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Topics for this week

Describe the apparent motions of stars across the sky during a night as seen from various locations on Earth Describe and explain the apparent motion of the Sun relative to the stars during a year Explain how the tilt of the Earth's axis causes the seasons Describe how the path of the Sun across the sky during a day differs during different seasons Describe and explain the phases of the Moon and the motion of the Moon relative to the stars during a month Explain how eclipses occur

Assignment for next week

Read Chapter 3.

The quiz next Wednesday will include one question on chapter 2 and one on chapter 3.

The homework due next Friday includes your observations of Venus, Mars, and Spica. If you haven't seen them yet, get started quickly. You have to observe them several times separated by several days to see how they move. The Moon: Phases, Eclipses, etc.

Most questions about the appearance of the Moon can be answered by drawing the right drawing:

- The Moon orbits around the Earth in the same direction as the Earth rotates. The Sun lights up the side of the Moon (and Earth) that faces the Sun.
- Eclipses (but not phases!) are caused by shadows of the Earth and Moon on each other.

Typical questions:

- What time does the Moon rise and set in each of its phases?
- What phase is the Moon in just before a solar eclipse?
- What phase is the Moon in just before a lunar eclipse?



A week or so ago the Moon was full.

At what time of day was it overhead?

Draw yourself standing on the Earth with the full Moon overhead, and ask what time of day it is.

At what time of day did it rise?

- Draw yourself on the Earth where you first see the Moon, and ask what time of day it is.
- We'll watch the Moon next month to check our predictions.



Quiz

Wednesday night the Moon was in the 3rd quarter phase.

- At what time did it rise?
- Hint: Draw the picture, remembering that everything moves counter-clockwise.
- A. around sunrise
- B. around noon
- C. around sunset
- D. around midnight

Quiz

Wednesday night the Moon was in the 3rd quarter phase. About when did it set?

A. sunrise

- B. noon (12 hours after it rose)
- C. sunset

D. Midnight

What will its phase be next Wednesday?

- A. new
- B. 1st quarter
- C.full
- D. 3rd quarter

Eclipses

Lunar eclipses (when the Moon disappears, or at least gets darker) occur when the shadow of the Earth falls on the Moon.

Solar eclipses (when the Sun is hidden) occur when the Moon passes in front of the Sun, blocking our view. In that case, the shadow of the Moon falls on us.

What is the phase of the Moon just before a lunar eclipse? A. new

- B. full
- C. 1st quarter
- D. 3rd quarter



Eclipses and the ecliptic

Why isn't there a lunar eclipse every full Moon?

- The reason is that the orbit of the Moon isn't exactly in the same plane as the orbit of the Earth (the ecliptic).
- Usually the Moon passes above or below the Earth's shadow.
- There are only 1 or 2 lunar eclipses each year.
- And we only see an eclipse if we are on the side of the Earth facing the Moon (i.e. the Moon is up).



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Eclipses and the ecliptic

Why isn't there a solar eclipse every new Moon?

It's almost the same reason.

Usually the Moon's shadow passes above or below the Earth.

Also, the Moon's shadow is very small when it hits the Earth, and only those people in the shadow see a solar eclipse.



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Did I tell you?

- The Earth's rotation on its axis takes one day.
- The Moon's orbital motion takes one month.
- The Earth's orbital motion takes one year.
- This means that motions during a night are almost entirely due to the Earth's rotation all objects in the sky move together, east to west.
- When we talk about the motion of the Moon and planets we will talk about how they move relative to the stars on the celestial sphere. That tells us whether they move across the sky slightly faster or slower than the stars. They still move east to west during a night.

Motions of the planets

- During a night (or day) the planets appear to move across the sky along with the stars, due to the rotation of the Earth.
- But from night to night the planets slowly move relative to the stars.
- Usually, they move west to east relative to the stars.
- That is, they move east to west across the sky slightly slower than the stars do.
- This is called prograde motion.
- Occasionally, they reverse their motion, moving east to west relative to the stars.
- This is called retrograde motion.



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The Greek and Arabic models

- Aristotle, and later Ptolemy, explained the motions of the planets with a system of spheres around the Earth, with the planets on smaller spheres rotating on the bigger spheres.
- They assumed that when the planets appeared to reverse their direction of motion they actually did.

