



UNIT 1:

INNER PLANETS – OUTER PLANETS

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ACTIVITY 2

APPROACHING AND RECEDING FROM THE PLANET MARS. OPPOSITION.

OBJECTIVES

In the previous activity, we established an initial contact with the measurement tools of the image analysis software. In this practice we're going to reinforce the skills we acquired, by measuring the apparent size of an outer planet when approaching or moving away from it, trying to calculate the closest approaching date to Earth.

INSTRUMENTS AND MATERIAL

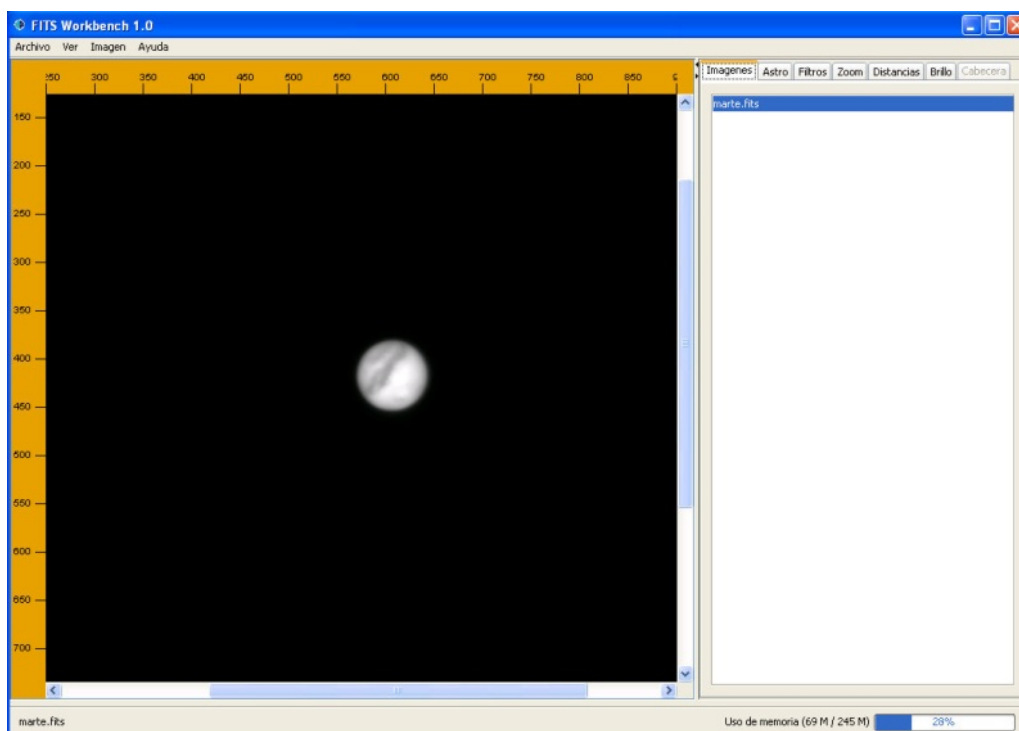
For this practice we are going to use a selection of images of Mars which have been taken over several months with the Liverpool Telescope at the Roque de los Muchachos Observatory (Canary Islands, Spain). These images are contained in the folder */Mars/* in our website www.iac.es/peter. For the image processing we will use the “peter_soft” program. The tool we will use the most is the one for measuring distances.

METHODOLOGY

Each astronomical image will be examined. Then we will measure the apparent size of the planet. We will obtain a data table that will be represented on graph in order to deduce the size variation during the months and we will try to calculate the date of closest approach to Mars.

PROCEDURE

The first thing to do is to download and unzip in our computer the file *U1_imagenes_Marte.zip*, which contains all the images we're going to study. Then we will open the “peter_soft” program and the image files.



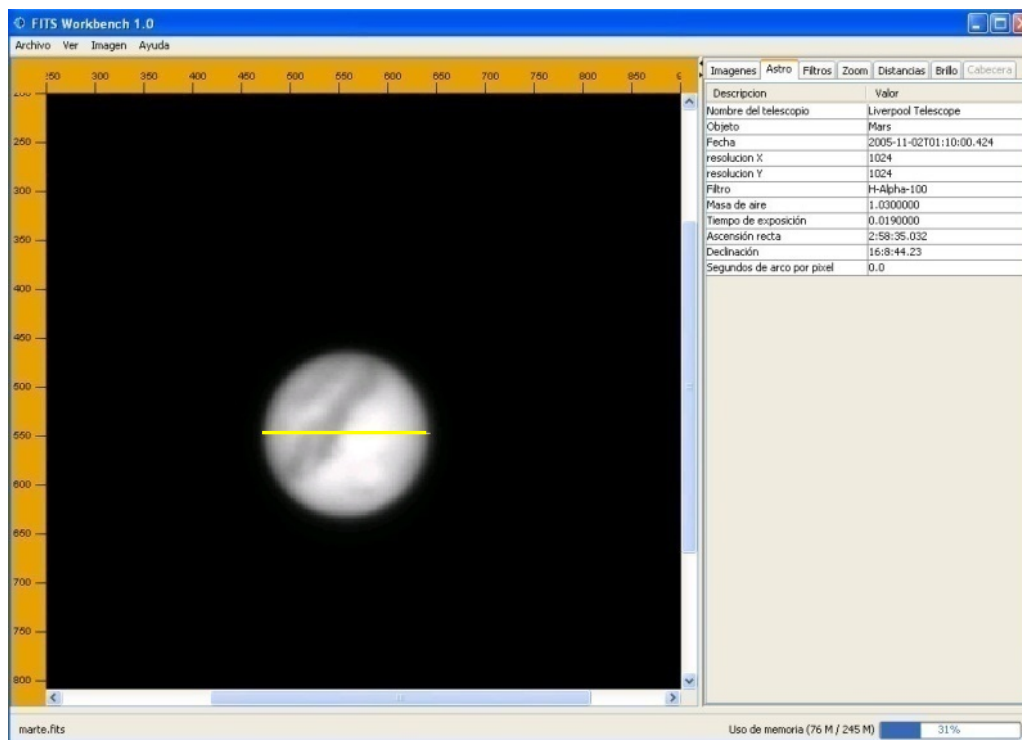
Once we have loaded the images in the program, you can obtain information of each of them by clicking the *Astro* tab: date and time at which the image was taken, exposure time in seconds, etc. This information is very important as it will help us to get the necessary data for the purpose of this practice.



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As we have done in the previous activity, we're going to use the zoom to increase the planet size. In this case it is very important to enlarge the image because, as you will see, the planet appears small, due to its remoteness.



We will also use the *DISTANCES* tab tool and we will measure the planet diameter from one end to the other. This measurement must be done from one pole to the other since Mars also has phases. The phases of Mars are not as marked as those of Venus. In opposition, Mars shows all its surface fully illuminated, while some months before and after opposition we have a slightly side-view of the planet (given its proximity) and, therefore, we see part of the surface that is not illuminated by the Sun, offering us a small phase similar to that of the Moon 3 days before and after Full Moon.

We want to see how the apparent size of the planet changes with its distance from Earth, and to determine the moment of the closest approach. So, we are going to obtain a data table with the date on which the image was taken, and the planet apparent size in arcsecs.



Image	Date	Size (pixels)	Size (arcsecs)
370j000			
383a000			
407g000			
430e000			
438c000			
445e000			
455i000			
470f000			
506g000			

In these images the *Astro* tab doesn't have the scale of arcsecs per pixel, which is needed for estimating the apparent angular size of Mars. The scale is the same as in the previous activity: 0.27837 arcsecs per pixel.

Finally, we will represent the data on a graph, so that we can check how the planet apparent size increases and decreases when approaching and moving away from us, respectively.

If you look at the images you will see that the planet surface is not always the same, as it is the Moon case. Since Mars has a rotational period higher than ours, over the days we can observe surface portions that cannot be seen on other images. Would you like to learn more things about Mars? We could also find out which Martian surface parts are observed in the images. To do this, you need to use a map of the planet's surface and we recommend using the images in which Mars looks bigger (it was closer), because you could better distinguish the details of its surface.



For further information, please visit our website: www.iac.es/peter

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