

What is the orbital period of Europa?

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**Summary:**

What are the orbital periods of Jupiter's moons? This was my initial question of the beginning of my observation project. My plan was to observe Jupiter and its Galilean moons every clear night through 20 power binoculars and document my work with pictures on a digital camera. I made two observations using this technique and then found that digital photography did not successfully capture the image for documentation. I reverted to pencil and paper.

My next observations were made with my new recording process on 1/28 and on 1/30. These observations showed the Galilean moons to be moving much faster than I had previously anticipated, to making one full orbit in less than 24 hours. After this, I took three more observations, but all quite a few days apart. Because of the amount of time between these observations, they were inconclusive.

I then revised my technique, taking consecutive observations of only one of the moons, Europa, in the same morning. Doing this gave me a conclusive picture of the movements of Europa. I made these consecutive observations three days in a row, with a total of 8 observations. Doing this, I found that Europa's orbital period is approximately three and a half days.

**Method:**

My method of observation consisted of waking up around 5 am, taking the 20 power binoculars outside, locating Jupiter and locating the positions of its moons. Later, I just noted the position of Europa. I recorded this in an observation log sheet. After taking these observations I would go to Skytonight.com and check that my observation of the day was accurate. If my data did not match that which was on the website, I would go back outside and immediately take another observation. I would then check this secondary observation.

**Equipment:**

- Cannon Digital Camera
- 20 power by 80 mm binoculars
- Computer with internet access

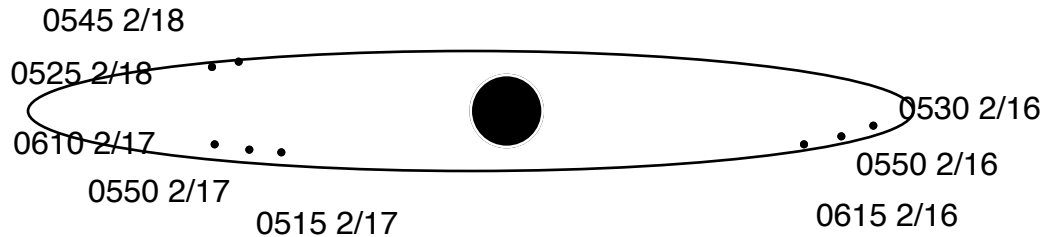
**Discussion:**

At the end of my observing period, I had five inconclusive and disorganized observations; two that began to touch on usefulness, and finally, 8 that showed clear movements of Europa. When I began my observations, I believed that taking a picture would be the most successful and accurate way to document my data. But, it did not work out that way. I overcame this by simplifying my recording method. Once I had reliable documentation, all I had to do was get out there. I did that, but without a particular plan, except for clear early mornings. This proved to be problematic, because without purposeful, directed observations, my data was useless. This was when I formulated my plan for the consecutive morning observations. Doing this, and changing my objective from all the Galilean moons to Europa only, gave me a clearer picture of Europa's orbit.

Looking at the data figure, I can clearly see the distance traveled by Europa in 24 hours. There are three spaces of 24 hours on my final data sheet then one approximately half this distance

again before Europa reaches its starting point. This data solidify's my conclusion that the orbital period of Europa is three and a half days long.

Below is my final data sheet (it combines the observations of three consecutive mornings):



### **What I learned:**

I learned that doing the work really didn't matter unless I had a clear plan with attainable goals. I made my 8 successful observations in only 3 mornings by putting into practice these important lessons.

- Determination
- Just doing it
- Focus
- Organization

I became much better at these aspects of work during my observation project.

### **Follow-up questions:**

- How would one determine the exact measurements of an elliptical orbit?
- Why are most/all orbits elliptical?
- Why does Jupiter have four moons?
- If earth had more than one moon would our orbit be different?
- How would one observe Jupiter and its moons after sunrise?