Motions of the Planets: Not the same as Stars!

Venus:

never farther than 47 degrees from the sun, on morning or evening side, hence referred to as “morning star” or evening star”

“My Very Educated Mother Just Served Us Nachos” – the planets, in order from the sun
Mercury...

Never seen more than 28 degrees from sun, in morning or evening sky. Never as bright as Venus, so harder to see.
Mars, Jupiter & Saturn

These “wander” along a path in the sky that was called the zodiac, or the ecliptic. About once a year they perform a loop in their path that is called retrograde motion. Mars’ loop is largest, Saturn’s is smallest.

Figure 3: The Retrograde Motion of Mars. Each dot represents the position of Mars with respect to the stars two weeks later starting from Aug 24, 2007.
Review: Planet’s Motions in the sky

Sun: annual motions carries it through the constellations called the zodiac (or ecliptic)

Planets: (from “wanderers” in Greek) – naked eye planets include Mercury, Venus, Mars, Jupiter, Saturn. Over a period of weeks and months they move among the constellations

- Mercury: never farther than 27 degrees from the sun, on morning or evening side
- Venus: never farther than 47 degrees from the sun, on morning or evening side
- Mars, Jupiter, Saturn: move eastward within the zodiac, but each one makes a westward loop once a year when its farthest from the sun
- Uranus, Neptune: need a telescope to see them, but they each describe westward loops once a year, each smaller than the previous planet.

How can this motion be explained?
Ancient Astronomical Observations

Venus, Mars and the moon were carefully observed by ancient cultures. Their results for various quantities were extraordinarily accurate considering that their technology was pre-telescope.
Chichen Itza: Caracol & Castillo, a probably Mayan observing site
The Greek explanation of planetary motion

Earth (sphere) was the center of everything, and planets revolved around it, with extra loops in their orbits. No evidence that Earth moved in space, so they created model of wheels upon wheels:

http://astro.unl.edu/naap/ssm/animations/ptolemaic.html
Copernicus: Polish mathematician, 1473–1543, proposed to explain motions by the planets revolving around the sun.
but it was a sun-centered (heliocentric) model
Let’s try to predict what you might expect to observe.

http://astro.unl.edu/naap/ssm/animations/configurationsSimulator.html

This was before the telescope, so no ideas about what planets actually looked like – just points, like stars.
Lecture-tutorial, p. 99, Observing Retrograde motion
Galileo, and his telescope, proved the heliocentric model was correct.

Next time: Kepler and laws of planetary motion
Homework: practice test questions to answer