NATURALIST'S CORNER

A Winter Parade of Planets

Did you get a chance to see the total solar eclipse back in April? Well, there is another special astronomical treat coming to us this winter: a planetary parade. Ok, that's not a real science term, but if you're lucky and the weather cooperates, you will be able to see all eight planets—remember, Pluto is not a planet anymore—starting in late January and running through most of February.

During this month-long event, the planets will line up across the night sky. As the sun sets, you'll see Mercury, Venus, Saturn, Neptune, Uranus, Jupiter, and Mars in a straight line from the west to east. Why are they lined up? Because all the planets are on the same plane, an imaginary line called the ecliptic. To explain why this is, we'll need to go back in time and explore how we have understood the universe and our solar system.

We start our journey through time with the Greek philosopher Aristotle. About 350 B.C.E., Aristotle realizes that the sun was our nearby star, with other stars fixed in a celestial sphere very, very distant from Earth. Aristotle tries to explain how the wandering stars, which we today call planets, relate to Earth, sun, and these distant stars. Egyptians and other Greeks had placed the sun at the center of the universe. To make sense of what he saw, Aristotle instead places Earth at the center. Since the universe was created by the gods, everything would be perfect and unchanging (except for Earth), so all planets, moons, and the sun would move in perfect circles and themselves be perfect circles, creating a line across the sky.

Four hundred years later Ptolemy, a Greek living in Alexandria, Egypt, creates a system to explain the motion of the planets based on Aristotle's ideas. I often criticize Aristotle and Ptolemy in my classroom for their geocentric solar system. But how Ptolemy tries to match real-world observations with his Earth-centered model is what makes astronomy a true science. If Mercury and Venus are orbiting Earth, why are they always so close to the sun? When our models don't match what we observe, we need to adjust our models. Ptolemy does exactly this. He tries to explain the orbits of Mercury and Venus as circles within circles, called *epicycles*. But this doesn't quite work.

In the 1500s a Dane named Tycho Brahe makes even more detailed observations. Every night, Brahe goes out to observe the night sky. Using a sextant, a cross-staff and, I imagine, very good eyesight, Brahe records the location of every possible astronomical object. He realizes that Ptolemy's model is outdated. Its predictions of planetary positions are off by more than a month. Another model made by the Polish astronomer Copernicus is better but still off by two days, so Brahe updates these models. His revised model has all the planets orbiting the sun but the sun and moon orbiting the Earth. It solves some of the problems but saddles us with others.

In 1687 Sir Issaac Newton publishes his theories of motion and gravity. Inspired by the works of Galileo and Johannes Kepler, Newton proposes a mechanism for why objects move in the universe. Scientists seize on this new understanding and begin applying it to explain observations in the solar system. Perhaps the most famous such deduction was by Newton's friend Sir Edmund Halley, who used the law of gravity to predict the return of the comet that today bears his name.

Now with a mechanism to explain the motion of planets, scientists can theorize how they formed. Around the time of the American Revolution, Immanuel Kant proposes the idea that the planets formed when a nebula of dust and gas was pushed into motion by a passing star: The gravity from the star made the nebula swirl like a whirlpool. At the center of the whirlpool the sun formed. Planets were the result of gravitational collisions building up mass and causing eddies in the whirlpool. As the nebula spun faster and faster, only those planets along the central plane of the sun's gravity were able to stay in orbit.

Perhaps our solar system previously contained more planets. Some may have been thrown across the resulting planetary plane, i.e., the ecliptic, causing collisions with the planets we know today. This could explain why Venus spins backwards or why Uranus is lying on its side. Many scientists suggest our moon resulted from a collision between a Mars-sized planet and our own. But that's another story for another day. So, the planets are all lined up on the ecliptic because a cloud of dust and gas was moved into motion some 5 billion years ago.

Today scientists don't think it was a passing star that set the nebula into motion. Perhaps it was instead the result of a nearby supernova. You see, our theories still have some problems, but it is the need to resolve these problems that helps us better understand how our universe works. If you would like to find out more and get a chance to see some of these planets through a telescope, join our Star Party on Saturday, February 1st (rain/cloudy date: Sunday, February 2nd) at Nobleview Outdoor Center in Russell. See the announcement on page 3 of this newsletter.

~Tom Condon