



May 30, 2020

Hello Astronomers! For the last two weeks I've shared with you some of the thrill we've experienced when we seen eclipses of the Sun and Moon. A solar eclipse happens when the Moon passes in front of the Sun. Lunar eclipses happen when the Moon passes into the shadow of the earth. When do these things happen? Why don't the happen more often? Want to know? Read on!

The Earth is always on a trip around the Sun. Do you know how many days that trip takes? Yes,  $365 \frac{1}{4}$  Days, what we call a year. So today, the Earth is an *almost* the same place, compared to the Sun as it was last May 30. We say that the Earth is in **orbit** around the Sun. The Moon is in **orbit** around the Earth. So does the moon have a year, too? Sure, but to avoid confusion, when the Moon makes one complete trip around the Earth, we call it a **moonth**. A **moonth** lasts about 29 days. The Moon makes about 12 trips around the Earth each year. We have 12 **moonths** each year. By now you've figured out that our word for each of these 12 cycles is month, with the second 'o' removed from **moonth**.

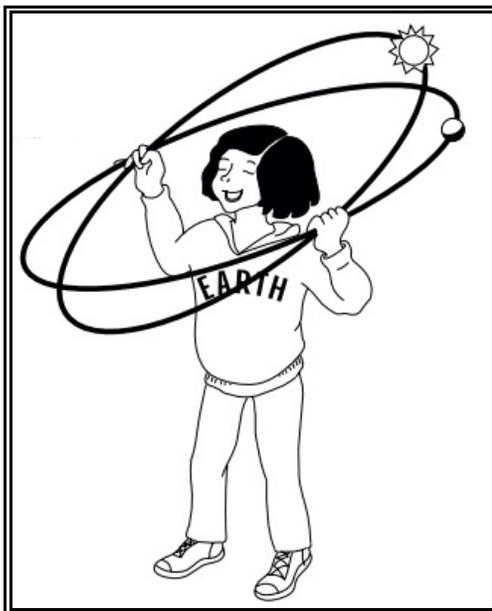
Something we learn about space is that everything is moving and *fast*. Let's start with the Earth. You probably know that the Earth is spinning like a top. If you look at a toy top spinning around on the floor, you might notice that it is spinning faster around its middle than at its top and bottom, just like a wheel of your bicycle turns faster at the tire than at the hub. The Earth does the same thing. If you stood at the north or south pole of the Earth for a day you would make one full turn in about 24 hours (this sounds like a pretty cold and boring thing to do!). If you stand at a spot on Earth's equator, you would zip along at 1000 miles per hour! Why don't you fall down? Because everything around you is streaking along at the same speed. If you've ever flown in an airliner, you might notice that it's easy to walk up and down the aisle once the pilot says it's safe to do that. That's because both you and the airplane are moving at the same speed, just like the person in the picture below. Can you believe that this person is walking at 400 miles per hour?



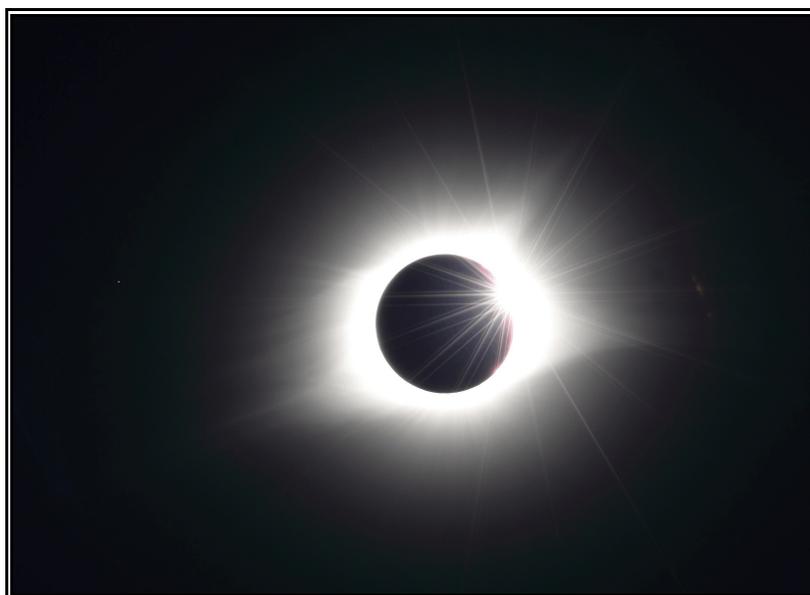
When we notice the Sun (or stars) move across the sky we are not seeing them move, we are the ones moving. We are "passengers" on the Earth and are being carried along as Earth spins on it's axis. But if we look carefully over several days or nights we might notice something else. The Moon changed phases from crescent to full *and* it was a little further east each night. That shows us that the Moon is traveling on its orbit around the Earth. Each day we see the Sun rise in the east and set in the West. That's because the Earth spins all the way around once every day. Well, the Sun also changes its location in the sky each day. That's really hard to see because the Sun is so bright and there are no stars visible in the sky to compare it to. But every day the Sun will shift east against the stars behind it because the Earth is orbiting the Sun.

So, what does this all have to do with eclipses? Since we see the Moon move in the sky against the stars from night to night, we can imagine a trail that the Moon follows across the sky. What are we seeing? It's the 29-day monthly orbit of the Moon around the Earth! To us, the Sun also has a 'trail' if follows across the sky. It is a much longer trail that is about 12 times longer than a **moonth**. We call that length of time, a year. We have a special name for the long path the Sun takes through the sky over a year. It's called the **ecliptic**. It got that funny name because knowing the path the Moon takes through the sky in a month and the path the Sun takes through the sky in a year helps us to know when solar and lunar eclipses happen!

**Try this.** Do you have two hula hoops around your house? If you do, place one hoop inside the hoop by bending them a little. Hold them like this drawing from the Astronomical Society of the Pacific.



Imagine that one hoop represents the **ecliptic**, or trail the Sun seems to take around the sky. The other hoop represents the trail the Moon takes through the sky. Your head is the Earth. Do you see where her hands are, holding the hoops together? That's where the hoops cross. An astronomer calls these meeting places the **nodes**. The Moon travels around the "moon hoop" in a month and the Sun travels along the "sun hoop" in a year. You'd be right if you guessed that once in a while the Sun and Moon will meet at one of the two **nodes**. In space, the Sun's hoop, or **ecliptic**, is way bigger than the Moon's hoop, or orbit, so the Sun and Moon never really meet. But, when the Sun and the Moon *seem* to "meet" at the same **node**, we have a solar eclipse.



When the Sun and Moon are at opposite nodes at the same time, we have a lunar eclipse that looks like this.



For more information about eclipse prediction, it helps to know a little about something called the **Saros Cycle**. There is a pattern that ancient Babylonian astronomers worked out. After careful observation over centuries years they found that all eclipses repeat over a span of about 18 years. Check out this site from Sky and Telescope magazine if you'd like to learn more.

<https://skyandtelescope.org/observing/saros-cycle-solar-eclipse-lunar-eclipse/>

Want to know when the next solar or lunar eclipse will happen? Fred Espenak, famed eclipse expert, has a great website that you can visit:



Next time, lets travel a little further out in space. There is so much to discover!