

Physics 10293 Lab #5:

Starry Night – Student Exercises II

Introduction

We will continue today exploring some of the useful applications of the Starry Night software to learn about motions in the sky.

Step A10

Start by opening the Skyguide tab on the sidebar, then select the top option, "Student Exercises".

Select "A: Earth, Moon and Sun". This will open a list of exercises, and we will work through the last four.

Open **Exercise A10: The Moon** and work your way through the three exercises contained in this section, answering the corresponding questions below.

Within this exercise, select Part 1: The Moon's Rotation. This exercise will ask you to determine the length of a sidereal day on the Moon, and we will also determine the length of a solar day. Just as a sidereal day is the amount of time it takes for a star to return to the meridian, the solar day is the amount of time it takes for the sun to return to the meridian once it leaves the meridian. The answers below will each be among the four choices offered in the exercise.

The length of the sidereal day on the Moon is _____ days

The length of the solar day on the Moon is _____ days

The sidereal day on the Moon is the true measure of the Moon's rotation period, relative to a distant, non-moving reference frame (the stars). The solar day is the time it takes for the Moon to complete a cycle of phases as seen from Earth.

Now proceed to Part 2: The Moon's revolution.

How long does it take the Moon to complete one orbit around the Earth? _____ days

From Part 3: The Moon's libration: You can measure the distance from the observer to the Moon by simply hovering the cursor over the Moon. This information will be displayed on the screen to the left along with other data.

When the Moon has its smallest angular size, what is its distance from the Earth, to the nearest thousand kilometers?

When the Moon has its largest angular size, what is its distance from the Earth, to the nearest thousand kilometers?

The percentage difference in the Moon's orbital distance from Earth can be found with $100 * (\text{biggest} - \text{smallest}) / \text{smallest}$ _____ %

Step A11

Open **Exercise A11: Phases of the Moon**, and work your way through the ten exercises, answering below:

From Part 1: Synodic Month:

What is the length of the synodic month? _____ days

From Part 2: New Moon:

What time of day does the new moon rise? _____

From Part 8: Last Quarter:

What time of day does the 3rd qtr moon rise? _____

From Part 10: Phases are caused by the Moon's orbital motion:

At the beginning of the simulation, on Nov 16, 2005, what is the phase of the Moon? _____

What is the phase on Nov 23, 2005? _____

What is the phase on Nov 30, 2005? _____

What is the phase on Dec 7, 2005? _____

Step A12

Open **Exercise A12: Lunar and Solar Eclipses** and work your way through the eight exercises, answering below:

From Part 1: Line of nodes:

Which is the correct answer for Question 1, why is an eclipse not possible at this time?

From Part 2: Eclipses and the phase of the Moon:

What is the phase during solar eclipse? _____

What is the phase during lunar eclipse? _____

From Part 3: Lunar Eclipses

How long (in minutes) does the total lunar eclipse last (the time during which the Moon is completely inside the umbra)? _____

According to the animation showing the a view from the Sun, looking past Earth as the Moon passes through Earth's shadow, which continent is unable to witness the lunar eclipse? _____

From Part 4: Partial lunar eclipses

Briefly explain the difference between a total and partial lunar eclipse.

From Part 5: Solar eclipses

What is the date of the eclipse? _____

After viewing the eclipse from Shanghai, China, was the solar eclipse annular or total? _____

Now watch the shadow of the Moon cross the Earth from a distance (the last "click here"). What body of water is the moon's shadow over when the eclipse ends and the moon's shadow no longer touches the Earth? _____

From Part 7: Solar eclipse seen from the Sun

The inner circle is the umbra of the moon's shadow. Anyone in the path of this dark spot will see a total eclipse. The outer circle is the penumbra, within which observers will only see a partial solar eclipse.

Does Rome see a total eclipse? _____

The Saros cycle is an approximate 18 year period between similar alignments of the Sun, Earth and Moon. The exact length of the cycle is 6585.3 days. The next eclipse of this particular Saros cycle will begin on April 8, 2024 at 17:00 UT. UT stands for Universal Time, which is usually the same as the time on the Prime Meridian in Greenwich, England.

Set the date and time accordingly. To the nearest hour, what time will this total eclipse begin at TCU? _____ UT

Our local time is UT - 5 hours when we are on Daylight Savings Time, so the time of eclipse start will be 5 hours earlier, roughly, from the time you estimated here.

From Part 8: Annular Eclipse

What is the distance from the observer to the Moon during this eclipse? _____ km

Based on your answers in the first section of this lab (Part A10, section 3), is the moon near its furthest distance from the Earth (apogee) or its closest distance to the Earth (perigee)? _____

Step A13

Open **Exercise A13: Precession and Nutation** and work your way through the five exercises, answering below:

From Part 1: Precession of the Earth's spin axis

What is the precession period of Earth's spin axis (you may wish to increase the time flow rate for this)? _____ yrs

What is the angular size of the precession circle? _____°

How does the size of the precession circle compare to the Earth's tilt?

From Part 2: Shifting Celestial Pole

In approximately what year will Vega be the "North Star"? _____

In approximately what year in the most recent past was Thuban the "North Star"? _____

From Part 3: Precession of the Equinoxes

In what constellation was the Vernal Equinox found during the year 200 BC? _____

In approximately what year will the Vernal equinox cross into the constellation Aquarius? _____

From Part 4: Nutation and Part 5: Nutation Period:

If you zoom in, you can see the sinusoidal wobbling motion of the stars as they move past the North Celestial Pole. Watch these wobbles for a bit and then use the buttons to start and stop time so that you can estimate how many years it takes for the axis to make one of these small nutation wobbles.

Nutation wobble period: _____ years

You can also do this exercise in part 5 if you are having trouble (note the dots are separated by 2 years, not 1 year as the exercise states).

Essay

Look back through each part of this lab and pick the one that (a) was most interesting to you and then pick the part that was (b) most helpful in your understanding of a concept you didn't previously understand. Briefly justify each choice with a sentence or two of explanation.