“Seeing” alternating current

(How to see that home alternating current is alternating and how to measure its rate with the help of a fluorescent tube and a bicycle)

This experiment must be carried out in a room illuminated by one or several fluorescent tubes.
The first thing we will experiment will be the stroboscopic effect of these lights (That is, the effect caused by a light quickly turning on and off).
We must hold, as is shown in the drawing below, a black Bristol board with one hand and with the other we must quickly move a white pen in front of it.
We will see light and dark areas appearing along its run.
On the contrary, if we carry out the same experiment with the light of an incandescent light bulb, this will not happen.

The explanation of this effect is that the fluorescent tube turns on and off a lot of times, which is impossible to detect with the naked eye because our retina retains the image for a longer period of time, but it can be seen when the pencil is moved because we take a longer period of time.
The cause for this phenomenon is the alternation of the rotation direction of the current that feeds the tube. When the current circulates in one direction the fluorescent tube turns on, and when it changes direction the tube turns off.
The second part of the experience consists of calculating how many times it turns on and off in one second, that is, the rate of this stroboscopic lighting and of the alternating current.
For this second part of the experience you must turn a bicycle upside down and paint with white ink a regular number of white dots along the back wheel.

We will see that, when the wheel turns, these white dots offer a changing aspect. Sometimes we cannot see them, sometimes they appear as if they were dots that move forward or backward along the wheel, or even they stop at the same spot.
It is necessary for one of the experimentators to turn the pedal by hand until managing to "stop" these dots. This means that the light turns on every time one of the dots goes through the same spot, that is, that the time the light takes to turn on and off is the same that two consecutive white dots take to go through the same spot.
A second mate must be looking at the wheel and, as soon as the dots are stabilized (the first operative must inform about it and try to keep the pedalling pace for a while), time how long it takes for the wheel to turn 10 times (he or she can observe the valve on the wheel).
With these data we have enough information so as to calculate the rate of the alternating current.

Experimental data:

. The time it takes for the wheel to turn 10 times:.....
. Number of dots painted on the wheel .....

Deduction: The rate is the number of times the light turns on in one second, that is, the number of dots per second once they are stabilized.

$$\frac{\text{Number of dots painted on the wheel} \times 10 \text{ turns}}{\text{The time it takes for the wheel to turn 10 times} \times 2}$$

(The factor "2" must be taken into account, because the fluorescent tube turns on twice each complete oscillation)

Homework:

1- Check each of the following light sources to see whether they have or not this stroboscopic effect:

. Street lamp:
. Incandescent light bulb:
. Linestra:
. Torch:
. Fluorescent tube
. Tungsten-Halogen lamp:
. Television display:
. Long life bulb

2- Explain why, sometimes, we can see on the television the effect of a wheel that turns as if it went on the reverse direction.

3- Explain why it is not recommended to play table tennis in precincts illuminated by fluorescent tubes.

4- Why, to avoid this problem, a serial condenser is connected to one of each pair of fluorescent tubes? (Question to be posed only after studying the chapter on electric current).

5- Try to discover whether all countries in the world have the same alternating current rate.

6- When you were making the experiment, it is also possible to see that, by changing the turning speed of the wheel, we can “stop” the dots by doubling the speed or reducing it to a half. How could you explain this phenomenon?

7- At the dance floors, what is the effect produced by the stroboscopic effect?