectrograph

(this template can be pasted on card)

1 DVD player

Scissors

Scotch tape (only small pieces of tape are used)

glue

Conclusions

- A new kit for NASE courses permits to work at the classroom exclusively on LP.
- Part of the material is developed during NASE workshops (like the spectrometer).
- Low cost resources.
- NASE assures 29 Local Groups in 19 countries to maintain the activity (August, 2015)
- This proposal complements other initiatives on the Globe on the subject.

Thank you very much!
make and enjoy the kit

