AST 301
Introduction to Astronomy

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Topics for this week

Describe how the planets appear to move during a night and from night to night relative to the stars.

How did Aristotle explain the motions of the planets?

How did Copernicus explain the motions of the planets?

Was his explanation more accurate than Aristotle's?

How did Kepler improve on Copernicus' model?

State (and define the term in) Kepler's laws.

What makes a model a scientific theory?

Assignment for this week

Read Chapter 3.

The homework due on Friday includes your observations of Venus, Mars, and Spica. I hope you have been able to see them on at least two nights. The weather doesn't look promising for the rest of this week, and it will be hard to see Spica after this week (although Venus and Mars will stay around for a while longer).

If you haven't seen these objects, use SkyGazer or another computer model to make simulated observations. Say on your homework if you made your 'observations' this way.

Eclipses and the ecliptic

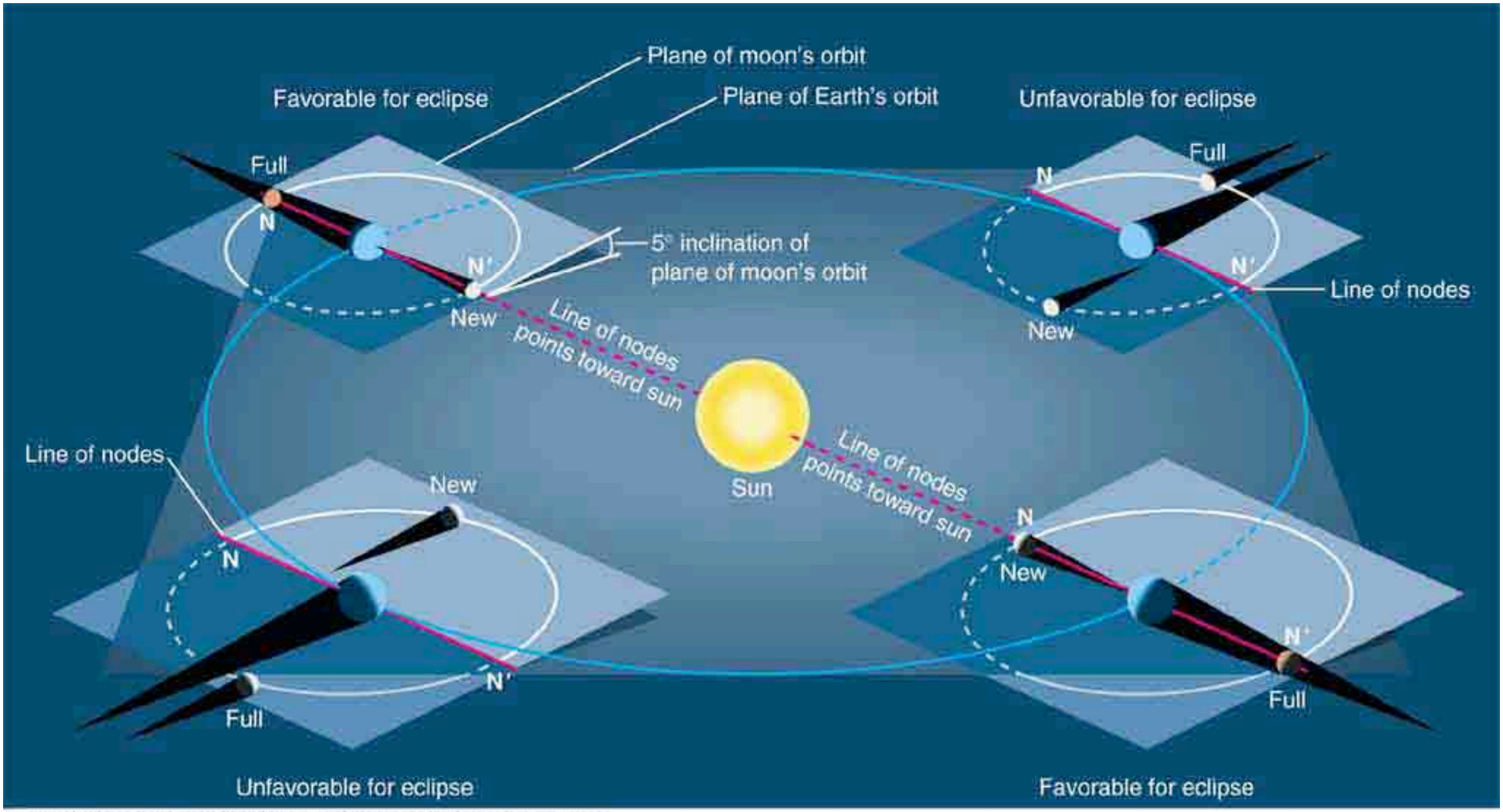
Why isn't there a lunar eclipse every full Moon?

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).



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.

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.

All of these motions are counter-clockwise looking from above the north pole.

The 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.

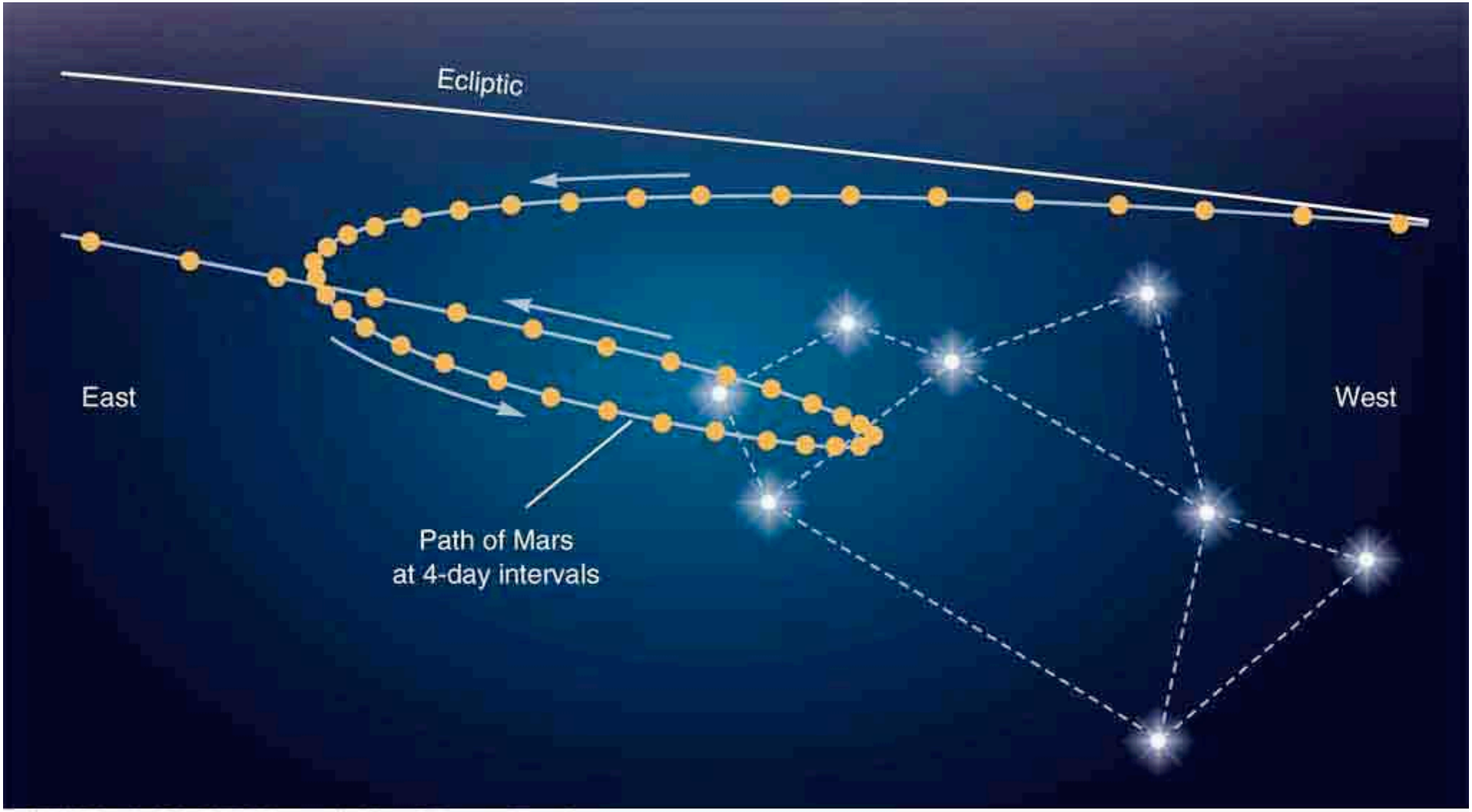
Usually, they move west to east relative to the stars.

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.

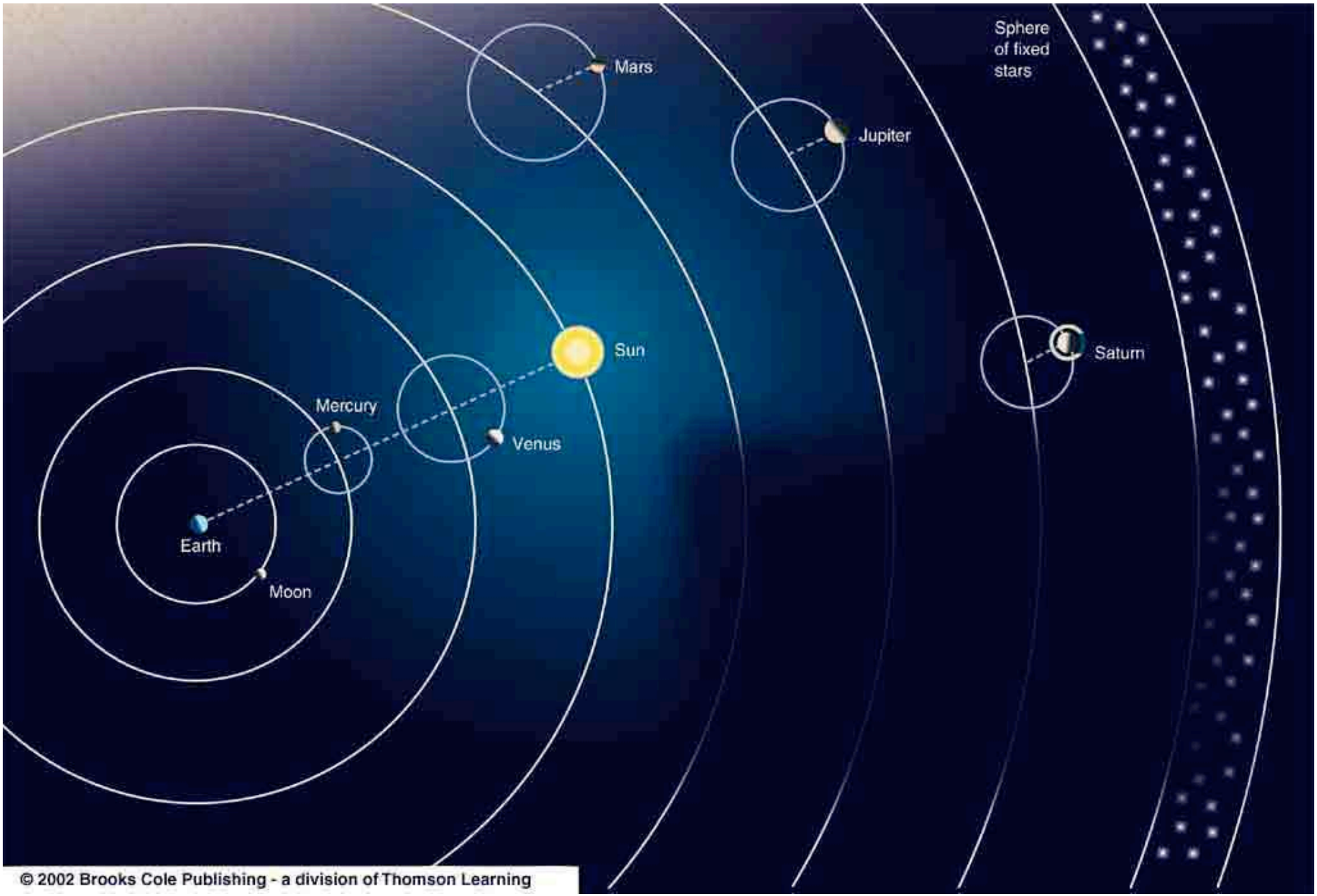
This is called retrograde motion.



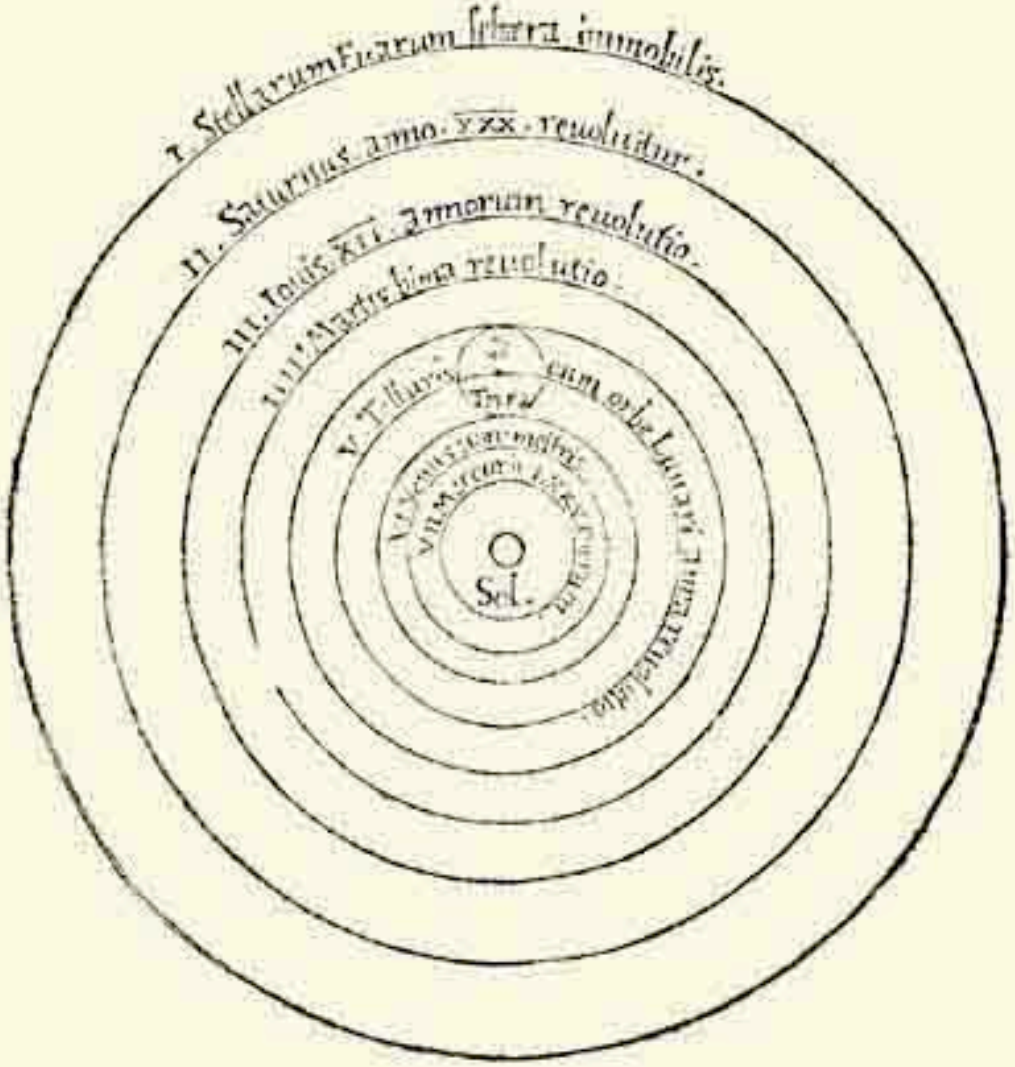
The Greek and Arabic models

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.



net, in quo terram cum orbe lunari tanquam epicyclo contineri diximus. Quinto loco Venus nono mense reducitur. Sextum denique locum Mercurius tenet, octuaginta dierum spacio circũcurrens. In medio uero omnium residet Sol. Quis enim in hoc



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.

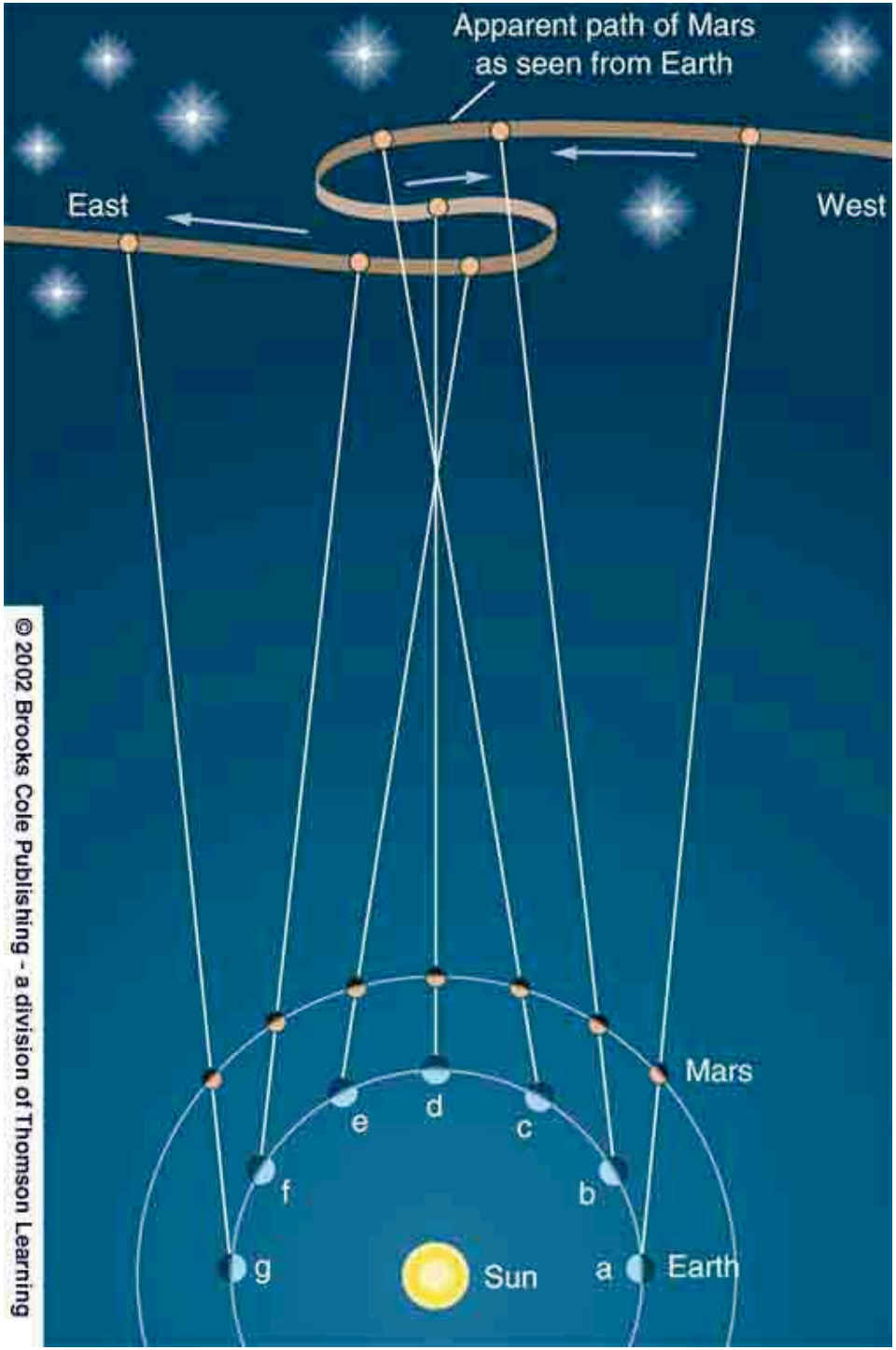
Prograde motion is when a planet moves west-to-east relative to the stars.

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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