The Mass of Jupiter

Objectives:

Students will identify the moons of Jupiter in astronomical images and estimate the orbital period of one or more of the moons. Students will then use that information to estimate the mass of Jupiter.

Checklist:

☐ Complete the pre-lab quiz with your team (if required).
☐ Compile a list of resources you expect to use in the lab.
☐ Work with your team to complete the lab exercises and activities.
☐ Record your results and mark which resources you used.
☐ Share and discuss your results with the rest of the class.
☐ Determine if your team’s answers are reasonable.
☐ Submit an observation request for next week (if required).

Resources:
Pre-Lab Quiz

Record your group's answers to each question, along with your reasoning. These concepts will be relevant later in this lab exercise.

1. 

2. 

3. 

4. 

5. 
Part 1: Identifying the Galilean Moons

1. Determine the time span covered by your images.

<table>
<thead>
<tr>
<th>Start Date</th>
<th>End Date</th>
<th>Total # Images</th>
<th>Avg. # Images / Day</th>
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2. Pick an image in which you can see all four moons and identify each of them. Make a sketch of the image below and label Jupiter and the four Galilean moons.

Image Date/Time:

3. Find the orbital period of one of Jupiter’s moons using your images.

<table>
<thead>
<tr>
<th>Moon Name:</th>
<th>Period (days):</th>
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Part 2: Applying Kepler’s Laws

1. Determine the distance from Earth to Jupiter at the time of your images. Write down any assumptions or approximations inherent in your answer.

2. Measure the semi-major axis for the orbit around Jupiter of the moon whose period you found in the previous section. Explain how you determined this and record your results below.

|--------------------------|-------------------------------|--------------------------|

3. Look up the mass in kilograms of the moon you are studying and of Jupiter. Enter the values below in scientific notation.

|--------------------|-----------------------|-----------------------------|
4. Calculate the mass of Jupiter using Kepler’s Third Law. Show your work.

Mass of Jupiter (kg): ____________________________

Mass of Jupiter (Earth masses): ____________________________

5. How accurate is your result – are you within 10 times of Jupiter’s actual mass? 100 times? How could you change your method to improve your accuracy?