Volume 1 **Number 9**

November 2023

Grand Strand Astronomers
Monthly Events

General Membership Meeting:
Every Last Thursday @ 7:00 pm
Meeting: VIA Zoom.
Please see email or Facebook for link

Observing Session: November 11th @ 6:00 pm
Location: Hampton Plantation
Gates open @ 6:00 pm

Inside This Months Newsletter

Grand Strand Astronomer's Social Media

Grand Strand Astronomers Web Site

Grand Stand Astronomers Facebook

Header photograph: NASA releases ultra-HD video of the sun | GMA

Insights From Ian

Hello everyone,

I hope everyone got a chance to see a little bit of the recent partial solar eclipse. Some of our members graciously helped out at the public observing we had at Coastal Carolina University, where we got some views, but battled clouds and rain.

We do have some public observing sessions scheduled in November that I hope some of you will support. It's actually a very good time of year to host viewing for your friends or neighborhoods because we have Jupiter and Saturn (which are always big hits) well placed for viewing and it is getting dark earlier and earlier.

Finally, I would like welcome all the new members that have contacted us recently and expressed interest in coming out to our events and joining our group. Clear Skies. -I

GSA LEADERSHIP

Executive Officer
Ian Hewitt

Treasurer
John DeFreitas

Secretary
Gerald Drake

Social Media Coordinator
Denise Wright

Newsletter Editors
Gerald Drake
Tim Kelly

Call For Volunteers

Grand Strand Astronomers are looking for volunteers to help with the social media platforms such as Facebook, YouTube and Twitter if the need arises. Presently Facebook needs a new face lift and be brought up to present time activities. Our website can also use some TLC and someone responsible to keep it updated with club activities and astronomy related items. If anyone would like to help in these categories, please contact Ian Hewitt at the email address below.

This newletter needs contributions of articles related to astronomy. Send articals to **t.m.kelly349@gmail.com**. Please provide name of author of article to protect Grand Strand Astronomer.

GSAC Telescope Loaner Program

Did you know our club has telescopes available for loan? They are Dobsonians that were donated to the club when we first started. These are available for club members to use at no charge. All you have to do is take care of them and return them if someone else wants to borrow one. The first one is an Orion XT 8. It's in great shape. It gives beautiful views of the moon, planets, and galaxies. Comes with accessories that include a 2X Barlow, 25mm eyepiece, 9mm eyepiece, and laser collimator tool. The other one is an Orion Skyquest XT 10 with Orion's IntelliScope computerized object locator. It includes more than 14,000 objects in its database so you'll be able to locate those dim galaxies. Should be hours of fun. Accessories are included. Both of these are begging to be used. Send us an email if you're interested in borrowing one.

Grand Strand Astronomers - New Members

Grand Strard Astronomer's has no new members this mounth.

Astronomical League Advantages

As a member of Grand Strand Astronomy you automatically are a member of the Astronomical League. The Astronomical league is a nation wide organization with 10 regions across the U.S. This membership gives you access to numerous incredible programs, observing certificates, night sky guides and charts. You can read past and present issues of the Reflector Magazine. Please see hyperlinks for discriptions.

Astronomical League Regions
https://www.astroleague.org/regions-2/

Participating Vendors
https://www.astroleague.org/celestial-savings/

Downloadable Certificates from the Astronomical League
https://www.astroleague.org/downloadable-certificates/

Alphabetical Listing - Offerings From The Observing Program Division Of Astronomical League
https://www.astroleague.org/alphabeticobserving/

Observing Progam Selector Grid
https://www.astroleague.org/observing-program-selector-grid/

Navigating The Night Sky Guides
https://www.astroleague.org/navigating-the-night-sky-guides/

Grand Strand Astronomer's September 2023 Meeting Recap

Gerald Drake

Our last meeting was held on October 5, 2023, 7:00 to 8:00 PM via zoom. Ian opened the meeting and welcomed all who attended. The meeting was live streamed and available to view on YouTube.

Our recent Dark Sky observing session at Hampton Plantation went well. About 20 people came out. Our next one is schedule for October 14 (did not happened because of weather). This is the same day as the partial solar eclipse. We will meet at coastal Carolina where they will block off part of the parking lot and use some of the universities' H-Alpha telescopes. Also, on October 20 there is a public observing schedule at Huntington Beach Sate Park (also did not happen due to weather)

Ian gave an outstanding presentation of the sun. Hopefully, those who are participating in the public observing sessions can share this information with the public.Grand Strand Astronomers October 2023 Meeting Write-Up

A Q&A followed. Discussion the color radiation of the sun as compared to black body emissions. The sun behaves different because it is mostly gas. A lot of physics goes on in the sun so there is a lot to comprehend. Others share their experiences of seeing the Aurora Borealis.

End of meeting.

Please see page 10 for a wriiten version of Ian's presetation on the Sun. The presentation can also be found on YouTube.

Future Meetings and Outings

The next Hampton Plantation observation night is November 11.

The next indoor Zoom meeting is November 30.

November 2023 Calendar Of Celestrtial Events

http://www.seasky.org/astronomy/astronomy-calendar-current.html

November 3 - Jupiter at Opposition. The giant planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Jupiter and its moons. A medium-sized telescope should be able to show you some of the details in Jupiter's cloud bands. A good pair of binoculars should allow you to see Jupiter's four largest moons, appearing as bright dots on either side of the planet.

November 4, 5 - Taurids Meteor Shower. The Taurids is a long-running minor meteor shower producing only about 5-10 meteors per hour. It is unusual in that it consists of two separate streams. The first is produced by dust grains left behind by Asteroid 2004 TG10. The second stream is produced by debris left behind by Comet 2P Encke. The shower runs annually from September 7 to December 10. It peaks this year on the the night of November 4 and the morning of the 5th. The second quarter moon may block most of the dim meteors this year. But if you are patient, you may still be able to catch a few good ones. Best viewing will be just after midnight from a dark location far away from city lights. Meteors will radiate from the constellation Taurus, but can appear anywhere in the sky.

November 13 - New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 09:28 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

November 13 - Uranus at Opposition. The blue-green planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view Uranus. Due to its distance, it will only appear as a tiny blue-green dot in all but the most powerful telescopes.

November 17, 18 - Leonids Meteor Shower. The Leonids is an average shower, producing up to 15 meteors per hour at its peak. This shower is unique in that it has a cyclonic peak about every 33 years where hundreds of meteors per hour can be seen. That last of these occurred in 2001. The Leonids is produced by dust grains left behind by comet Tempel-Tuttle, which was discovered in 1865. The shower runs annually from November 6-30. It peaks this year on the night of the 17th and morning of the 18th. The crescent moon will set before midnight leaving dark skies for what should be a great early morning show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Leo, but can appear anywhere in the sky.

November 27 - Full Moon. The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 09:17 UTC. This full moon was known by early Native American tribes as the Beaver Moon because this was the time of year to set the beaver traps before the swamps and rivers froze. It has also been known as the Frosty Moon and the Dark Moon.

November 2023 Star Parties

http://www.seasky.org/astronomy/astronomy-events.html

Nightfall 2017
November 9 - 12, 2023
Host: Riverside Astronomical Society
Location: Palm Canyon Hotel & RV Resort in Borrego Springs, California
Website: http://nightfallstarparty.com/

Nightfall is a 3-night star party at a great hotel and RV resort! With pools, hot tubs, free presentations, a premium workshop and the surrounding Anza-Borrego Desert State Park, this is the best star party around. Period!

Astrofest 2023
November 11 - 17, 2023
Host: Chiefland Star Party Group
Location: Chiefland Astronomy Village in Chiefland, Florida
Website: https://chieflandastro.com/astrofest/

The Chiefland Astrofest Star Party is back, and we welcome you all to one of the best observing sites in the country, the Billy Dodd Memorial Field in the Chiefland Astronomy Village. If you have never attended a Chiefland Star Party, get ready for some of the finest observing and imaging in the USA. The Chiefland Astronomy Village's great weather, dark skies, and for Astrofest, the on-site food vendor and a line-up of great speakers all add to the unique Chiefland experience.

The Messier Catalog

http://www.seasky.org/astronomy/astronomy-messier.html

Deep Sky Objects
Portrait of Charles Messier, author of the Messier catalog of deep sky objectsThe Messier Catalog, sometimes known as the Messier Album or list of Messier objects, is one of the most useful tools in the astronomy hobby. In the middle of the 18th century, the return of Halley's comet helped to prove the Newtonian theory, and helped to spark a new interest in astronomy. During this time, a French astronomer named Charles Messier began a life-long search for comets. He would eventually discover 15 of them. On August 28, 1758, while searching for comets, Messier found a small cloudy object in the constellation Taurus. He began keeping a journal of these nebulous (cloudy) objects so that they would not be confused with comets. This journal is known today as the Messier Catalog, or Messier Album. The deep sky objects in this catalog are commonly referred to as Messier objects.

Although many deep sky objects can display a wide array of colors in long exposure photographs, the human eye is not sensitive enough to see most of these colors through a small telescope. The photos in this section are presented in black and white to best represent the view that would be seen through a telescope. Many of these photos are copyright protected. Click here for copyright & source information. Click the link below to open the catalog or use the menus below to help locate a specific object within the catalog.

Astronomy for Mere Mortals

Aaron B. Clevenson

An Introductory Astronomy Text

Learning about astronomy is a way for all of us to share in that universe. There are planets, stars, and galaxies waiting to be found. We just need to look. The more we understand about how it all works and how it all fits together, the greater its grandeur.

There are many quality texts available for astronomy, but they are often at a higher level than is appropriate for introductory astronomy courses taught often to non-science majors. New astronomers need a textbook that will facilitate learning and provide a way for them to incorporate astronomy components with things they already know. We want to incorporate astronomical terminology as the reader progresses through the material, but in a way that is clear and seamless for non-scientists.

The text assumes that this information may be conveyed as a single course, or as two courses of study: Solar System Astronomy, and Stars and Galaxies Astronomy. Rather than conventional chapters, the material is organized around Components. If you learn the material of the entire text, then you will have a complete picture of the universe.

This text book is a free 484 page manual that is broken into several teaching units. The Solar System Astronomy Course has four teaching units, and the Stars and Galaxies Astronomy Course has five teaching units.

You can download you free copy from Astronomical League at the following address:
https://www.astroleague.org/wp-content/uploads/2023/09/Astronomy-For-Mere-Mortals-v-23.pdf

All Photographs, unless otherwise indicated, are public domain. All astronomical photographs in this text are provided courtesy of NASA, unless otherwise indicated. (www.nasa.gov). All diagrams are original to the author, Aaron Clevenson, unless otherwise indicated.

Reflector Magazine

Astronomical League

The Astronomy League's Reflector Magazine is available to read. Issues from September 2023 to June 2021 can be downloaded here: https://www.astroleague.org/reflector/

Observing Program Division Announcement

Astronomical League

Reminder of the International Observe the Moon Night

The Observe the Moon Night Observing Challenge is upon us. Observations may be done from today through October 25, 2023. Deadline for submission is November 21, 2023.

For details on the Challenge, click on: https://www.astroleague.org/al-observing-challenge-special-observing-award/

For the downloadable certificate, click on: https://www.astroleague.org/wp-content/uploads/2023/10/IOMN-Certifictes-2023-v6-downloadable.pdf

Jupiter Racing Toward Opposition On November 2-3, 2023

https://earthsky.org/astronomy-essentials/jupiter-at-opposition-closest-brightest-best/
Deborah Byrd

October 7, 2023
Earth will fly between the sun and Jupiter – bringing Jupiter to its yearly opposition – on November 2-3, 2023. That's one day after Jupiter reaches perigee – its closest point – to Earth.

Jupiter in 2023
Maybe you've noticed Jupiter. It's been the very bright object ascending in the east earlier each evening. Brighter than all the stars!
It'll reach opposition on the night of November 2-3 (5 UTC (12 a.m. CDT) on November 3). That's when Jupiter will be most opposite the sun in our sky. It happens as Earth flies between the sun and Jupiter.
Jupiter is generally closest to Earth around opposition. And it's precisely closest one day before opposition, overnight (by American clocks) on November 1-2. At that time, its distance will be 3.982 astronomical units (Earth-sun units, aka AU)/ 370 million miles/ 595 million km/ 33.11 light-minutes from Earth.
Opposition constellation: Aries the Ram.
Brightness at opposition: Magnitude -2.9. Jupiter will shine as the 4th-brightest object in the sky, after the sun, the moon and the planet Venus. It'll be the brightest starlike object visible for most of the night (until Venus rises before dawn).
Size at opposition (as seen through a telescope): 49.45 arcseconds across.
Through binoculars (anytime): Jupiter reveals a bright disk. If you look closely, you'll see several of its four Galilean moons appearing as pinpoints of light, arrayed in a line that bisects the giant planet.

Remaining Jupiter Events In 2023

November 1, 2023: Jupiter at perigee, or closest to Earth for 2023.
November 3, 2023: Jupiter at opposition, or opposite the sun as seen from Earth.
December 30, 2023: Jupiter ends retrograde motion, a sign that the best time of year to observe Jupiter is ending. But the planet will remain somewhere in our night sky for many more months, and in fact is visible somewhere in our night sky for most of every year.

A Failed Star

Perhaps you know that Jupiter isn't a rocky planet like Earth. It's more like a failed star, not massive enough or hot enough inside to spark thermonuclear fusion reactions, but some 2 1/2 times more massive than all the other planets in our solar system combined. Jupiter is big! But without that thermonuclear reaction it can't shine as stars do.

You'd need some 80 Jupiters – rolled into a ball – to be hot enough inside to spark fusion. So Jupiter isn't a star. That is, it doesn't shine with its own light, but instead by reflected sunlight.

Yet in late October and early November 2023 – as bright Jupiter rises in the east more or less opposite the sunset – you can stand on Earth all night and peer toward bright Jupiter in our sky. And you can imagine that, if the giant planet did have enough mass to shine as stars do, then around Jupiter's opposition, we'd have no night at all. Instead, Jupiter would shine as a 2nd sun, all night long.

How To See And Enjoy Jupiter's Moons

https://earthsky.org/astronomy-essentials/how-to-see-jupiters-moons/
EartSky

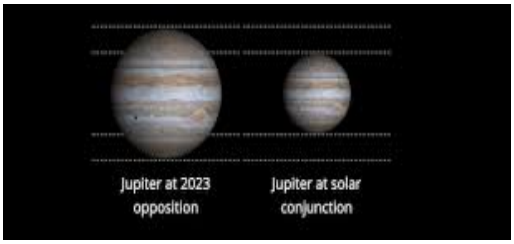
How To See Jupiter's Moons
All you need is a good pair of binoculars (or a telescope) to see the four largest moons of the biggest planet in our solar system, Jupiter.

Three of the four moons are bigger than Earth's moon. And one – Ganymede – is the largest moon in the solar system. These four satellites are collectively called the Galilean moons to honor the Italian astronomer Galileo, who discovered them in 1610. October 2023 is a great month to look for Jupiter's four large moons. That's because the king of planets is nearing opposition – when Earth will sweep between it and the sun – in early November. So the distance between Earth and Jupiter is now less than usual. And Jupiter is bright!

From Earth, through a small telescope or strong binoculars, the moons of Jupiter look like tiny starlike pinpricks of light. But you'll know they're not stars because you'll see them stretched out in a line that bisects the giant planet.

Depending on what sort of optical aid you use, you might glimpse just one moon or see all four. If you see fewer than four moons, that might be because a moon is behind – or in front of – Jupiter. If a moon is in front of the planet, you can sometimes see the moon's shadow on Jupiter's cloud-tops. That shadow is called a transit.

Going from the moon closest to Jupiter to the outermost, their order going outward from Jupiter is Io, Europa, Ganymede and Callisto.



Jupiter at opposition vs conjunction

Jupiter and the 4 Galileon Moons

Special Viewings Of Jupiter's Moons
As with most moons and planets, the Galilean moons orbit Jupiter around its equator. We do see their orbits almost exactly edge-on, but, as with so much in astronomy, there's a cycle for viewing the edge-on-ness of Jupiter's moons. This particular cycle is six years long. So every six years we view Jupiter's equator – and the moons orbiting above its equator – at the most edge-on. During these special times, we can see the moons eclipse and cast shadows on not just giant Jupiter but on each other.

In 2021 we were able to view a number of mutual events (eclipses and shadow transits) involving Jupiter's moons. The next cycle of mutual events will be in 2027.

Another special event, a rare triple transit, occurs on October 18, 2025, when three of Jupiter's moons will pass in front of the giant planet at once. The last time Earth could witness a triple transit was in 2021. Triple transits are not visible from all parts of the globe, however.

Jupiter At Opposition In November 2023
On November 2-3, 2023, Jupiter is at opposition, when the planet is opposite the sun in the sky as seen from Earth. When Earth passes directly between Jupiter and the sun, we'll see Jupiter rise at sunset and set at sunrise. Opposition is the middle of the best time of the year to see a planet, since that's when the planet is up and viewable all night and is generally closest for the year. But any time Jupiter is visible in your sky you can view Jupiter's four major moons.

So if you get a chance, grab some binoculars or a small telescope and go see Jupiter's Galilean moons with your own eyes!

Our Sun
Ian Hewitt's Presentation on the Sun

The sun is huge; 110 earths can stretch across the sun. 99% of All mass in the solar system is made up by the sun. Sun spots reveal that the sun is rotating at a rate of 25 to 36 days. There is not a solid surface so different parts of the sun rotates at different speeds. The interior is rotating much faster. It's a ball of plasma so the different rotation speeds are not surprising. The sun emits all colors, so it looks white to us. Its luminosity is huge at about 3.86 x 10^26 W. That equate to 1 million billion billion 100 W light bulbs. Lots of energy. The prominence emitted from the sun are huge as well. They look small compared to the sun, but they are much larger than the earth.

Up to 100 years ago, we really didn't know what the sun was made of. The leading theory was that it was made of the same stuff as the earth, just heated up really hot. But a young astronomer named Cecilia Payne-Gaposchkin developed a different model. It was not initially accepted, but her dissertation is considered one of the most brilliant in history. Not being allowed to graduate from Cambridge, she moved to the US and received her PHD at Harvard/Radcliffe where she later taught. By calculation she came up with the components of the sun. Her numbers were found to be totally correct. Her model showed our sun is made up of 73% hydrogen and 25% helium with some other trace elements. She was finally recognized as full professor in 1956. To astronomers, everything besides hydrogen and helium are considered metals.

Inside the sun is nuclear fusion. This only occurs deep inside the core where the pressures and temperatures are high enough to sustain the process. That is the inner 10% of the sun. It takes light anywhere from 4000 to 500,000 years to travel from the sun's core to the surface. Light gets generated in the fusion process, but is captured by gravity and bounces off atoms as it slowly moves through the layers. The sunlight you see today, was actually generated as much as 500,000 years ago.

The sun's power is derived from a sequence of fusion process collectedly called the proton-proton chain. 6 protons in; gets converted to 1 helium, 2 hydrogens, neutrinos, and light. The result weighs less than the 6 protons of hydrogen. The missing weight is explained by Einstein's famous equation E=mc2. The missing math is due to mass being converted to energy.

Our sun is made up of a core, radiation zone, convection zone, photosphere, chromosphere, transition zone, and corona. Astronomers are mainly interested in the upper 3 layers; the photosphere, chromosphere, and corona. The photosphere is considered the surface, although there is no hard surface you can stand on. It is where the gas is optically thin and less gas density allows the light to escape. The photosphere is what you see when you look at the sun with a white light filter (never look directly at the sun without the right filter. You'll burn your eyes out). This is where you see sun spots. It is also where you get the temperature of 5800 K. The core is actually 15 million K.

When you look at sunspots though the right filter, they look small but they are actually the size of earth. Galileo discovered sun spots in the early 1500's using an inexpensive primitive telescope by our standards and no filters. He did damage to his eyes. The sun spots proved the sun was not perfect as supposed by people of his time. Sunspots look black because they are relative cooler than the surrounding surface. They occur in pairs because they are formed by magnetic field lines generated with in the sun. Just like a magnet has North and South poles these sunspots have two poles that go in and out of the sun. They always occur in pairs because the magnetic field holds them open. You may not always see the second spot, but it will be there. Sometimes plasma will shoot up and follow these magnetic lines. These are called prominences.

Sun spots occur in 11-year min/max sequence. Charts have been made and its cycle is determined to be pretty reliable. When there are more sunspots there seems to be higher temperature on earth meaning the sun is more active. Although sun spots contribute to temperature variability on earth, they are not driving climate change. Ian shared a chart that shows the sun variability as declining while global temperatures are rising.

When you look at the sun with a white light filter, you are looking at the photosphere. The next layer up is called the chromosphere. It is like the sun's atmosphere. It is called the chromosphere because it has a distinct red color. You can see the sun's chromosphere during a full solar eclipse. You can also see it using an H-Alpha telescope. The chromosphere emits very little light because it is of low density. It always looks red because of the 3 to 2 (656.3 nm) line emissions of hydrogen.

While the photosphere hovers around 5,800 kelvin, the temperature of the chromosphere varies between 4,500 K and 20,000 K. Even though it's more distant from the center of the Sun, the chromosphere is hotter than the photosphere. The cause of this is still being studied today. Some think it is because of the magnetic field. The chromosphere is 10,000 times less dense than the photosphere and 100 million times less dense that Earth's atmosphere.

A hydrogen-alpha telescope shows the chromosphere layer and all its activities such as the prominences that shoot up. As you observe these prominences over two or three hours, you'll note a lot of change. Ian shared a video of changing prominences and convection activity.

The magnetic lines in a prominence will actually snap and release energy and solar material. This is called coronal mass ejection. Ian shared satellite images showing only the solar flares and coronal mass ejections (CME). The satellite has a blocking disk that blocks out the sun so only the chromosphere is visible.

Solar flares are energetic burst of light and particles triggered by the release of magnetic energy on the sun. They are very powerful, like billions of hydrogen bombs. These move pretty fast and get to the earth in 20 minutes.

CMEs are huge clouds of solar plasma. They too travel fast to the earth and can cause power grid problems. In 1859 there was a massive CME that took out a lot of telegraph equipment due to induced energy.

While looking at H-Alpha scopes, there are a couple of things you'll see. You will see the prominences and filaments. They are actually the same thing. Prominences you'll see around the rim, but if you're looking down on prominence rising in the middle of the sun they'll look like filaments.

The 11-year cycle occurs because the sun's rotation is different within its layers. This causes the magnetic field to twist up and eventually snap back to smooth lines. You can watch this as sun spot activity starts out on the rim, then move closer to the middle over time. When the magnetic field snaps, it actually switches poles. N becomes S and S becomes N. So, the suns poles change every 11 years. The sun gets more active as it gets closer to the peak of this cycle.

In a total eclipse, you can observe the corona and see that it is indeed very thin. The solar gas escapes and becomes solar wind. Solar wind moves about 500 km/sec and reaches earth in about 3 days. Our magnetic field protects us from the sun's escaping particles. These particles get trap in our magnetic field in between field lines. This is known as the Van Allen radiation belt. These charged particles lose energy end up following the earths magnetic lines up to the poles. It shows up as aurorae when the charged particles interact with our atmosphere causing a glowing light. Reacting with different gases produces different colors.

Such as red from nitrogen and green from oxygen. In 2003 there was some very large solar flares. So much so, the red color could be seen as far south as South Carolina with the naked eye. The green was harder to see could be seen in dark areas.

The Caves and Canyons of Mars: Charting Optimal Roads Using the Eskey System

By Megan Eskey

Reloquence, Inc. has completed the first maps of the first lunar roads under contract with FiOR Innovations, a US-based mapping company. We have charted three inaugural roads, and are currently working on a poster suitable for hanging on the wall.

Our next step is to chart the inaugural roads on Mars, demonstrating the general applicability of the Eskey System, the first planetary address framework to include a system of roads. Using our proposed standard, we will consider planetary geomorphology to create optimal networks of travel for resource acquisition, exploration and colonization.

Imagine an effort that sends robotics rovers ahead of manned missions to lay down rover tracks; astronauts could later follow the roads, allowing them to go faster and farther more safely. It's similar in concept to how humans used the earliest roads; they followed animal tracks.

How many miles of planetary roads would we need on the Moon and Mars? I've estimated ~190K miles of roads on the Moon and ~280K miles on Mars. On Earth, roadbotics companies provide a service to governments around the world to objectively manage their road networks using artificial intelligence. In space, roadbotics might include autonomous rovers that are better, faster and cheaper with only one purpose: to leave their tracks for future explorers. Some of the Mars rovers leave their names in the tracks. In Figure 1, holes in Curiosity's tire treads spell out JPL (Jet Propulsion Laboratory) in Morse code.

Figure 1: Curiosity's tire treads spell out JPL in Morse code

A space logistics platform could coordinate roadbots from many different space agencies around the world, similar in concept to how Uber coordinates rides and ride sharing across multiple drivers, thereby minimizing the cost per passenger. As a symbol of peace, the rovers could spell out the names of the roads in the tire treads in many different languages. As of 2023, 74 different government space agencies are in existence, including 68 national space agencies and six international agencies.

I have taken some time to explore the legal implications of the planetary roads in the context of United Nations (UN) outer space treaties, and have concluded that they may fall into a gray area based on recent US legislation that has legalized the ownership of natural resources on the moon. In the same way that natural resources are not land, so too the roads are not land.

> "Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."

Power, communication and terrain are three factors that must be considered in planning a rover traverse. What is the optimal approach to charting the planetary roads on a map? In the simplest use case, a low slope route will suffice with slopes of 15 degrees or less, avoiding steep craters and steep cliffs, while optimizing for speed. A map that charts the low slope routes from a set of candidate landing sites on Mars would be beneficial, but will not cover every use case.

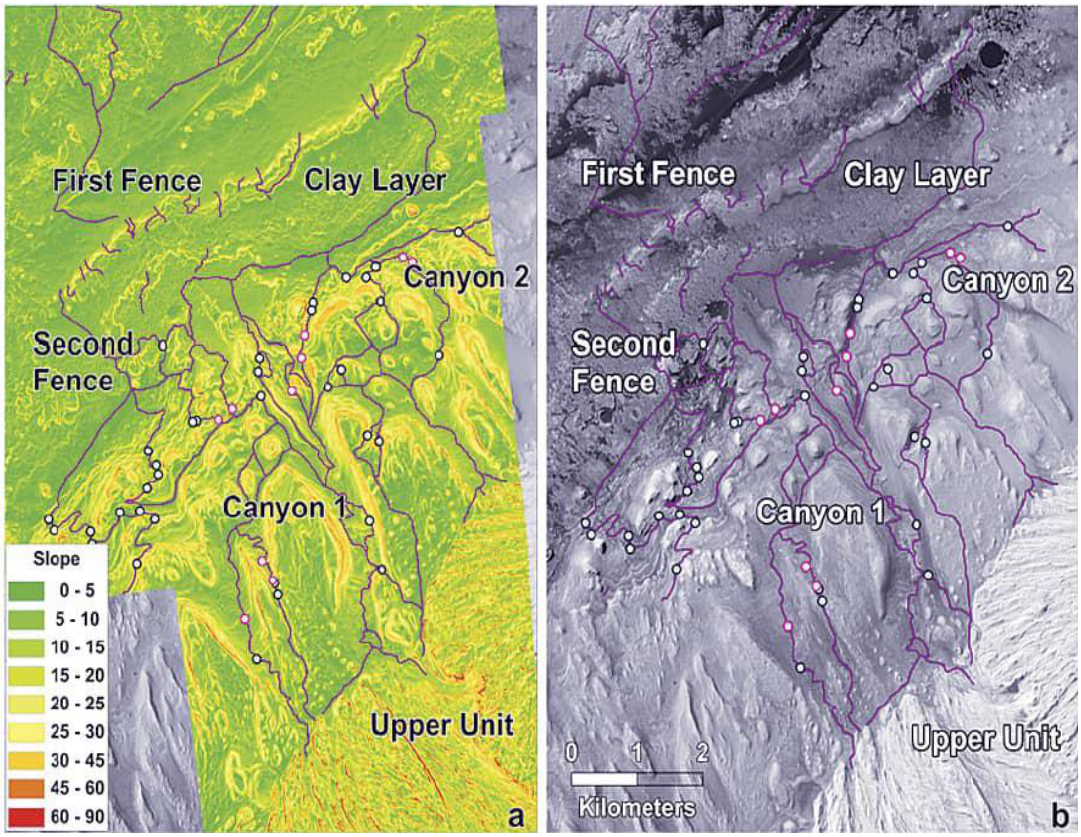


Figure 2: Curiosity cuts through the canyons using multiple candidate routes near Mount Sharp on Mars

In the example of a canyon, shown in Figure 2, the width of the passage will constrain the possible routes. Temperature and illumination are two other factors to consider in choosing an optimal landing site. Communication delays between the rovers and the mission controllers on Earth slow them down, sometimes to the point of being impractical from the standpoint of laying a network of rover tracks. On Mars, the rovers have a maximum speed of about .1 mph, and can operate in three modes: autonomous using AutoNav, controlled via data passing back and forth between Mars and Earth, and blind. Although blind is the fastest mode, it is also the most dangerous. One possibility would be to add a fourth mode that is a blend between blind and some initial set of good candidate routes, while optimizing for speed.

I have focused on two use cases for Mars: the canyons and the caves. The caves are perhaps the highest priority because the earliest explorers would benefit most from a network of rover tracks leading to their openings, viewable from space. The caves are possible shelters for future manned missions to Mars.

Dust storms and sand traps are obstacles that should be avoided. Sand traps are not necessarily circumvented by low slope routes. Dust storms block the sun so that the rover can't recharge its batteries using solar panels, but neither of these obstacles will be easily identified in time to avoid a breakdown.

Using mapping software, sophisticated algorithms determine optimal routes based on a variety of variables such as weather, landforms, resource proximity and human ecosystem requirements for survival in extreme environments. Before sending any rovers to the surface of the Moon or Mars, simulations and analogs on Earth will help to identify potential hazards and pitfalls. On the lunar and Martian surfaces, charting optimal planetary roads will necessarily consider many different factors.

Explore the Oort Cloud, Home of Long-Period Comets

https://starwalk.space/en/news/what-is-oort-cloud?utm_medium=content&utm_source=email&utm_campaign=roundearth

Have you ever wondered what lies at the farthest reaches of our Solar System? Scientists believe that a massive “bubble” of ice and dust surrounds the Solar System – this region of space is called the Oort Cloud. The Oort cloud is so far away and so hard to reach that most of its secrets remain hidden. But we need to keep studying it to understand what our Solar System actually looks like and how it was formed. In this article, we’ll take a look at what we know so far about this fascinating region of space.

What is the Oort cloud?
The Oort cloud is a theoretical spherical cloud composed of small icy bodies that surrounds the Solar System. The existence of the Oort Cloud hasn’t yet been proven by direct observation, but it is widely accepted by the scientific community.

What is the Oort cloud made of?
The Oort Cloud is made of trillions of small icy objects that travel in different orbits. These objects, most of which are less than 100 km (62 miles) in size, contain a variety of icy substances like water, methane, ethane, carbon monoxide, hydrogen cyanide, and ammonia. Together, they form a celestial cloud with a total mass estimated to be 10-100 times that of the Earth.
Objects in the Oort cloud

The Oort cloud is believed to be home to long-period comets – those that take from 200 to thousands of years to orbit the Sun. In fact, these comets are evidence that the Oort cloud exists.

As the Dutch astronomer Jan Oort, after whom the Oort Cloud is named, suggested, long-period comets couldn’t survive in their orbits close to the Sun. The gravitational pull would soon cause them to collide with the Sun or one of the planets. Moreover, comets burn out relatively quickly as they pass through the Solar System, so there must be a “fresh supply” of comets in a colder, distant region; otherwise, we wouldn’t see so many comets in our era. Based on these observations, Jan Oort concluded that there is a spherical reservoir of comets at the edges of the Solar System.

Long-period comets spend most of their life within the Oort cloud. However, they can be occasionally “knocked out” of their orbits by passing stars, molecular clouds, or galactic tides. As a result, they begin to fall into the inner Solar System and become visible as they approach the Sun. It’s supposed that there are numerous potential long-period comets in the Oort cloud that have yet to visit the Sun.

It’s also thought that the Oort Cloud may contain dwarf planets. One notable example is Sedna, discovered in 2005. With its remarkably elongated orbit, Sedna takes around 11,400 years to return to its closest point to the Sun, at a distance of 76 astronomical units (AU).

How did the Oort cloud form?
Scientists believe that the Oort cloud appeared together with the Sun and the planets of the Solar System approximately 4.6 billion years ago. As young giant planets (such as Jupiter and Neptune) formed, their gravitational pull started to influence the trajectories of smaller objects, called planetesimals. Some of the planetesimals collided with larger objects, some were captured as moons, and others were pulled far away from the Sun into the forming Oort cloud. After that, the gravity of the galaxy probably caused them to settle in the spherical cloud at the edge of the Solar System, where the planets and the Sun couldn’t disturb them anymore.

The Oort cloud is still not stable. Some of the cloud's inhabitants may get pulled away into the vastness of space, and some objects may also be collected from the neighboring star systems.

Oort cloud distance & size
The Oort cloud is a massive and most distant region of the Solar System, but what is its actual size and location?

The Oort cloud is located in the interstellar space at the very edge of the Solar System. At such a distant location, the Oort cloud isn't affected by the Sun's magnetic field and the planets' gravitational forces.

The inner edge of the Oort cloud is located at around 2,000 AU from the Sun. This means the Oort cloud begins a whopping 2,000 times farther from the Sun than the Earth! Just to give you an idea, Neptune, the farthest planet in our Solar System, is only about 30 AU away from the Sun.

How big is the Oort cloud?
As noted above, the inner boundary of the Oort cloud is around 2,000 AU from the Sun. Its outer boundary lies somewhere between 10,000 and up to 200,000 AU from the Sun. The outer boundary of the Oort cloud can reach halfway to our nearest neighbor, Proxima Centauri. With our current technology, it would take approximately 30,000 years for a human-made spacecraft to pass through this vast space region.

Is it possible to see the Oort cloud?
The ice particles that form the Oort cloud move too slowly and don't reflect much light; they are also just too far away from us – so, for now, the Oort cloud can't be seen even with the most powerful telescopes. But we can explore it indirectly through the objects that escape the cloud and "fall" into the inner Solar System. Most of such objects are long-period comets.

You can use the free astronomy app Sky Tonight to locate the comets reaching us from this distant region of space. For example, the newly discovered long-period comet C/2023 A3 (Tsuchinshan-ATLAS) is expected to reach a magnitude of -3.5 by October 2024, clearly visible to the naked eye. For now, it's not a notable sky object, but you can already track it in the sky with Sky Tonight. To find out more about the comet C/2023 A3 and how to locate it via Sky Tonight, read our dedicated article.

Bottom line
The Oort cloud is a huge and distant cloud made up of trillions of icy objects surrounding our Solar System. Stretching from 2,000 to 200,000 AU away from the Sun, it remains hidden from direct observation. However, by observing long-period comets that originate from the Oort cloud, we can gain insights into this enigmatic region. Track these cosmic visitors with the help of stargazing apps like Sky Tonight, and marvel at the wonders of our vast and fascinating universe.

Spinning Propeller Star Slingshots Plasma at 7 Million MPH

harles Q. Choi, Contributor
https://www.insidescience.org/news/spinning-propeller-star-slingshots-plasma-7-million-mph

The fastest-spinning white dwarf on record completes a full rotation in 25 seconds.

(Inside Science) -- Astronomers have detected the fastest-spinning white dwarf star found yet -- one that researchers say acts like an extraordinarily powerful magnetic propeller, a new study finds.

White dwarfs are stars that have burnt up all their fuel and shed their outer layers, leaving behind their cool, dim cores. Our sun will one day become a white dwarf, as will more than 90% of the stars in the Milky Way.

In the new study, researchers analyzed the white dwarf in the binary star system LAMOST J024048.51+195226.9. The white dwarf is a stellar remnant about 2,015 light-years from Earth that is roughly our planet's size but at least 230,000 times its mass. The researchers imaged the spinning of the star using the highly sensitive HiPERCAM instrument on the largest functioning optical telescope in the world, the 10-meter-wide Gran Telescopio Canarias in Spain's Canary Islands.

The white dwarf's powerful gravity yanks plasma off its larger companion, a red dwarf star. In the past, this material fell onto the white dwarf's equator at high speed, resulting in its extraordinarily fast spin.

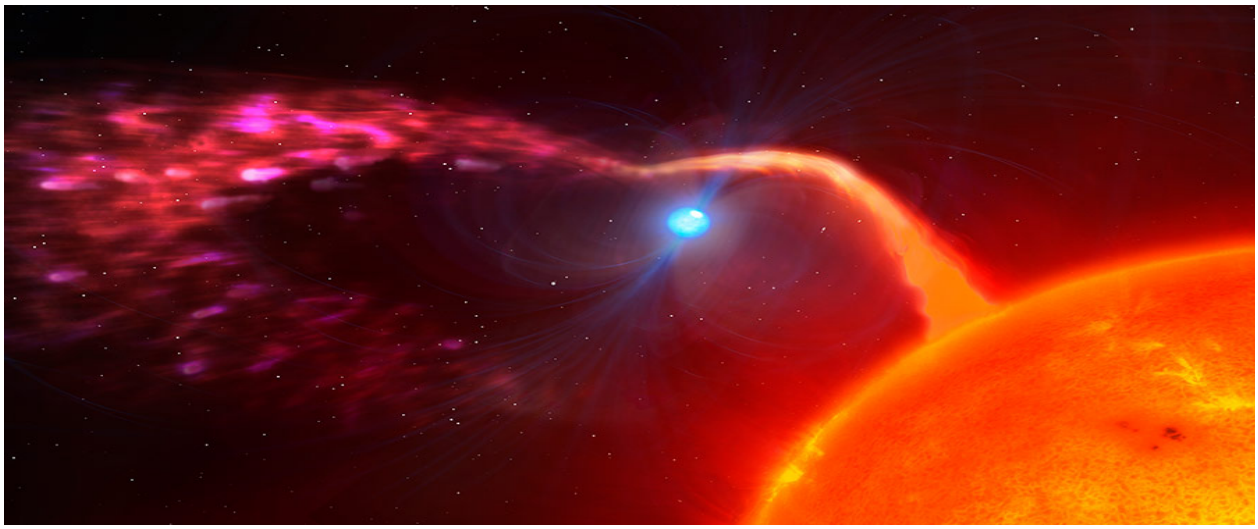
The white dwarf also possesses a strong magnetic field, which acts like a protective barrier that causes most of the plasma falling onto it to blast out from the dead star at speeds of roughly 6.7 million mph. This makes this stellar remnant only the second "magnetic propeller" white dwarf ever found, more than 70 years since the first.

Any plasma that doesn't get propelled away from J0240+1952 flows toward the white dwarf's magnetic poles. It gathers in bright spots on the white dwarf's surface, and as these rotate in and out of view from Earth, astronomers observe pulses of light, which they use to measure the white dwarf's rate of spin.

All in all, the white dwarf completes one full rotation in a record-breaking 25 seconds. That is nearly 20% faster than the next fastest-spinning white dwarf, which completes a revolution in just over 29 seconds. "Put into Earth's perspective, it is like the day only lasted for 25 seconds," said study lead author Ingrid Pelisoli, an astrophysicist at the University of Warwick in England.

These findings help support theoretical predictions of how magnetic propellers should behave, which scientists had not been able to confirm until they found a second example of one. "I find it very satisfactory to find exactly what you expected," Pelisoli said.

The scientists detailed their findings online Nov. 22 in the journal Monthly Notices of the Royal Astronomical Society.



On November 29 and 30
The Sun aligns with the streets of Manhattan. But on November 30 it's perfectly aligned. So if the weather conditions are not ideal, you can always try the day before.

These are all the updates for November. You are welcome to enjoy the beautiful sky view throughout the whole month. Take a camera with you, and gather some gorgeous pics. If you need help, I'm here for you. Just whistle or leave a comment below. I'll do my best to solve your problem.

Astronomy Humor

STAR JOKES

Q: What does a star win in a competition?
A: A constellation prize

Q: What kind of stars wear sunglasses?
A: Movie stars

Q: Who here can tell me the distance from Betelgeuse to Procyon
using a standard chart?"
A: About an inch and a half.

PLANETS JOKES

* Scientists have found that the center of Jupiter contains the letter "i".

*Jupiter came down to Earth one day and helped these two criminals plan a bank robbery. Anyway, they both got caught and after the judge sentenced the two earthlings to fifteen years behind bars, Jupiter was a bit shocked to get arrested and handed a ten year stretch himself. "But your honour. I didn't even take part in the robbery!" said Jupiter. "Yes" replied the judge. "But you did help them Planet!"

Q: How does Jupiter hold up his trousers?
A: With an asteroid belt.

Q: What type of songs do the planets sing?
A: Nep-tunes!

MOON JOKES
* One kid asks the other, "Which is closer, Florida or the Moon? the second answers: "Duh! The Moon! You can't see Florida from here!

* If your kid seems a little obsessed over the moon, don't worry. It's probably only a phase.

Q: what do you call a tick on the moon?
A: A luna-tick.

Q: How do you know when the moon is going broke?
A: When it's down to its last quarter.

Heavens Above
November 2023 Interactivity Shy Chart

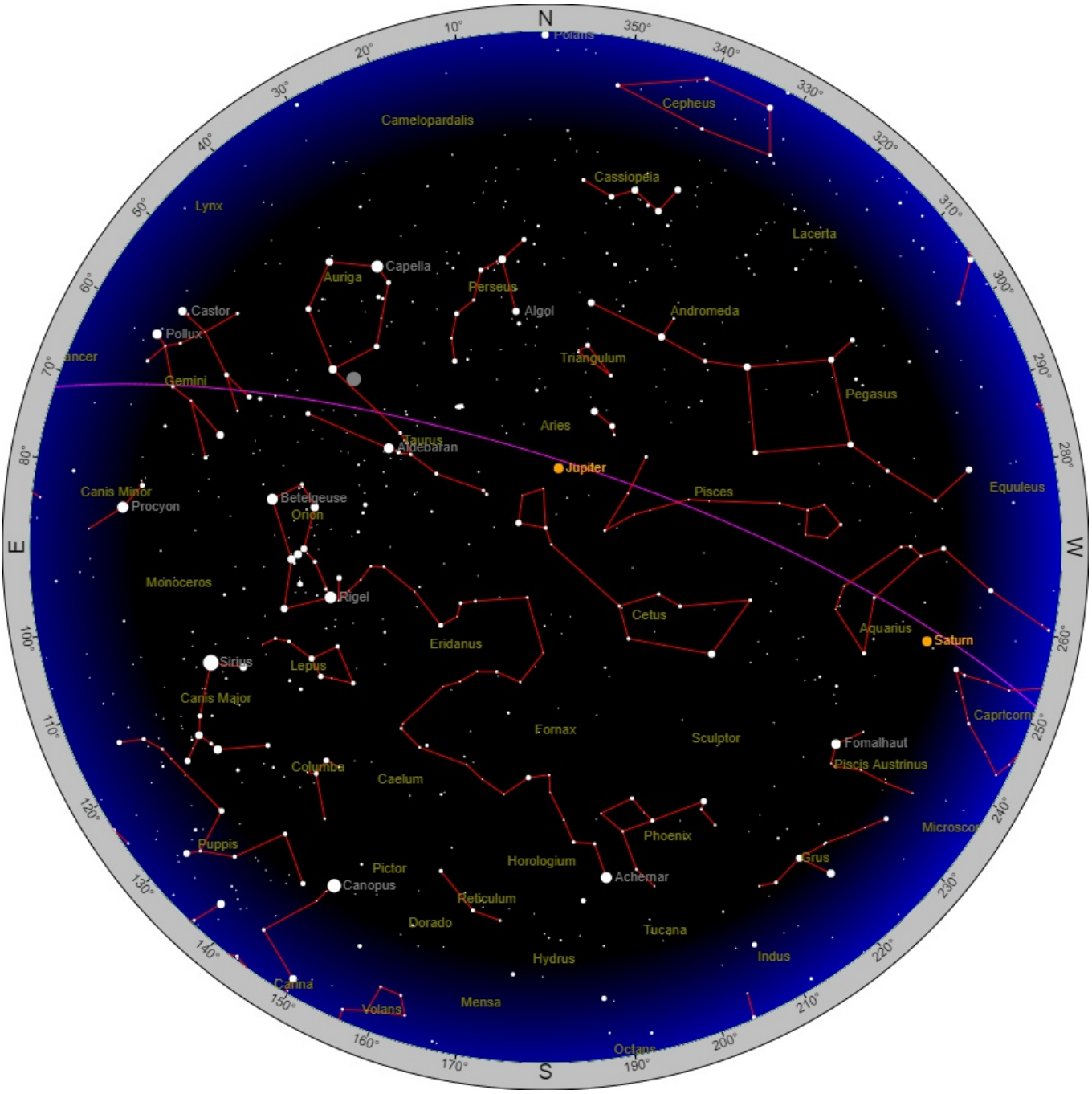


Illustration shows the following:

--> ecliptic plane
--> star names
--> planet names
--> constellation names
--> constellation lines