Wednesday, Sep. 10

Syllabus, class notes, and homeworks are at:
www.as.utexas.edu → courses → AST 301, Lacy

Reading for this week: chapter 4 (quiz today)

The homework handed out last Friday is due Friday of next week. It requires observations of the Moon and planets.

We will take last week's homework this week. Bring it up after class.

The Wednesday help session has been moved to GRG 424 at 5:00 (for the entire semester).

Note the new time and place.

Did I tell you?

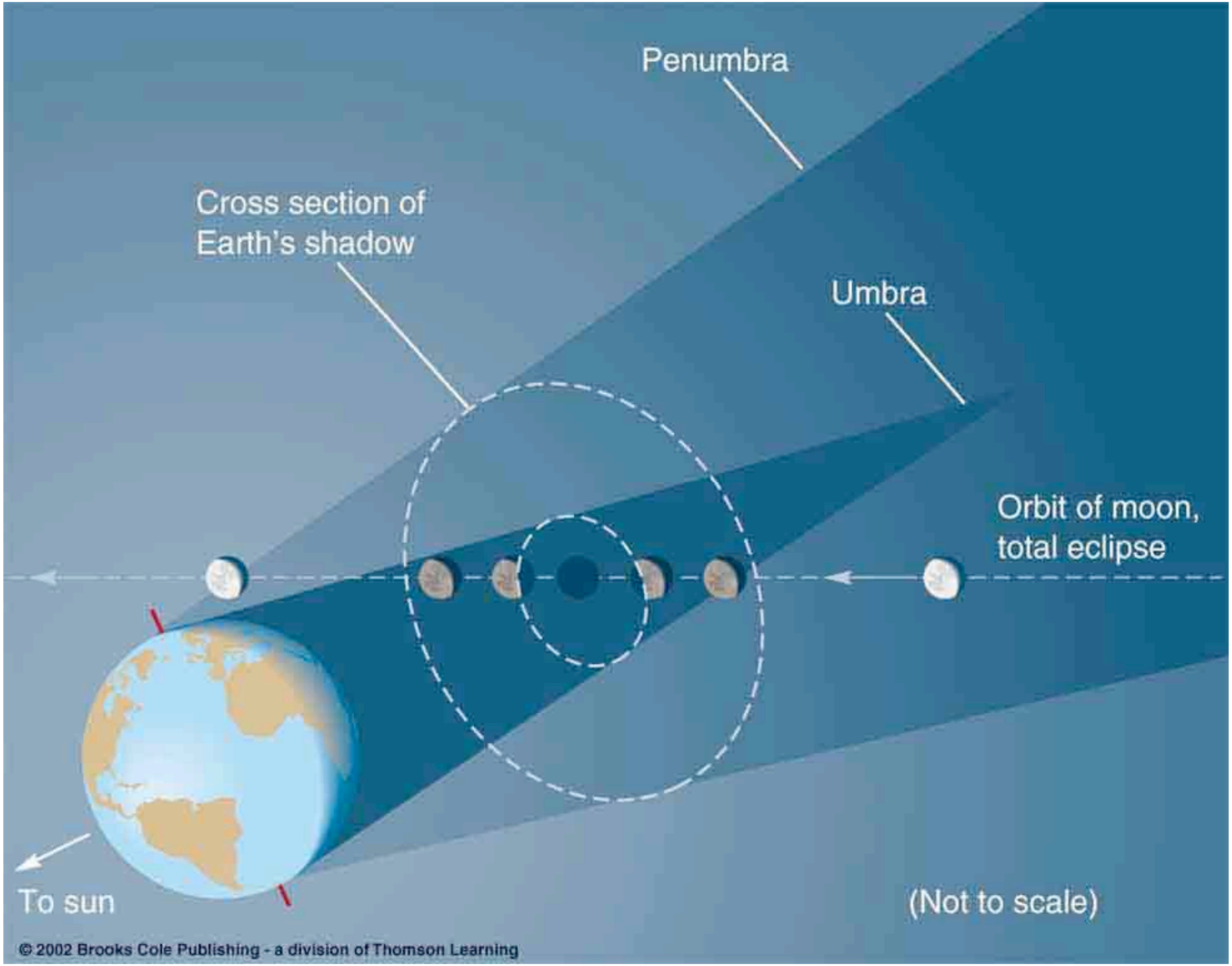
The Earth's rotation on its axis takes one day.

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.


Penumbra
Cross section of
Earth's shadow
Umbra
Orbit of moon,
total eclipse
To sun
(Not to scale)
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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

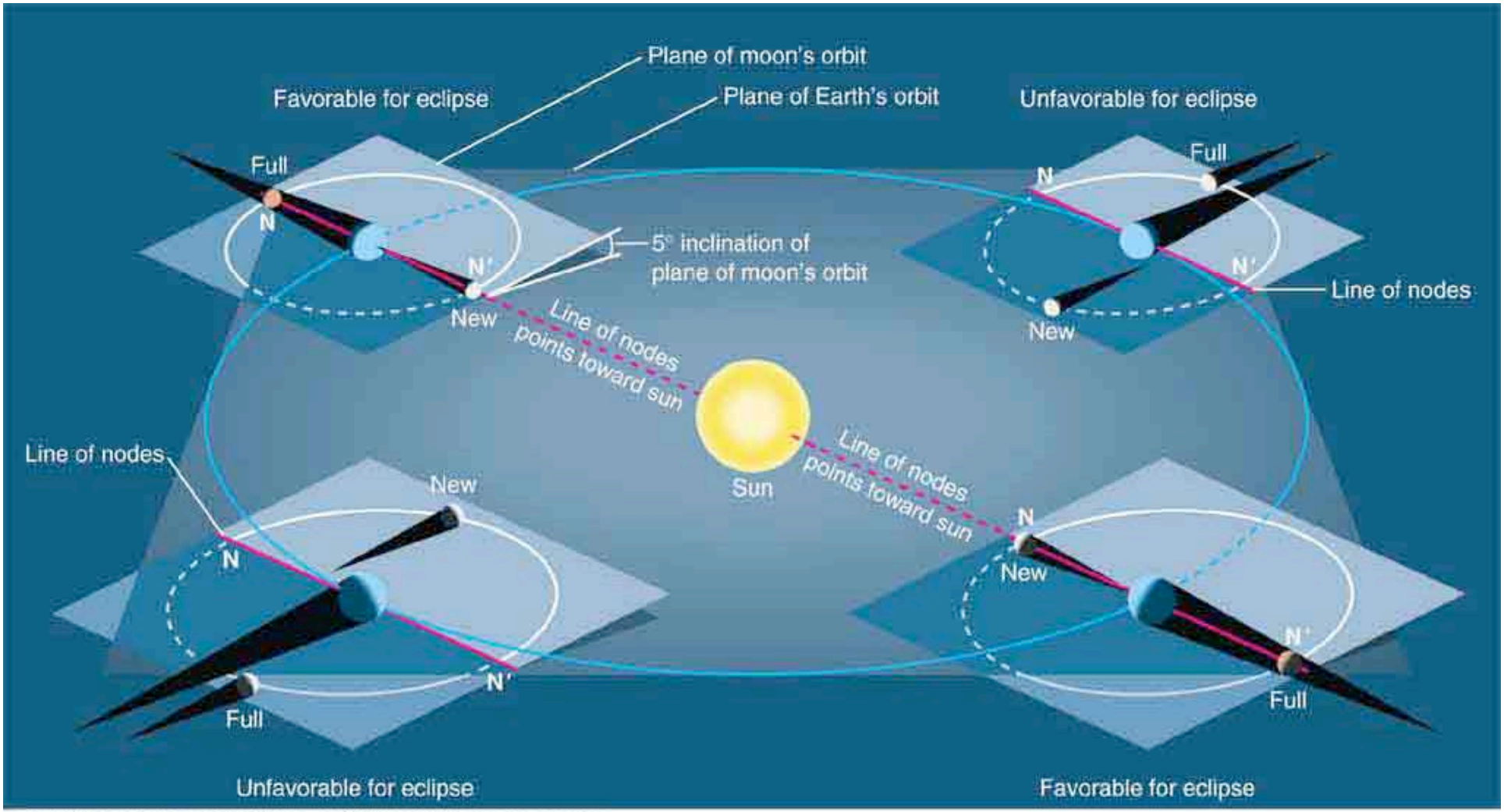
Why isn't there a lunar eclipse every full Moon?

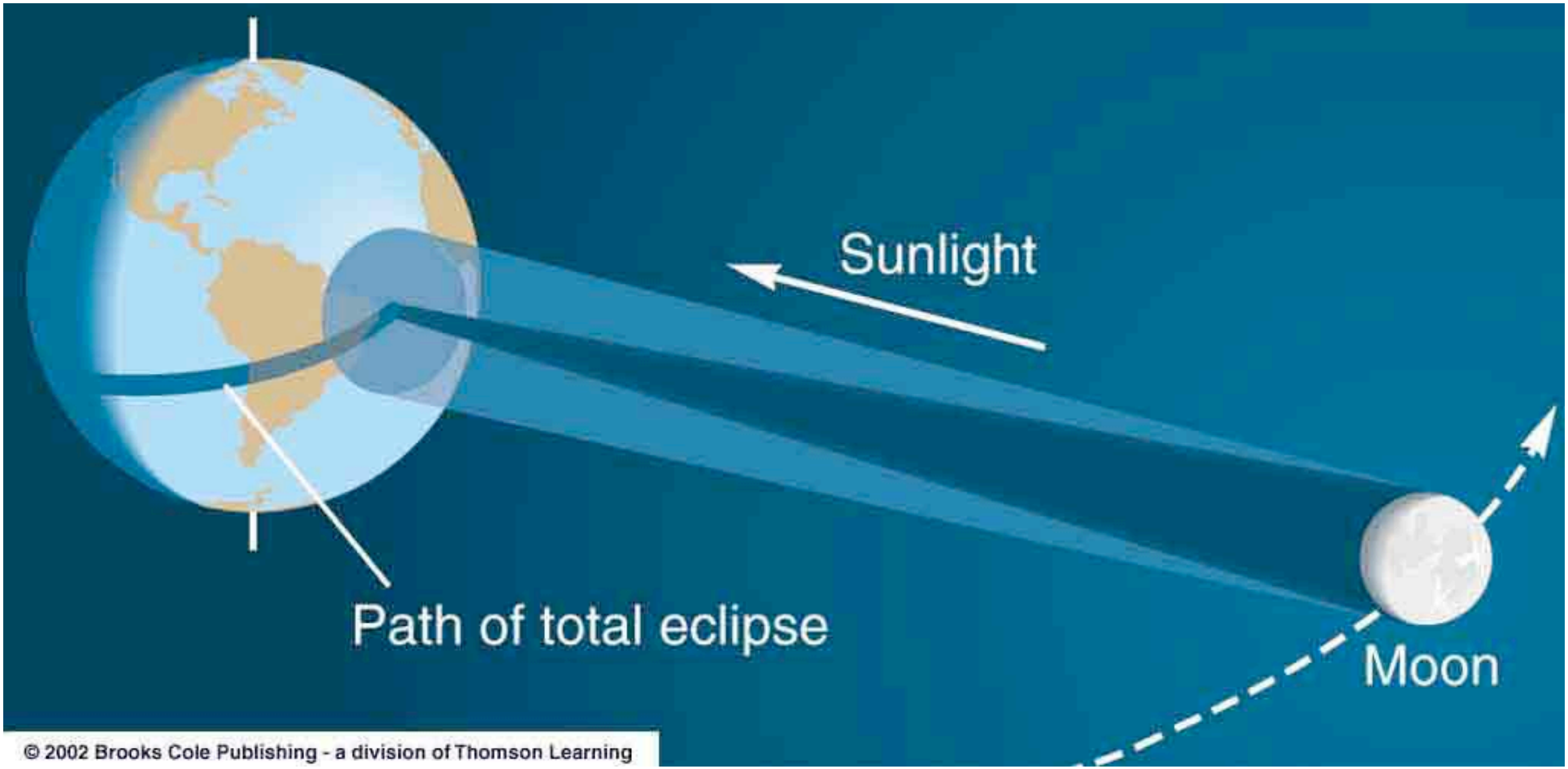
The reason is that the orbit of the Moon isn't exactly in the same plane as the orbit of the Earth (the ecliptic).

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).





Weekly quiz

1. Why is it hotter in Austin in June than it is in December?

There are two related astronomical reasons. Give both for full credit.

The main reason is that the Sun passes more nearly overhead in June, so the Sun's light shines directly down on Austin rather than at an angle. In December the sunlight is spread over a larger area since it comes in at an angle.

Also, the daytime is longer in June.

Both could be explained from the fact that the Sun is north of the celestial equator in June and south of the celestial equator in December. Or because the northern hemisphere is tipped toward the Sun in June and away in December.

2. In a sentence or two say how Copernicus' model of the universe differed from previous models.

He put the Sun, rather than the Earth, at the center. And all of the planets revolve around the Sun, rather than the Earth.

Topics for this week

Describe the models of Aristotle, Copernicus, and Kepler. How correct and how accurate was each? How did each explain retrograde motion of the planets?

State each of Kepler's 3 laws and be able to use them to compare speeds of different planets and of one planet at different points in its orbit.

What arguments did Galileo make in favor of the Copernican model?

What did Newton add to our understanding of Kepler's laws?

State Newton's 4 laws. Know what the words in each mean. Apply them to the problem of falling balls.

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.

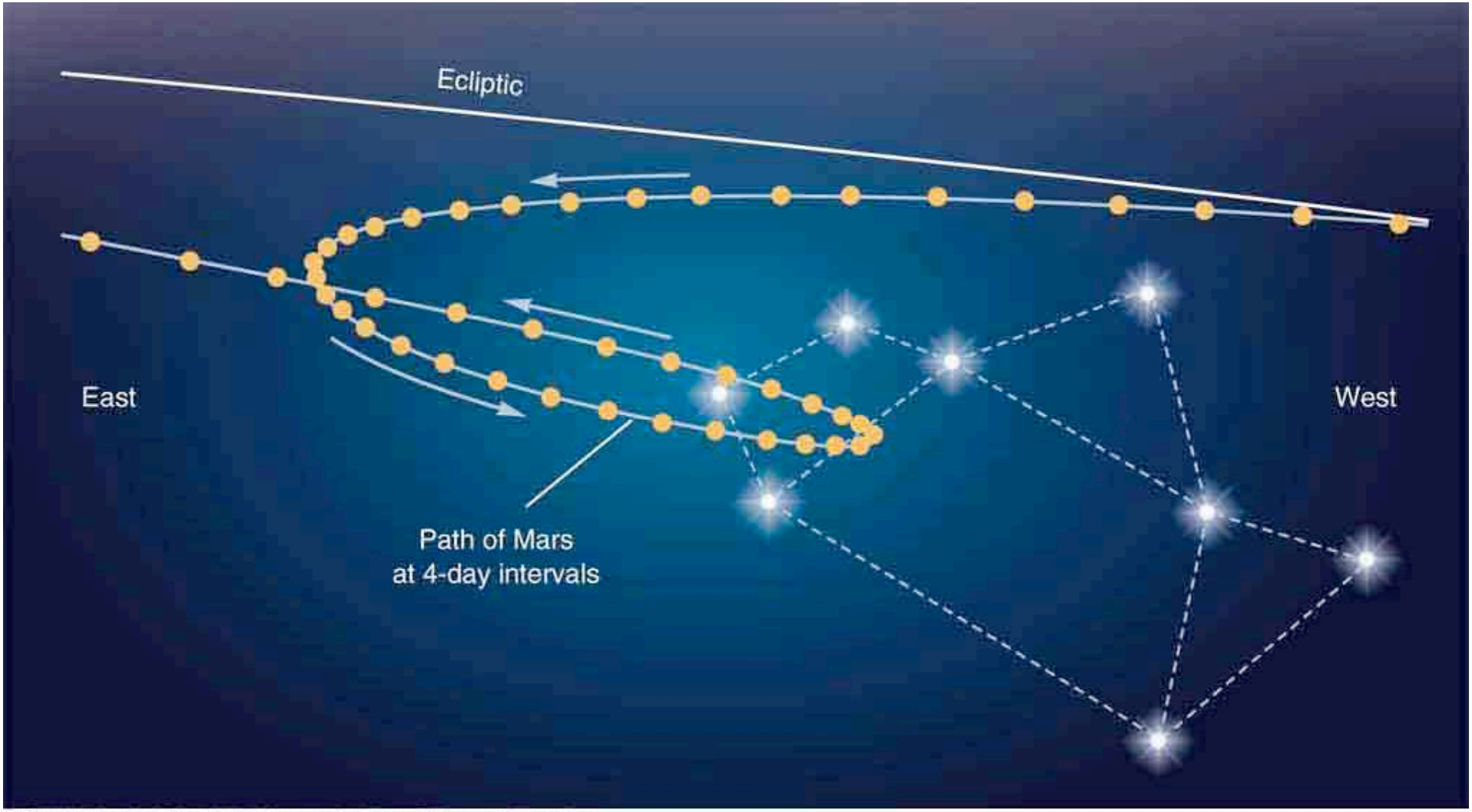
Usually, they move west to east relative to the stars.

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.

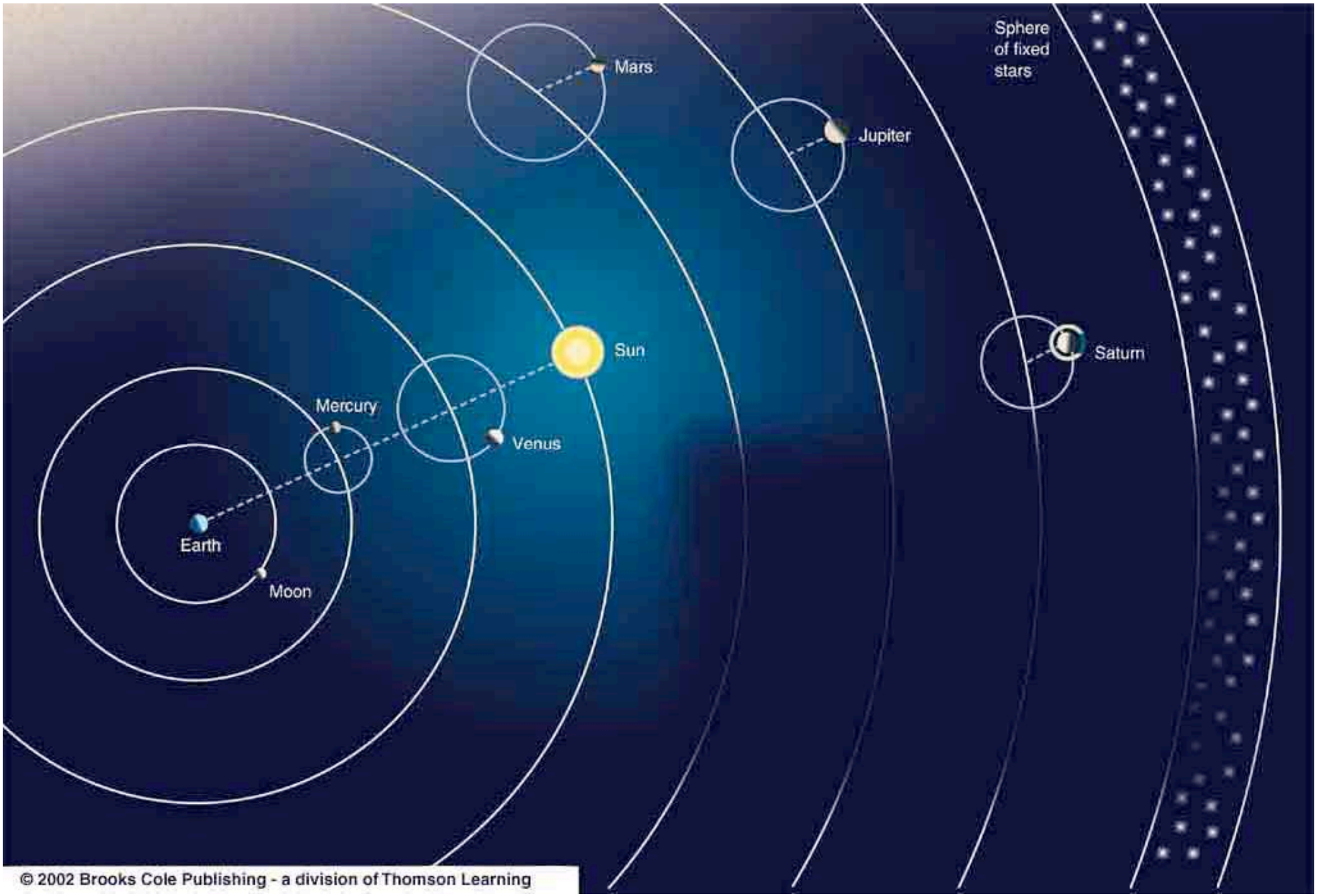
This is called retrograde motion.

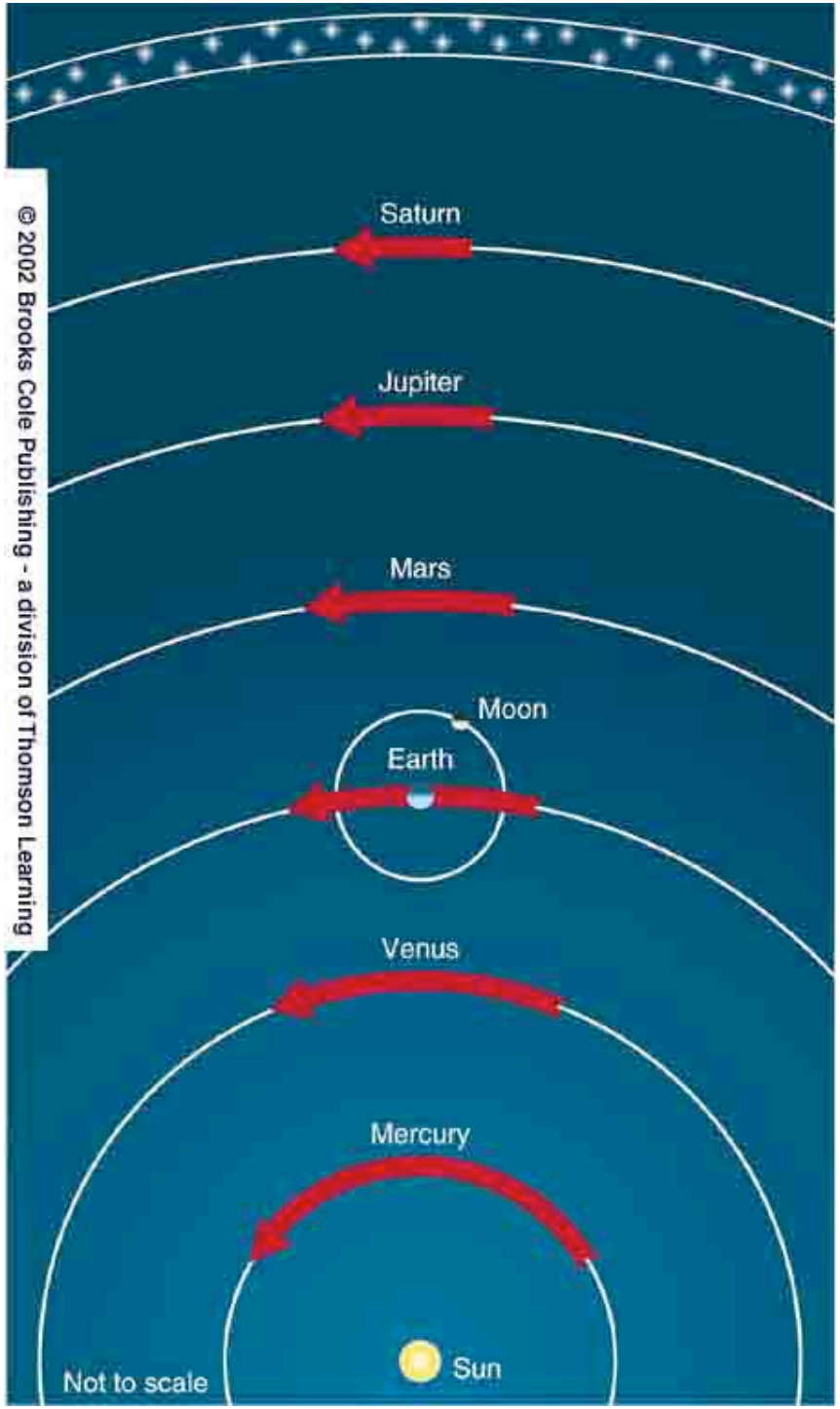


The Greek and Arabic models

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.





Prograde and retrograde motion

Remember: all objects in the sky move east-to-west during a night due to the west-to-east rotation of the Earth.

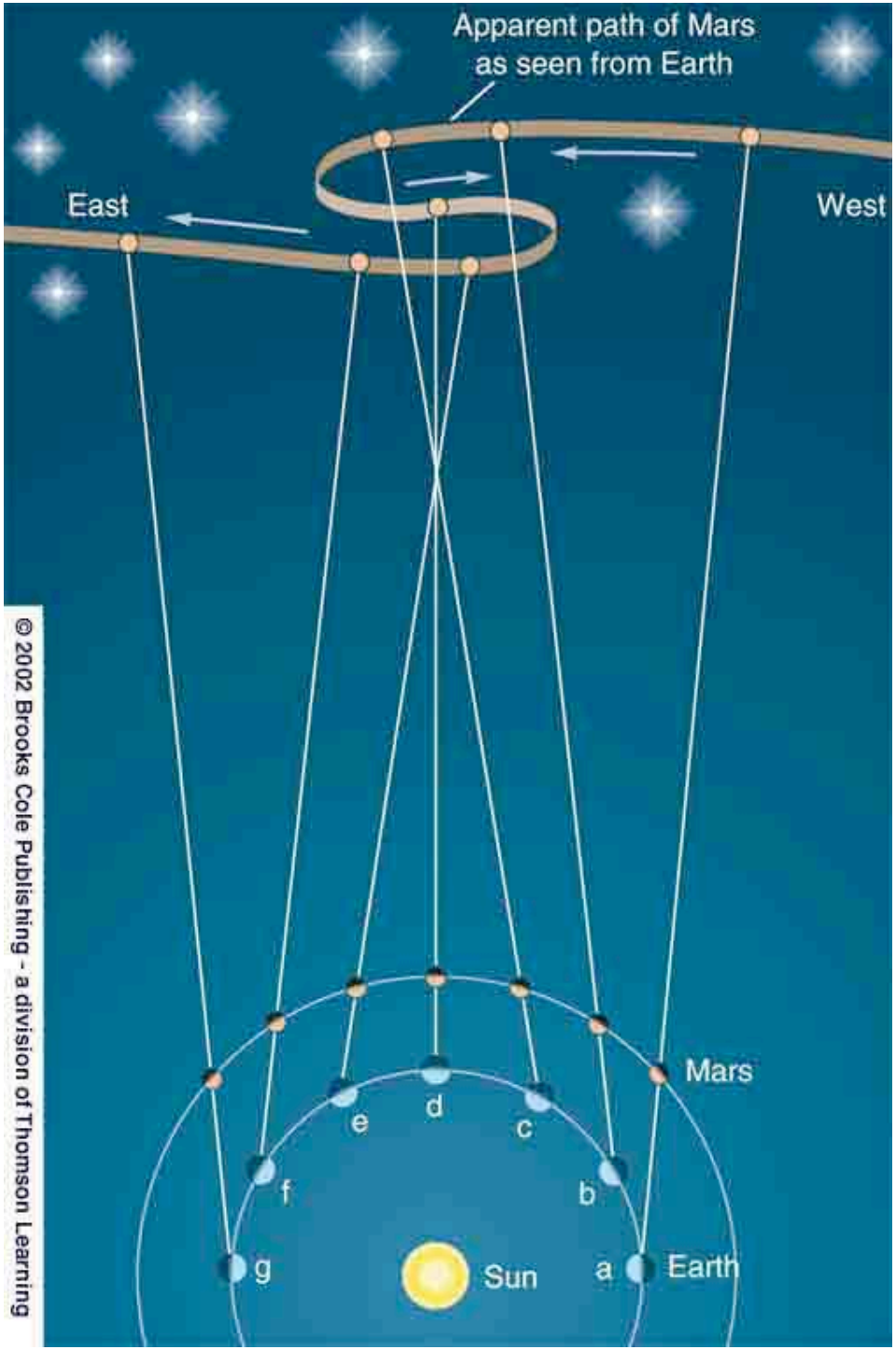
Prograde motion is when a planet moves west-to-east relative to the stars.

The Sun and Moon always move prograde.

Retrograde motion is when a planet moves east-to-west relative to the stars.

Looking down on the solar system from the north, prograde motion occurs when the line from the Earth to the object rotates counterclockwise (in the same way the planets actually move).

Retrograde motion occurs when the line rotates clockwise because the Earth passes the planet.



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