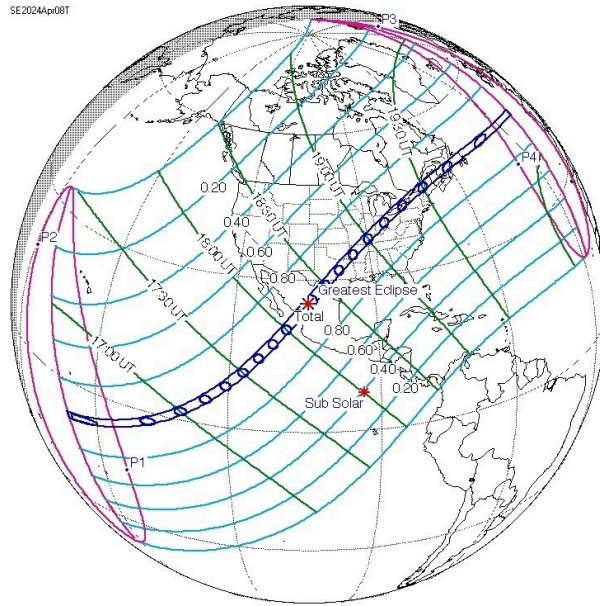




News from the Den



On 8 April 2024, a total solar eclipse will cross the United States while the sun is in its most active phase-the solar maximum and at a period of high solar activity. These two events-solar maximum and high solar activity-will afford the observer a rare glimpse at the outer edges of the sun. Solar winds originate within the photosphere of the sun and are carried outward on plasma jets, visible during the period of eclipse totality. NASA is asking citizens to participate in making observations if you are fortunate enough to be within the path of the eclipse (the path of solar maximum will arc from Toronto, Ontario, Canada to Del Rio, Texas, crossing the midwestern states (see globe above). If you have a chance to visit this area, do not hesitate as the next total solar eclipse in the US will not occur until 12 August 2045.

There are several ways to participate: download the [SunSketcher](#) app to photograph and time the occurrence of Baily's beads. These bright spots of light occur when sunlight shines through valleys in the moon's topography. Capturing and timing these bright flashes allow scientists to determine the sun's shape. Volunteer to participate in [Eclipse Soundscapes](#) to measure the profound effects total eclipses have on animals. You can order a complete listening kit on their site or instructions on how to build one. There are many more citizen science opportunities listed on the web: [Learn More Here](#)

Latest and Greatest Science News - The Moon

A planet the size of Earth should not have a satellite the size of our moon. With a diameter of 2,159 miles (3,475 kilometers), the moon is over a 1/4 the size of earth and is larger than Pluto. There are 293 moons or planetary satellites in the solar system, of which, the moon is the fifth largest. At 1/4th the size of earth, it has a much larger planet-to-satellite ratio than any other moon in the solar system. This means the large moon has a much greater influence on our planet than the other satellites due on their planets. Even though it's 1/4 the size, it is only 1.2% the mass of earth. Quite low compared to its size.

But where did the moon come from? Did the earth capture a really large asteroid? Did two planetoids form near each other and enter a shared orbit? Did the early earth spin so fast it shed some of its surface off into an orbiting debris field, which coalesced into the moon?

Many different hypothesis on lunar origin exists. So, how did our little planet (the fourth smallest in the solar system) get such a large satellite? If we assume the asteroid-capture hypothesis is correct then, it's all about gravity and mass. Gravity is created by the deformation of space-time, e.g. stretch a blanket out between four people and place a bowling ball in the middle of the blanket, the ball pushes down, deforming the blanket, creating a 'well' containing the ball. The heavier the ball, the deeper the well. Earth can be correlated with the ball and its mass creates the same 'well' in fabric of space-time. But earth isn't very heavy and its well isn't very deep, so capturing a large asteroid or holding a co-formed planetoid in co-orbit seems unlikely.

It wasn't until Apollo 11 astronauts returned lunar samples from the moon's surface in 1969, did we start to form a theory about how the moon formed. The first lunar landing returned 22kg of samples from the Sea of Tranquility. The Sea of Tranquility is one of the large lunar mare on the lunar surface, a crater filled with dark rocks. Dark rocks of an earth-like basalt was expected from astronomical observations and the bulk of the 22kgs contained this rock type. But a single small white rock fragment, found within sample #10020, was not expected. This tiny sample was anorthosite, a calcium-rich, feldspar-mineral rock. If you have ever seen granite countertops of a deep blue-black with flashing light blue crystals - that's anorthosite. This rock type is very rare on earth and was not predicted to exist on the moon. It was hypothesized the small white rock came from the light colored lunar highlands would therefore make up a large volume of the lunar surface. ([More Here](#)).

Given this mineralogical discovery, the moon's large size but low mass compared to earth, the existence of anorthosite on the moon, and now a further study which correlates and matches geochemical signatures between rock types on earth and the moon ([Geek Out Here](#)), the impact theory of the moon, during planetary formation, is confirmed.

4.45 billion years ago during earth's planetary formation, a proto-planet, approximately the size of Mars, struck the early-earth a glancing blow. This proto-planet is named Theia. The collision sheared off a considerable amount of crustal and mantle material from earth. The earth-derived material with some of the Theia material created a debris field which orbited early earth. Over time this debris coalesced, due to rotational gravity, into a planetoid, our moon.

After coalescence, the early moon was much closer to the earth, only 140,000 miles away. Now the moon is 250,000 miles from earth and moving away at 38mm (1.5") a year. This movement away from the mass of the earth is due to the shallow size of earth's gravity well and its inability to 'hold' such a large satellite in a fixed orbit. In about 600 million more years (at the current rate of withdrawal), the moon will be too far away from the Earth to cover the sun, thus bringing an end to solar eclipses. So don't miss the upcoming solar eclipse next month. [Read More](#).

The Theia impact did many things to facilitate the creation of the stable planet we live on. It tipped the axis of the earth over to 26 degrees from vertical, this created our seasons. Its gravitational mass slowed the rotational rate of the small earth, stabilizing its spin and reducing the rotational wobble of the earth. Its proximity created the tides. It's phases facilitate animal migrations and mating cycles, setting a 'lunar clock'. ([More Benefits](#))

Now, we have more data to confirm the impact-origin theory. Unusual 'blobs' of non-earth material have been discovered beneath the Pacific Ocean and the African continent. Discovered in the 1980's from seismic mapping, the blobs exist deep within the earth's interior near the core and geophysicists named them LLVPs, Large Low-Velocity Provinces. Thick masses which have lower density than the surrounding deep mantle rocks. They are called low-velocity because earthquake-generated seismic waves traveling through them slow-down. These provinces are hypothesized to be leftover pieces of the colliding proto-planet Theia, stuck in the earth's interior. Compositional computer models suggest this to be true and gives an idea about how much of the early-earth was merged with Theia. ([More here](#)).

Besides the positive changes the moon has made to earth, why else is the moon important? It is the perfect location for future inter-planetary journeys, for construction sites needing lower gravity, a source of water for future explorers. We are traveling back to the moon. India, Japan, China and now a private company have landed spacecraft on the lunar surface. The Indian, Japanese and private landers all focused on spots at the south pole of the lunar satellite. The Chinese vehicle landed on the dark side of the moon. The three south poles landers all had system failures. Chandrayaan-3 operated for 13 earth-days (one lunar day) and then went to sleep, it has not awakened since. The Japanese lander (SLIM) executed a near perfect, pin-point touchdown (within 100m of its target) but landed upside down. Thus, pointing its solar panels down. After 9 days SLIM had absorbed enough solar energy to begin powering its cameras. It is now asleep. Odysseus launched in February by Intuitive Machines, touched down on the 22nd of the month. This lander carried several telescopes for astronomical observation. However, on landing it tipped over on its side. Only the Chinese lander - Chang'e-4 - landed successfully and deployed a rover - Yutu-2. The craft landed on the dark side of the moon utilizing a paired lunar satellite for orientational maneuvers. Chang'e-7 is scheduled to launch in 2026, projected landing site is Shackleton's Crater in the south polar region. All the south poles expeditions are looking for water, frozen in the lunar soils. The moon is a key locale for numerous nations and one wonders about future conflicts over ownership of lunar resources. (Lander Logs: [1](#), [2](#), [3](#), [4](#))

Earth lives in a unique place within the solar system, just the right distance from the sun to allow liquid water to exist on the surface. But we are also fortunate to have our moon. Generated from one fortuitous impact event. Our solar system exists within a quiet part of the Milky Way galaxy on the Orion arm, minimizing the effects of galactic events and emissions from the supermassive blackhole at the galactic center- Sagittarius A*. Our place in the universe provided a place for life to develop and evolve.

Does life exist other places? Perhaps, it seems statistically possible, given all the eco-planets we are discovering. But given all the fortuitous events which impact our pale blue planet, could these events be serendipitous? And therefore, are we alone in the universe?

If you haven't read my Nexus Series Books, head on over and see how our lunar satellite features in the stories. ([Available here](#).)

Photo of the Month - Theia



The photo-planet Theia, which was roughly the size of Mars, slammed a glancing blow to proto-Earth, 4.5 billion years ago (Artist impression, Credit: Hernan Canellas/ASU)

A Question for Consideration - Neuralink

Last week, Elon Musk announced his company Neuralink implanted a 'brain-reading' device into a person. This fully-implantable, wireless brain-computer interface (BCI) is purported to enable paralyzed individuals to control external devices with their thoughts. I don't know about you but the hive mind of the Star Trek universe - The Borg - comes to mind (no pun intended). Experts appear to be excited about this and Neuralink has opened a called for volunteers to expand their implant program ([Review Here](#)). However, a huge question remains. Should a private company, which lacks all transparency, be able to conduct human trials? To what end? Altruism or mind control? Let me know your thoughts by hitting reply to the newsletter. I'll share your comments anonymously next month.

Historical Foundations - Darwin's Trove

The disturbing saga of the cyberattack on the British Library continues but another astonishing historical foundation has been created - Darwin's Trove is a website 18 years in the making. A 300-page catalogue of 7400 books, pamphlets, and journals contained in the personal library of Charles Darwin. John van Wyhe of the National University of Singapore and his colleagues complied this amazing digital library. [Online Library](#) Previously, more than 85% of Darwin's library reference holdings was unknown. Coinciding with Charles Darwin's 215th birthday, this online archive contains more than 9400 links to the digital source material. The printed originals from his library are spread between the University of Cambridge, Darwin's home-Down House, private collectors and other institutions. [Read about the project.](#)

Book of the Month - *Blue Machine*, Helen Czerski

Beginning her career as an experimental physicist working on explosive physics, Dr. Czerski became interested in ocean mechanics. Oceans cover 7/8ths of the earth's surface and account for our weather, powered by sunlight ocean's shunt radiant energy from the equator to the poles. This book summarizes how oceans impact human culture, animal life, natural history and geography. In our time of climate change, can harnessing the oceans' power and its ability to capture carbon help slow the heating rate? ([Available Here](#).)

Minutiae

Next month we will do a deeper dive into our amazing planet and the geologists that study the surface and the geophysicists who study the interior.

Leave a comment on the Question of the Month. I'm testing this out to increase the conversation we have every month. Up until now, it's been a one-way conversation from me to you. I'd like to make it more two-way. Hear what you think about what I report. What you'd like to hear about or what's on your mind. Let me know by replying to the newsletter or dropping a note to caauthor@earthlink.net.

Have a wonderful month. Be well, be kind. CA



keep being curious

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