

Studying the Jovian System with small telescopes: An activity at Aula Espazío Gela UPV/EHU

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Abstract

We describe a learning activity performed at the Aula Espazio Gela UPV/EHU in which students of the Master of Space Science and Technology study the Jovian System and deduce some of its parameters using their own images.

1. Introduction

The Aula Espazío Gela at the Faculty of Engineering of the University of the Basque Country UPV/EHU is a facility dedicated to the teaching of Space Sciences at Master and Doctorate level, and to the promotion of space science and technology both in the public and private sectors [1]. It includes an urban observatory located at the roof of the university building, in the center of Bilbao that allows students to get familiar with hands-on astronomy from the very start of their master studies [2], and to develop experimental and technical master theses [3]. The observatory has a fundamental role in engaging students in astronomy, giving them the opportunity of measuring themselves some of the phenomena that they study in lectures. We describe here a series of observations that allow students to familiarize themselves with the Jupiter system, of particular interest in view of the Juno and JUICE missions.

2. Observing Jupiter and its main satellites

The Aula Espazío Gela observatory comprises a CDK 20" aperture telescope under a dome and a set of smaller mobile telescopes (Meade 14" and Celestron 11"), which allow both to perform simultaneous observations of the same phenomena and to travel to more favorable locations in terms of light pollution and seeing when needed. Diffraction limits the resolution of these small telescopes, but they can nevertheless resolve atmospheric features in the planet as well as the diameter of Galilean

satellites, and study occultation, transits of satellites and eclipses. Observations of satellite events are easily programmed with ephemerides sources such as "Jupiter's Moon's" in Sky & Telescope [4]. Images are typically captured in sequences of 1000/1500 frames and saved as .avi files. Students are encouraged to process the images themselves, using software to align and stack the videos to increase resolution and dynamic range, and process the final image to enhance details.

Here we show a set of experiments based on images taken with the available telescopes that illustrate the kind of phenomena students are encouraged to capture and study.

Simple properties that can be measured and deduced by the students are: Period of rotation of Jupiter; differential motions of Jupiter atmosphere and its equatorial jet (requiring observations over at least two nights); radius and period of the orbits of the satellites and deduction of their masses and that of Jupiter.

More advanced work allows them to perform spectrally calibrated photometric studies and deduce properties of the Jovian atmosphere and its clouds [3].

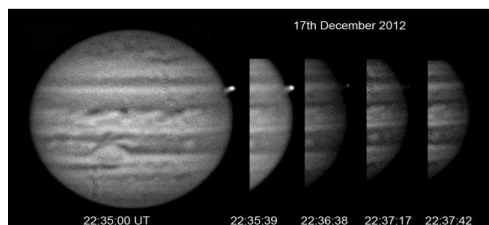


Figure 1: Io occultation, captured with a Schmidt-Cassegrain Telescope (Celestron CGE PRO 1100 HD, aperture 11" 28cm f/10).

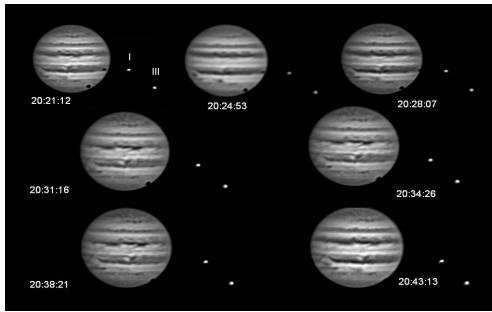


Figure 2: A sequence of images captured on the 3rd of January 2013 at different UT times, showing the motion of Io and Ganymede and that of their shadows on the planet disk (Celestron CGE PRO 1100 HD, aperture 11" 28cm f/10).

This activity, that involves planning and obtaining the observations, links knowledge from different subjects in the master, from technical subjects such as image processing to physical such as orbital dynamics or practical astronomy. The study of the Jovian system is particularly relevant in view of the ongoing NASA Juno mission and future planned ESA JUICE mission.

More information about the Master and the observatory is available at the Aula Espazio Gela website:

<http://www.ehu.es/aula-espazio/presentacion.html>

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