



The Luminosity of the Sun

Interactive Screen Experiment

Introduction

This experiment to measure the luminosity of the Sun uses simple equipment to construct a Bunsen oil spot photometer to compare the luminosity of the sun with that of a 150 W filament light bulb.

The ISE you will be using is a computer resource based on your interactions with a set of real images of the experiment in progress, rather than a computer generated simulation. The outcomes will therefore be a far closer representation of reality, enabling you to connect this exercise more closely to a real situation.

Getting started

The ISE is a stand-alone executable application on the computer, and requires no additional software (such as Internet Explorer etc.) to run. To activate the ISE, locate the resource named “luminosity_OER_1.exe” in the archive, extract it to your desktop and double-click it. The ISE will now run, but please wait until the title screen appears – this may take a short while, due to the large number of images the application needs to load.

Alternatively (and necessary for Mac users), launch the resource “luminosity_OER.swf” in the same way, in which case the resource will open in an internet browser window (you may need to install the relevant free Flash plugin, but your system will guide you in this operation). You will be presented with the title screen of the luminosity ISE, as shown in Figure 1

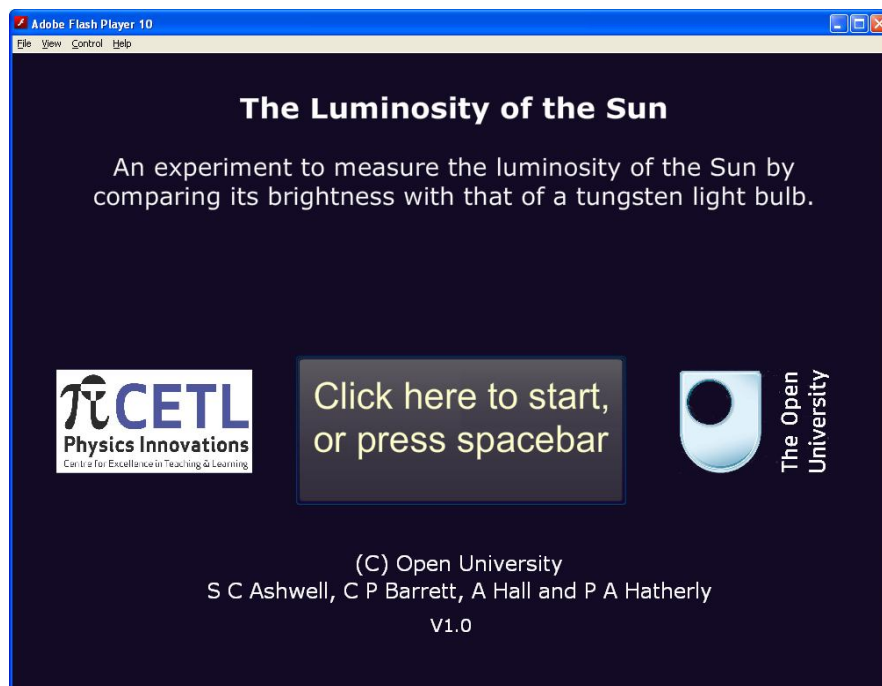


Figure 1. The Luminosity of the Sun ISE start-up screen

Clicking the button marked “Click Here to Start” will take you to the screen shown in Figure 2.

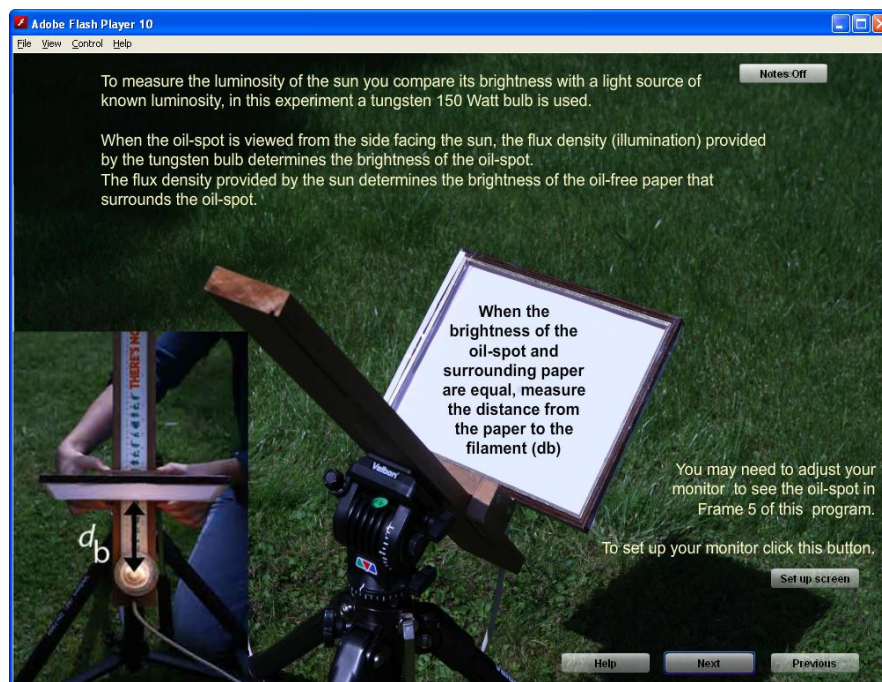


Figure 2. The initial screen of the Luminosity of the Sun ISE.

Setting up and understanding

The screen in Figure 2, and the following screen, provide background to the Bunsen oil spot photometer method and, since you will be assessing the similarity in illumination of a spot on the paper to the rest of the paper, a facility to set up your monitor is provided by clicking the “set up screen” button, which takes you to the screen in Figure 3. Simply follow the instructions here, and click “Finished” to return to the previous page.

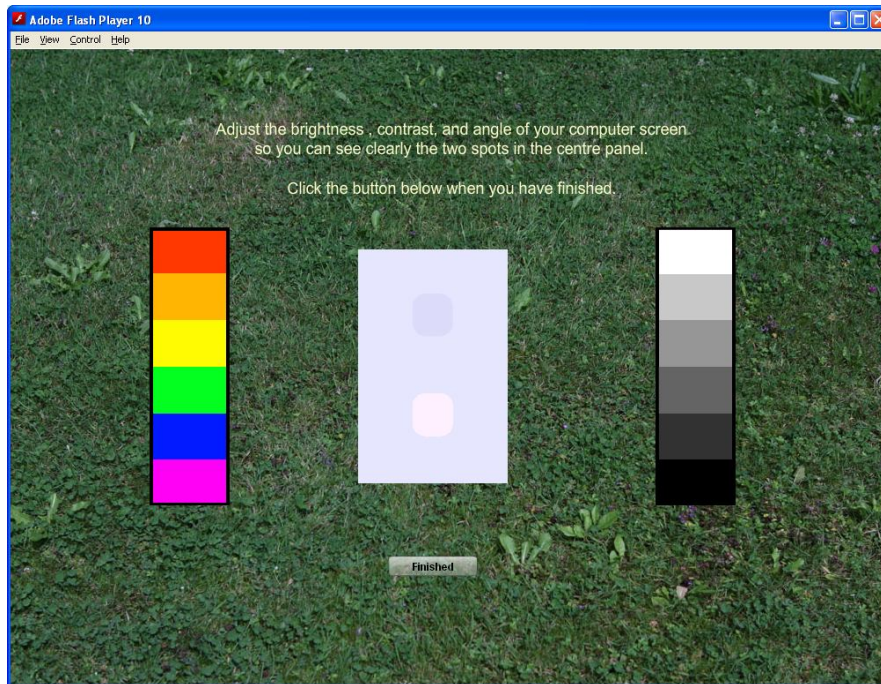


Figure 3. The screen set up page.

Now click on the “Next” button to proceed to the next instruction page, containing further information, before clicking “Next” again to reach the screen in Figure 4

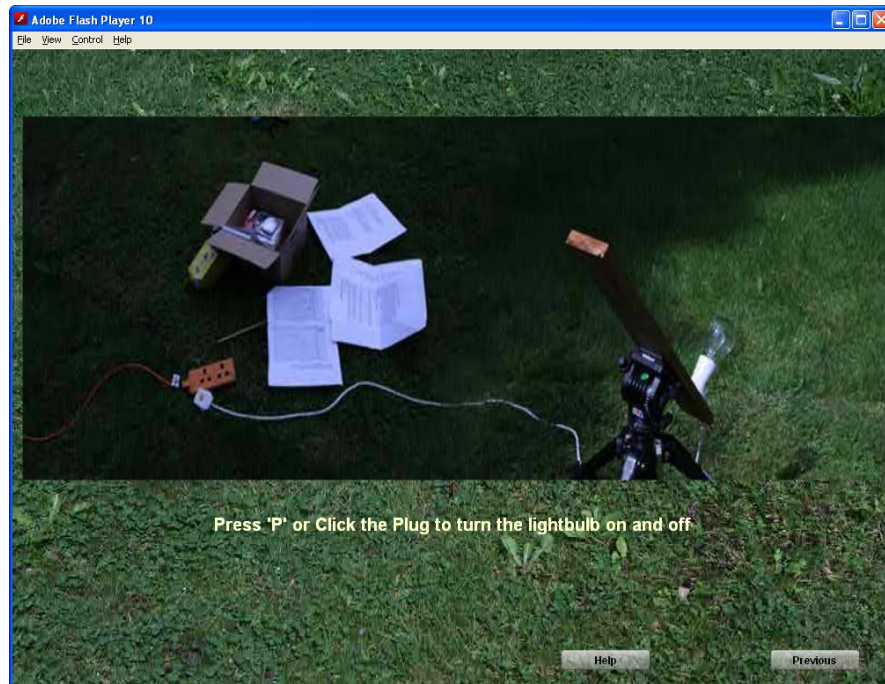


Figure 4. turning on the light bulb

To enable a “Next” button and thus proceed to the main experiment (Figure 5), either press “p”, or click on the plug to turn the light bulb on.

The main experiment screen (Figure 5) comprises two scenes of the paper and oil spot, and an overhead view of the experiment. Clicking on the paper screen on the overhead view and dragging it left or right changes the distance between the light bulb and the paper, as shown in the overhead view and the two scenes. On-screen instructions are given for alternative means of moving the paper, either using buttons or the keyboard.

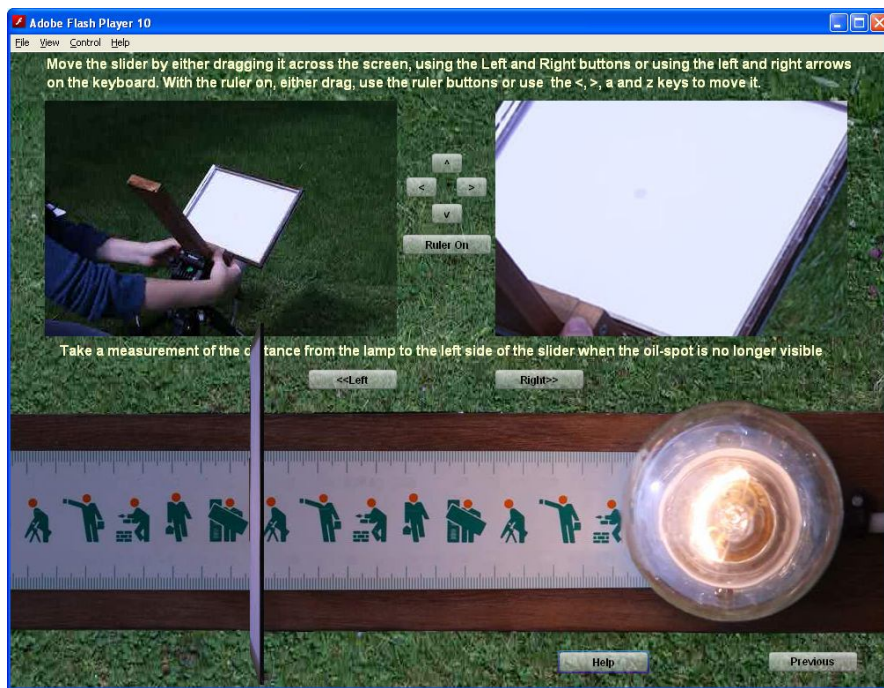


Figure 5. The main experiment screen

Once you have achieved a position of the paper where the oil spot is essentially not visible (it isn't perfect), the distance between the screen is measured by clicking on the "Ruler On" button, bringing up a draggable ruler as Figure 6 shows.

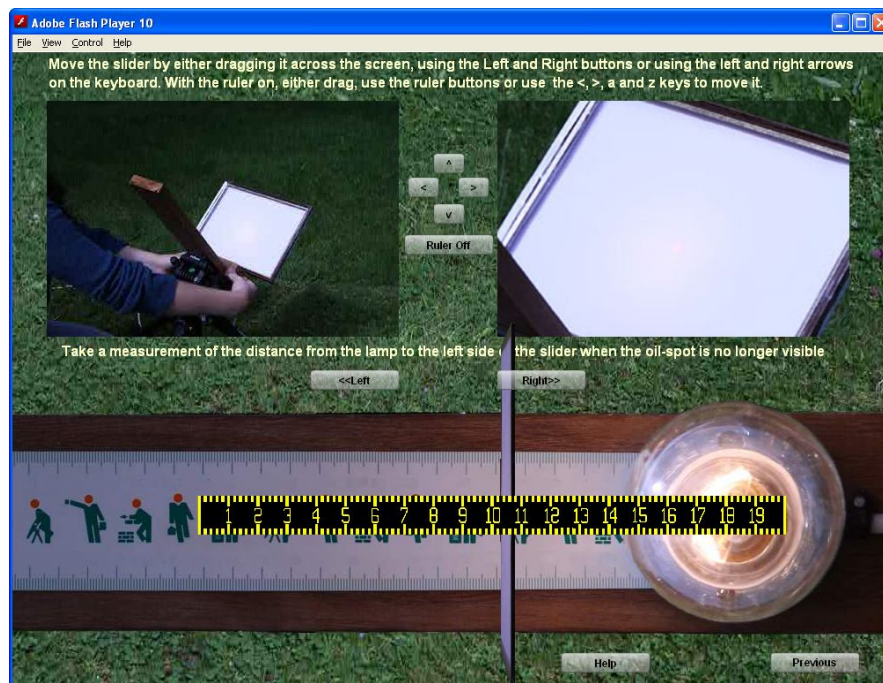


Figure 6. The main experiment screen with the ruler enabled.

The distance between the screen and the bulb is open to interpretation, and can be a matter for discussion.

The luminosity of the Sun can now be evaluated using a simple inverse square law, a knowledge of the distance to the Sun and given that the bulb has a total power output of 150 W.

Details of analysis of the data from this ISE are not given to allow third party activities to be produced, but some suggested activities using this ISE include:

- Determining the luminosity of the Sun, knowing the distance (or vice-versa)
- Investigating experimental uncertainties and their sources
- Investigating approximations (eg, to what extent does the bulb replicate a point source?)
- Investigating the effect of temperature on the visible intensity of an object (e.g. the bulb filament is substantially cooler than the surface of the Sun)
- Investigating reproducibility of experiments and perception in assessing the brightness of the oil spot.

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