UNIT 4:

GAS GIANTS

Author: Oswaldo González

Content revision and updating: Nayra Rodríguez, Alejandra Goded

Scientific Advisor: Alfred Rosenberg

Artwork: Inés Bonet

ACTIVITY 2

INCLINATION OF SATURN'S RINGS

OBJECTIVES

This activity aims to determine how the inclination of Saturn's rings as seen from Earth varies over a 4-year period. We will also determine the size of this system and the location of the Cassini division.

INSTRUMENTATION AND EQUIPMENT

For the realization of this practice we will use a selection of images of Saturn obtained at different times over four years with the Liverpool Telescope of the Roque de los Muchachos Observatory, which are contained in the *SATURN* folder of our web site **www.iac.es/peter** . For their processing we will use the *PeterSoft* program, which can also be downloaded and installed. The tool we will use from this program is the distance measurement tool.

METHODOLOGY

We will examine each astronomical image and make measurements of the apparent size of the ring system. We will obtain a table of data and calculate the inclination at which the rings are observed each year.

PROCEDURE

1. Open the images

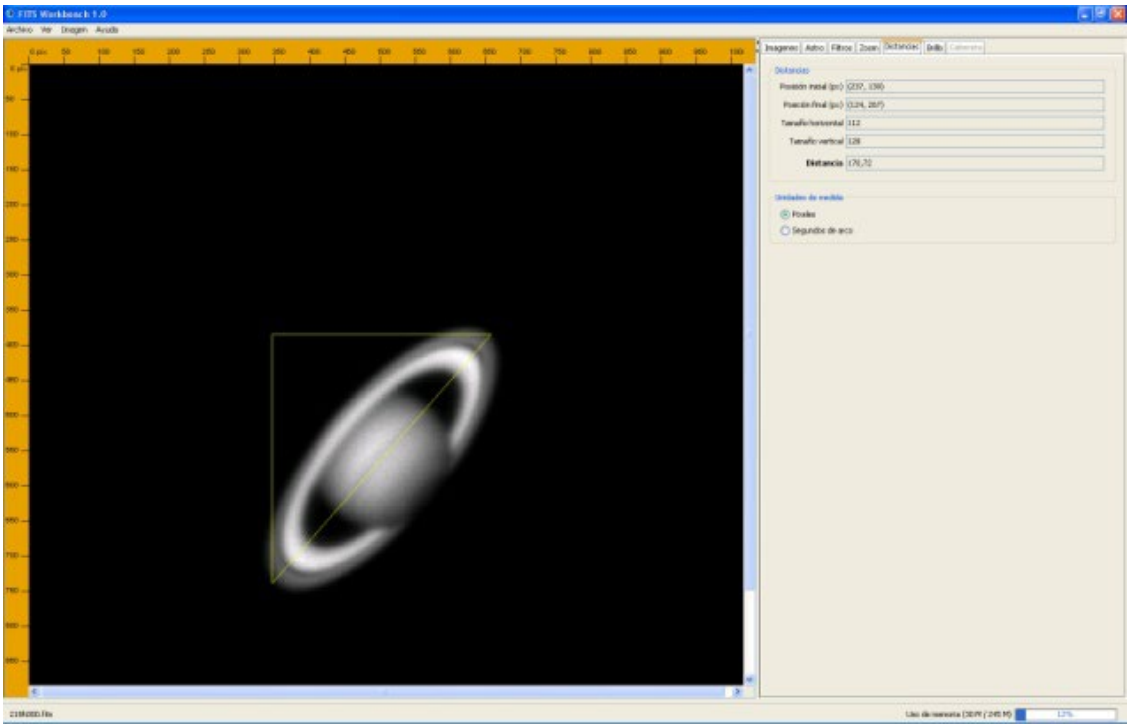
The first thing we have to do is to download and unzip the file *U2_imagenes_Saturno.zip*, which contains all the images that we are going to study in this activity. Afterwards, we will run the *PeterSoft* program and open the image files.

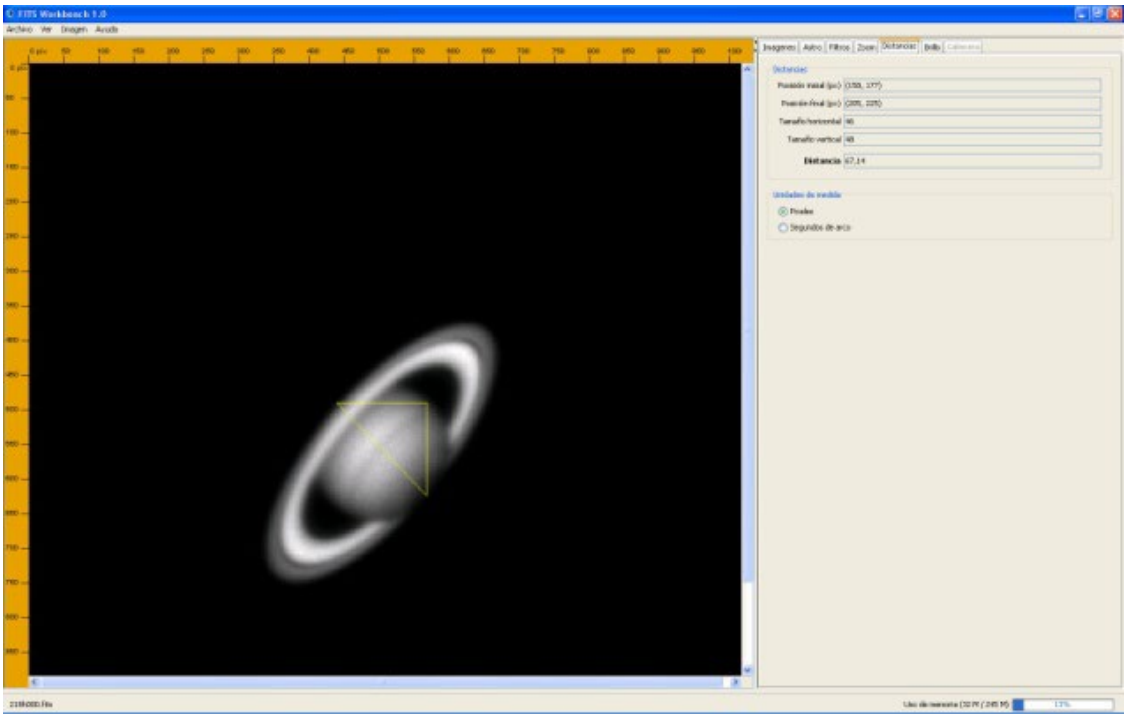
Once the images are loaded into the program, you can get information about each of them in the *ASTRO* tab: date and time the image was taken, filter used, exposure time in seconds, the scale used in arcseconds per pixel, etc.

We will proceed as in the previous activity, first we will zoom in to increase the size of the planet.

2. Measuring the diameter

As with Jupiter, we will use the measurement tool located in the *DISTANCIAS* tab and measure the diameter from one edge to the other in the equatorial direction and also in the polar direction. But this time we will cover only the ring system. Thus, in the equatorial direction we will measure the maximum length, but in the polar direction we will see that the size from our point of view changes depending on whether we are looking at the rings from the front, from the side or with a certain inclination.





We will do the same with the four images and fill in the following table.

Image	Date	Ecuatorial Diameter (Te)	Polar Diameter(Tp)	Tp / Te	arcsen(Tp/Te)
218h000					
503f000					
803b000					
1038d000					

3. Obtain the angle of inclination

What we want is to observe how the inclination of the rings as seen from the Earth changes as the years pass and the planet moves in its orbit around the Sun. To do this, we divide the polar size of the ring system by its equatorial size and calculate the tilt angle by applying the arcsine of that quotient. If you have not yet studied trigonometry, please ask your teacher to calculate it for you using a scientific calculator. The result will give us the inclination of the rings (in degrees) at that moment, as seen from the Earth.

At first glance you will have noticed that the rings have changed their tilt from one image to the other. Note also the dark area that divides the ring into two parts. This is the Cassini Division, do you feel up to measuring its size? And the width of the ring system?

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

Contact: **Nayra Rodríguez Eugenio, Alejandra Goded** (peter@iac.es)
Communication and Scientific Culture Unit
Instituto de Astrofísica de Canarias
Adress: Calle Vía Láctea, no number
38205 La Laguna
Santa Cruz de Tenerife
Spain

This didatic unit was funded by:

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

INSTITUTO DE ASTROFISICA DE CANARIAS IAC

LIVERPOOL JOHN MOORES UNIVERSITY