Tracking a Planet
Materials: Star maps for this semester, pencil.

You will be tracking a planet and recording its motion over the semester. Check the syllabus to find out which planets can be seen this semester and at what time you should observe.

To get full credit for this project, you MUST bring some observations to one of the instructor meetings. It is NOT enough to turn them all in at the end. Your observations are the maps with the planet plotted on them and date and time labeled.

This project requires at least 10 observations spread over at least 5 weeks for full credit. No two observations can be on the same night.

All the planets move among the stars, but only Mars and Venus, both move fast enough and are easy enough to find for you to get results in one semester. **You should be able to notice the motion compared to the stars over days to weeks (depending on the planet and the year). They will not seem to move compared to the stars over the course of one night. The entire sky nightly (stars and planets and the Moon) move compared to the horizon due to the Earth's rotation.**

The planets look much like stars when seen with your naked eye. They were first distinguished from stars because they move among the stars of the constellations. So the Greeks called them planets, or wanderers. Ancient people didn't think of them as other solid bodies with sizes comparable to the Earth, as we do today.

Weather matters. At DVC it is reliably clear and dry in the first part of fall semester and the last part of spring semester. I take this into account when assessing your progress. It does mean that you cannot procrastinate during fall semester and you should start early and expect to fight with the weather in the spring semester. I do expect that there is enough good weather each semester that you can do this exercise.

Your observations do not need to be at exactly the same time every night. But it does help to be at about the same time, otherwise you will find it very disorienting because the sky changes so much. Also try to observe about twice a week, so the planet does move too far between your observations.

1) Check on lab information page to find out which planets are visible, and when they can be seen. There will be a star map for each of the planets you can observe. Be sure to use this semester's map for whichever planet you are doing. The maps for the two planets are not the same. Use the one for the proper planet. If both Mars and Venus are visible, it is entirely your choice which to do. Venus is generally brighter and easier to see.

Depending on the semester, the planets may be visible only in the early evening, only before dawn or most of the night. If the times are not compatible with your schedule, choose another project.

2) Make lots of copies of the star map for your planet. You may want to enlarge the map. You should use one for EACH observation and one for the summary

3) Find your planet and some nearby stars. Some of the star maps have stars identified to help you know what to look for.

To recognize the planets, it helps to know that Venus is very bright. It sometimes looks like an airplane. Mars is about as bright as a bright star, but not usually outstanding. It has a slightly red cast. Check on this semester's star map lab for information on how to find the planet. If you

cannot find the planet, try coming to the observing night (for planets available in the evening) or talk to the instructor. Don't procrastinate.

4) Each time you observe the planet, record its position on the star map along with the date and the time you observed. Use a separate sheet for EACH night.

5) After you have plotted several weeks of data. Also plot all the planet positions on ONE star map. Ultimately, plot ALL the positions on the single summary map.

6) Connect the positions of your planet on the map. This is the one time that you should connect the dots (and not make a smooth curve). Using the scale of degrees on your star map and a string, how many degrees did the planet move over the time you observed?
(1 hour, labeled hr, is 15degrees)

7) Based on your observations, how long would it have taken you to figure out that this body was a planet, not a fixed star? Explain your reasoning.

8) Did the planet move only east among the stars? Or did it move retrograde, that is "westward" part of the time? On the map, eastward is toward your left, toward higher numbers of hours.

9) Did the stars appear at the same altitude (angle above the horizon) and azimuth (angle around from north on the horizon) each time you observed? How do they change?

The following are extra credit.
10) All the planets in our solar system move near a line called the ecliptic. You have an all sky map (allskyeclipticmap). Once you have made all your observations and have them plotted on your map for this semester, ALSO plot them on the allskyecliptic map. Based on your observations, how long would you estimate that it will take the planet to go all the way around the sky along the ecliptic? (hint below).

Your planet positions should lie near the ecliptic and your observations should show motion of the planet near the ecliptic. Measure the distance that your planet has moved and measure the entire length of the ecliptic Use a tape measure held on its edge or use a piece of string and then measure the string with a ruler. Be very careful to make accurate measurements. Then make the ratio

$$\frac{\textbf{Length of Ecliptic}}{\textbf{Distance your planet moved}} = \frac{\textbf{Time to move all the way around the ecliptic}}{\textbf{Time between your first and last observation}}$$

You know all but the "Time to move all the way around the ecliptic". So substitute your values for the other quantities and solve for the time to move all the way around the ecliptic.

Time to move all the way around the ecliptic (be sure to tell the units):

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11) Is the time that you computed for the planet to move all the way around the ecliptic the same as the sidereal period of the orbit of your planet that you can look up?

Is it the same as the synodic period?

If your value is not the same as these periods, there are several things that might be going on. As you have probably noticed, the sidereal and the synodic periods in your book are not the same value and do not have the same meaning.

What is the difference in the definitions of the sidereal and the synodic periods of a planet? (You may want to write down the definitions and THEN explain why they are different.)

If your answer for the time to move around the ecliptic were perfect, would it be a measure of the sidereal period or the synodic period? Why

12. What are some reasons that your value would be different from the value you find in books? (hint, NOT all this is something you did wrong)