

## Orbits of the Planets - Exercise

Student Name: \_\_\_\_\_

### Step 1.

- A. Start Stellarium. It should be in the default configuration you setup in the Using Stellarium exercise. You should be viewing to your South and set the program to full screen.
- B. Bring up the Location Window and set it to your default location.
- C. Bring up the Date/Time Window and set the time for 10:00:00 Local Time on 2010/4/1. Move the Date/Time Window to the upper right corner and leave it open.
- D. Set you view to the South with a FOV of at least 100°.
- E. Turn off the Landscape and the Atmosphere and the Equatorial grid.
- F. Open the Search window and select and center the Sun.
- G. Open the Sky and viewing options window, and un-check the stars and DSO's in the "Labels and Markers" section and make sure the box for planets **is** checked.

### Step 2.

- H. From the date/time you just set, look for the next maximum elongation for Mercury.
- I. Watch Mercury's distance from the Sun, while increasing the date in one day increments.
- J. When you get close, move the days back and forth to make your best estimate at the date of the elongation.
- K. Determine if the elongation is East or West, then record the date in Table 1, below, on the correct row for either East or West.
- L. Now use the Angle measure tool (Angle Measure tool button on the Bottom Tool Bar) to get the angular separation from the Sun to Mercury, then record the degrees and Minutes of the angle on the appropriate row.
  - Left button-drag the mouse arrow from the center of one object to a second object to get the angle value.
- M. Continue to move the days forward until you get to the next elongation for Mercury, on the other side of the Sun.

- N. Repeat sub-steps J and K above for this date/time and angle and record your data in Table 1.
- O. Now reset the date/time to 2010/4/1, 10:00:00 and repeat sub steps H through N. This time observe Venus and vary the date in months instead of days, once you get the month, refine the date by changing the days.
- P. Turn off the Angle Measure tool.

### **Step 3.**

- Q. Reset the date/time to 2010/1/1, 10:00:00.
- R. Open the Location window and select the drop down box for "Planet:" and scroll the list until you can select "Solar System Observer". Close the Location Window and open the Sky and Viewing options window. Check the box for "Show planet orbits".
- S. If the Sun is not selected, use the Search window to select and center the Sun. Now set the FOV until you can see Mars; and its orbit just fills the screen from top to bottom (about 4°).
- T. Now advance the time in one day increments until you see at least one of the planets (Mercury, Venus or Mars) line up directly with an imaginary line through the Earth and Sun.
- U. Determine which type of conjunction or opposition is observed for any planets in alignment (Mercury, Venus and/or Mars). Record the date for that planet in the correct row corresponding to its current type of alignment.
- V. Continue until you have filled out all of Table 2 for Mercury, Venus and Mars.
- W. Reset the date/time to 2010/1/1, 10:00:00.
- X. With the Sun still selected and centered, zoom out until the orbit of Jupiter just fits in the screen from top to bottom (about 13°).
- Y. Now advance the time in one month increments until Jupiter is close to aligning directly with an imaginary line through the Earth and Sun. You may need to move the days back and forth to get a good approximation of the dates of alignment.
- Z. Determine which type of conjunction or opposition is observed for Jupiter and record the date in the correct row corresponding to its current type of alignment.

<b>Step 4.</b>
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AA. Using the data in Table 1, answer the following:

- **Question 1:** Which planet appears to have the most elliptical (non-circular) orbit? \_\_\_\_\_
- **Question 2:** Why did you pick that planet?

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BB. Using the data in Table 2, and the fact that the Synodic period of an inferior planet is the time from one phase to the recurrence of that same phase, answer the following:

- **Question 3:** Estimate the Synodic period of Mercury.

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- **Question 4:** Estimate the Synodic period of Venus.

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### Elongations

<b>Mercury</b>	<b>Year</b>	<b>Month</b>	<b>Day</b>	<b>Sep. Deg.</b>	<b>Sep. Min.</b>
Max. Eastern Elongation					
Max. Western Elongation					
<b>Venus</b>	<b>Year</b>	<b>Month</b>	<b>Day</b>	<b>Sep. Deg.</b>	<b>Sep. Min.</b>
Max. Eastern Elongation					
Max. Western Elongation					

Table 1.

### Conjunctions and Oppositions

<b>Mercury</b>	<b>Year</b>	<b>Month</b>	<b>Day</b>
Inferior Conjunction			
Superior Conjunction			
<b>Venus</b>	<b>Year</b>	<b>Month</b>	<b>Day</b>
Inferior Conjunction			
Superior Conjunction			
<b>Mars</b>	<b>Year</b>	<b>Month</b>	<b>Day</b>
Conjunction			
Opposition			
<b>Jupiter</b>	<b>Year</b>	<b>Month</b>	<b>Day</b>
Conjunction			
Opposition			

Table 2.