

What is retrograde motion?

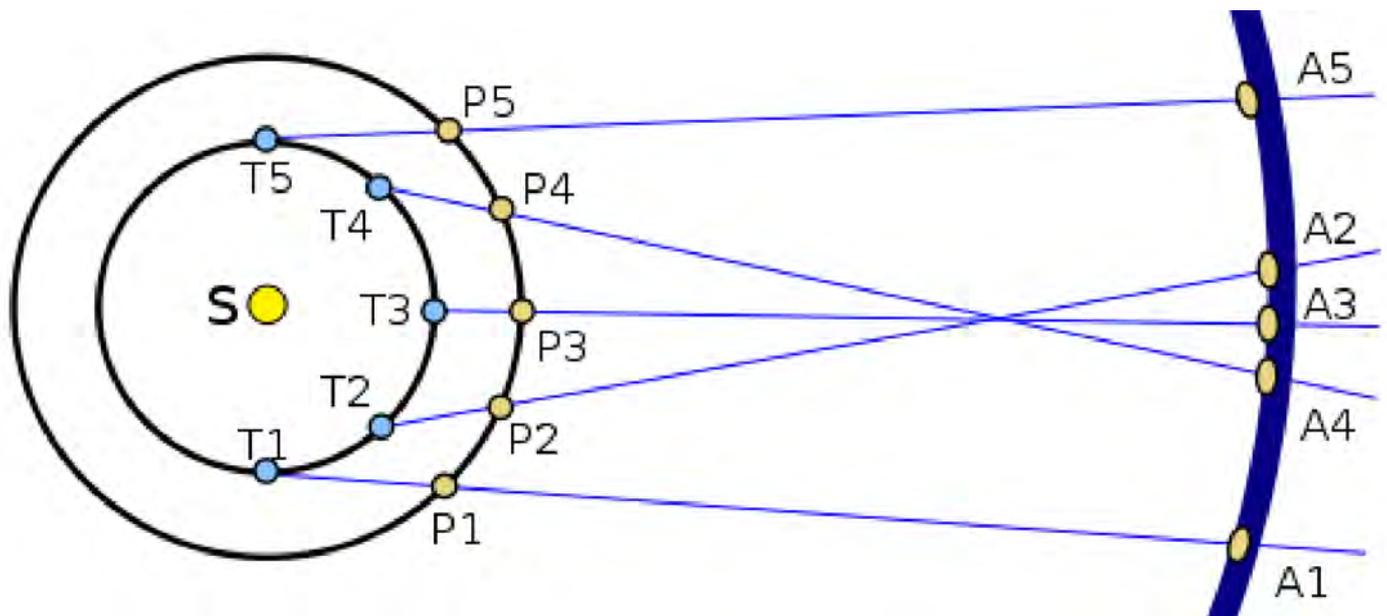
Sometimes, as seen in Earth's sky, the planets move backwards! How can that be?

Typically, the planets shift slightly eastward from night to night, drifting slowly against the backdrop of stars. From time to time, however, they change direction. For a few months, they'll head west before turning back around and resuming their easterly course. Their westward motion is called retrograde motion by astronomers. Though it baffled ancient stargazers, we know now that retrograde motion is an illusion caused by the motion of Earth and these planets around the sun.



You can test it for yourself, the next time you pass a car on the highway. As you approach a slower car, it's clearly moving in the same direction you are. Yet, as you pull alongside and pass it, from your vantage point the car appears to stop and then move backwards. Then, as you pull ahead of it, you realise the car does follow you, still forward again.

The same thing happens as Earth passes the slower-moving outer planets. When we pass Jupiter or Mars or Saturn, for example, these more outward planets move more slowly than Earth in orbit – appear to reverse course against the background of stars in our sky for a couple of months.

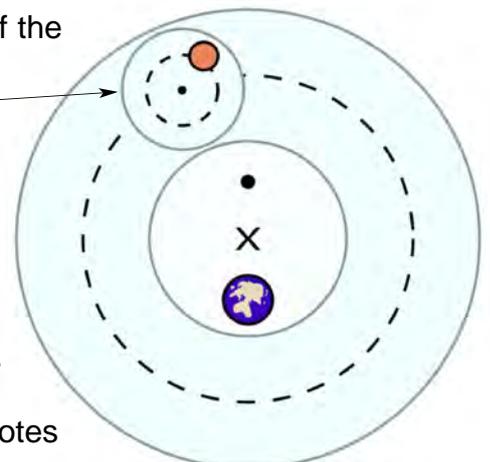


A schematic of how retrograde motion works when Earth (T) passes an outer planet (P) as they both orbit the sun (S). The changing viewing angle from Earth makes the projection of the planet against the celestial sphere (A) move backwards (A2-A4) as we pass the slower planet.

Ancient astronomers – who believed Earth lay at the centre of the universe – went to complicated lengths to attempt to explain retrograde motion. Theirs was a complex cosmology in which each planet not only orbited Earth, but also spun around a moving point on their orbit. Astronomers **Nicolaus Copernicus** and **Johannes Kepler** finally set us straight when they realized Earth orbits the sun. **Retrograde motion now made sense!**

Here is a schematic of how astronomers envisioned the motion of the planets before Copernicus. The Earth sat near the center of the universe. The planets moved around a small circle (the epicycle) which in turn moved along a larger circle (the deferent). The deferent was centred on a point (X) midway between the Earth and another spot called the equant.

However, the term Retrograde Motion is also used to classify other motions out of the ordinary. Venus, for example, rotates in the opposite direction from every other planet. And the moon Triton orbits the planet Neptune in retrograde motion, that means against the rotation of the planet. Astronomers believe it is a gravitationally captured object.



AK, with EarthSky Notes