NWASNEWS

Volume22, Issue 3

November 2016

Newsletter for the Wiltshire, Swindon, Beckington Astronomical Societies and Salisbury Plain

WHAT DO WANT FROM YOUR SOCIETY?

Firstly can I welcome our returning speaker Philip Perkins who last came to us when we met over the road in the WI hall.

His imaging of the night sky is really inspirational, making the transition from film (hyposensitising film was no joke) then moving over to digital.

His work can be seen on his website Astrocruise.com. He has an observatory in the south of France, but also does a lot of imaging from here in Wiltshire near Aldbourne.

What I have noticed is the drop in submissions for the newsletter from members, indeed the two usual submitters were indisposed for various reasons this month. It leads me to ask the question for the future.

What type of articles would you like to see in the newsletter/web site/Facebook pages?

Do we need the full 20+ page newsletter going forward?

With my resignation coming up, it would be nice to get all the future for the society agreed, and most importantly it can become even more member representative.

In the early years there may have been more beginners experiences, especially where I was learning the hard way myself, not worried about putting my mistakes to the society so, hopefully, they may learn from my mistakes.

Would somebody like to write a beginners piece every month? It doesn't have to be all your own work.

At last we have our darker skies with longer nights, it may bring cold and some cloud, but did you know there are more cloudy nights in August than in December? It is just a case of wrapping up warm and getting out there.

We have to put up with a lot of media hype these days, and a lot of inaccurate reporting, but Supermoons and Brilliant Meteor Displays (sometimes BOTH at the SAME TIME as last month Orionids, this months Leonids and next months Geminids) are thrown at us and builds expectations from the public. I feel we have to represent a more balanced view for the public, so some trawling for information will appear in the Space News section.

Clear skies

Andy

As predicted October brought us aurora as for south as Wiltshire, but only just. Here the mauve glow is all that could be seen on the 25th August, with bright Capella visible through the glow. Other nights we had cloud or high mist just at the wrong time for seeing the glow. It could just be seen to the naked eye. Andy.

Wiltshire Society Page

Wiltshire Astronomical Society
Web site: www.wasnet.org.uk
Meetings 2015/2016Season.
NEW VENUE the Pavilion, Rusty Lane, Seend
Meet 7.30 for 8.00pm start
2016

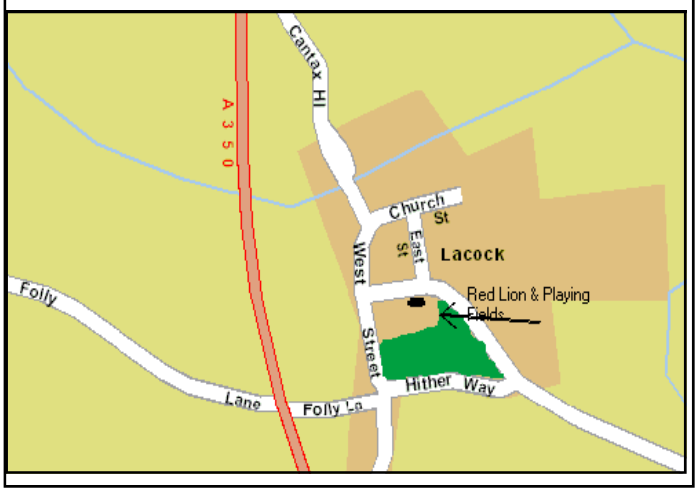
1 Nov	Philip Perkins, Imaging the Cosmos
6 Dec	Andrew Lound, Saturn – Lord of the Rings
3 Jan	TBA (Probable beginners set up session)
7 Feb	Professor david Southwood, 10 Years of Space Science at the European Space Agency
7 Mar	Steve Tonkin, And yet it Moves!
4 Apr	Dr Chris North, Telescopes through the Ages
2 May	Martin Griffiths, Planetary Nebulae Marathon
6 Jun	Mark Radice, Observing from the Caribbean + AGM

Observing Sessions

The Wiltshire Astronomical Society's observing sessions are open, and we welcome visitors from other societies as well as members of the public to join us.
We will help you set up equipment (as often as you need this help), and let you test anything we have to help you in your choice of future astronomy purchases.

Please treat the lights and return to full working order before leaving. With enough care shown we may get the National Trust to do something with them!

PLEASE see our proposed changes to the observing sessions, contacting and other details. Back Page

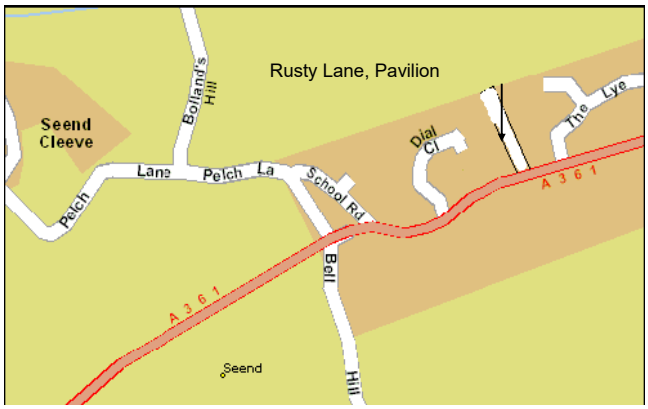


Our speaker tonight:
Philip Perkins
Astrocruise
http://www.astrocruise.com/
His biography is to the right.

Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

Andy Burns (Chairman, and Editor) Tel: 01249 654541, email: anglesburns@hotmail.com
Vice chair: Keith Bruton
Bob Johnston (Treasurer)
Philip Proven (Hall coordinator)
Peter Chappell (Speaker secretary)
Nick Howes (Technical Guru)
Observing Sessions coordinators: Jon Gale, Tony Vale
Contact via the web site details. This is to protect individuals from unsolicited mailings.



I have been interested in astronomy since about the age of twelve, when I can remember reclining full length on the dew-laden lawn of my parent's house in Parkstone, Dorset, trying to spot the polar caps of Mars through a 2" non-achromatic refractor I was given for my birthday.
My interest waned somewhat during my later teens, 20's and 30's (a misspent youth and subsequent preoccupations with career and family seemed to be the main cause), but re-emerged strongly in 1988 when I purchased my first 'real' telescope - a Meade 8" LX3. It was with this telescope that I started to dabble in astrophotography, but went on to more serious things in 1994 with the acquisition of a Meade LX200 10".
I started to become seriously involved in astrophotography in December 1996. In order to get better images I needed a dark site, so I started making regular trips to the south of France. I also acquired many images from the back garden of my house in Wiltshire, UK.
During 1998 I replaced my Tamron 300mm lens with Nikon 300mm and 400mm lenses and upgraded my hypering kit to support high vacuum film hypersensitisation. During my first two years of experience in astrophotography I became increasingly aware of the need to cover focal lengths in the 1000mm range. Therefore late in 1998 I made two major acquisitions: an AP 900 GTO mount and an AP 155 EDF f/7 refractor with 4" Field Flattener. A little later I also acquired a Pentax 6x7 camera to enable medium format photography with the new refractor. At this time most of my photography was done on gas hypersensitised film.
In October 2000 I replaced my 10" LX200 OTA with a 12.5" Ritchey-Chretien from RC Optical Systems to support higher quality in wide field photography. The RC has other advantages, such as 1/6 wave optics, a superb focusing system, and very good thermal stability (the focus does not shift during the night). A little later, in February 2001, I made a move into CCD imaging with the purchase of an SBIG ST-8E camera.
I am grateful to the many friends on mail lists such as APML and SBIG who have given me invaluable help. Mail lists are a wonderful thing - there is more knowledge and experience to be had than in any book, and it's totally free. Without this help I would still be in the proverbial dark ages.

Swindon Stargazers

Swindon's own astronomy group

The club meets once a month at Liddington Hall, Church Road, Liddington, Swindon, SN4 0HB at 7.30pm. See programme below.

Ad-hoc viewing sessions

Regular stargazing evenings are being organised near Swindon. To join these events please visit our website for further information.

Lately we have been stargazing at Blakehill Farm Nature Reserve near Cricklade, a very good spot with no distractions from car headlights.

We often meet regularly at a lay-by just outside the village of Uffcott, near Wroughton. Directions are also shown on the website link below.

When we use East Kennett, we meet at the public car park just below The Red Lion pub at Avebury; we usually hang on for 10 minutes and then move on to our viewing spot at East Kennett. Information about our evenings and viewing spots can be found here:

http://www.swindonstargazers.com/noticeboard/noticeboard06.htm

If you think you might be interested email the organiser Robin Wilkey (see website). With this you will then be emailed regarding the event, whether it is going ahead or whether it will be cancelled because of cloud etc.

We are a small keen group and I would ask you to note that you DO NOT have to own a telescope to take part, just turn up and have a great evening looking through other people's scopes. We are out there to share an interest and the hobby. There's nothing better than practical astronomy in the great cold British winter! And hot drinks are often available, you can also bring your own.

Enjoy astronomy at it's best!

Members of the Wiltshire Astronomical Society always welcome!

Meetings for 2016

At Liddington Village Hall, Church Road, Liddington, SN4 0HB – 7.30pm onwards

The hall has easy access from Junction 15 of the M4, a map and directions can be found on our website at:

http://www.swindonstargazers.com/clubdiary/directions01.htm

Friday 18 Nov 2016

Programme: Mike Leggett: Exploration of Mars

Friday 16 Dec 2016

Programme: Christmas Social at The Village Inn, Liddington

Meeting Dates for 2017:

Friday 20 January 2017
Programme: Sally Russell - Astronomical Sketching

Friday 17 February 2017

Programme: David Boyd - Spectroscopy

Friday 17 March 2017

Programme: AGM plus Dr Bob Gatten - Using the Faulkes Telescope Project's remote telescopes, results so far

Friday 24 April 2017

Programme: Dr Pauline Norris - The Ancient Egyptians and their Astronomy

Friday 19 May 2017

Programme: Martin Griffiths - Contact with extraterrestrials, how will it affect us

Friday 16 June 2017

Programme: Paul Roche - Robotic Astronomy

Website:

http://www.swindonstargazers.com

Chairman: Peter Struve

Tel No: 01793 481547
Email: peter.struve@sky.com
Address: 3 Monkton Close, Park South, Swindon, SN3 2EU

Secretary: Dr Bob Gatten (PhD)
Tel Number: 07913 335475

Email: bob.gatten@ntlworld.com
Address: 17, Euclid Street,

Swindon, SN1 2JW

BECKINGTON ASTRONOMICAL SOCIETY

Society Details & Speakers programme can be found on our Web-site www.beckingtonas.org

General enquiries about the Society can be emailed to chair-man@beckingtonas.org.

Our Committee for 2016/2017 is

Steve Hill----------Chairman- 01761 435663

John Ball----------Vice Chairman- 01373 830419

…….john@abbeylands1.freeserve.co.uk

Sandy Whitton---- Secretary-07974-841239

……..sandy.whitton@blueyonder.co.uk

Jacky Collenette---Treasurer…collenettejacqueline@yahoo.co.uk

Mike Witt---------- Membership-……mjwitt@blueyonder.co.uk.

John Dolton------Committee…. member@jdolton.freeserve.co.uk

Meetings take place in Beckington Baptist Church Hall in Beck-ington Village near Frome.

See the location page for details of how to find us on our web-site……

Post Code for Sat Nav is BA11 6TB.

Our start time is 7.30pm.

Programme details for 2016/2017

2016

Oct 21st…… Spectroscopy…….… Hugh Allen

Nov 18th…. An Echo of Ingenuity……. Dick Cardy

2017

Jan 20th: Tales from the Dark Side (Pt. 2)……. Mike Witt

Feb 17th: A Very Victorian Scientist……. Andy Burns

Mar 17th: The Sun…….. Ron Westmaas

Apr 21st: Observing the Solar System……..… Mark Radice

May 19th: Imaging Colloquium `Open discussion bring your kit along`…… Steve Hill.

All are welcome to come along for a chat from beginners to ex-perts.

SALISBURY PLAIN OBSERVING GROUP

Where do you meet?

We meet at a variety of sites, including Pewsey Downs, Everleigh, Bratton Camp, Redhorn Hill and Whitesheet Hill. The sites are cold in winter so you will need warm clothing and a flask. We are always looking for good sites around the edge of the Plain.

Do I join?

No. We are not a club. We meet informally, so aside from contacting our friends to give a yes or no to meet-ing up, that's it.

I am a beginner—am I welcome?

Of course you are — whether you have a telescope, binoculars or just your eyes, there will be someone to observe with. We have a variety of equipment and are always happy for newcomers to look through.

So I just turn up?

Essentially yes, but please drop us an email as parking can be an issue at some of the meeting areas or at the pubs.

I am more experienced—what's in it for me?

If you have observing experience we prepare a monthly observing list chosen in rotation by the group. We pick some easy objects, some moderate and some tough ones. If you are experienced, why not share what you know?

Any ground rules for a session?

Common sense applies in the group; red light is essen-tial to preserve night vision; we park cars so you can leave when you wish and not disturb others with your headlights.

Contact Details

Our Website

www.spogastro.co.uk

Our Email

spogastro@googlemail.com

Twitter

http://twitter.com/SPOGAstro

Facebook

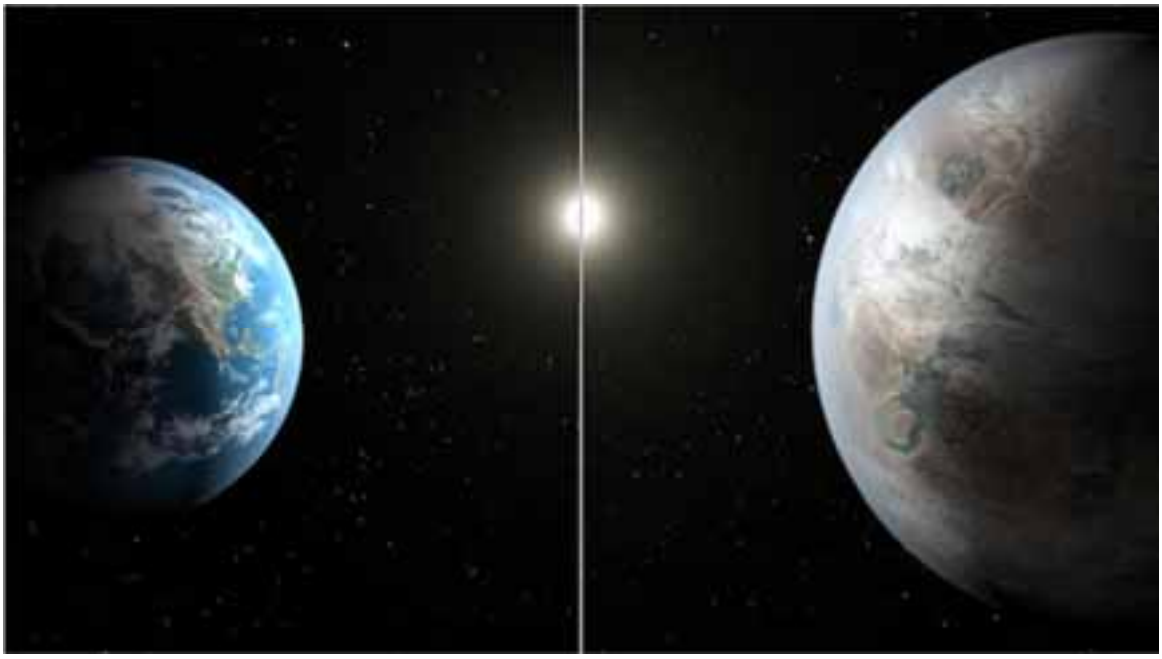
http://www.facebook.com/group.php?gid=119305144780224

Is Proxima Centauri's 'Earth-like' planet actually like Earth at all?

By Ethan Siegel

Just 25 years ago, scientists didn't know if any stars—other than our own sun, of course—had planets orbiting around them. Yet they knew with certainty that gravity from massive planets caused the sun to move around our solar system's center of mass. Therefore, they reasoned that other stars would have periodic changes to their motions if they, too, had planets.

This change in motion first led to the detection of planets around pulsars in 1991, thanks to the change in pulsar timing it caused. Then, finally, in 1995 the first exoplanet around a normal star, 51 Pegasi b, was discovered via the "stellar wobble" of its parent star. Since that time, over 3000 exoplanets have been confirmed, most of which were first discovered by NASA's Kepler mission using the transit method. These transits only work if a solar system is fortuitously aligned to our perspective; nevertheless, we now know that planets—even rocky planets at the right distance for liquid water on their surface—are quite common in the Milky Way.



An artist's conception of the exoplanet Kepler-452b (R), a possible candidate for Earth 2.0, as compared with Earth (L). Image credit: NASA/Ames/JPL-Caltech/T. Pyle.

On August 24, 2016, scientists announced that the stellar wobble of Proxima Centauri, the closest star to our sun, indicated the existence of an exoplanet. At just 4.24 light years away, this planet orbits its red dwarf star in just 11 days, with a lower limit to its mass of just 1.3 Earths. If verified, this would bring the number of Earth-like planets found in their star's habitable zones up to 22, with 'Proxima b' being the closest one. Just based on what we've seen so far, if this planet is real and has 130 percent the mass of Earth, we can already infer the following:

- It receives 70 percent of the sunlight incident on Earth, giving it the right temperature for liquid water on its surface, assuming an Earth-like atmosphere.
- It should have a radius approximately 10 percent larger than our own planet's, assuming it is made of similar elements.
- It is plausible that the planet would be tidally locked to its star, implying a permanent 'light side' and a permanent 'dark side'.
- And if so, then seasons on this world are determined by the orbit's ellipticity, not by axial tilt.

Yet the unknowns are tremendous. Proxima Centauri emits considerably less ultraviolet light than a star like the sun; can life begin without that? Solar flares and winds are much greater around this world; have they stripped away the atmosphere entirely? Is the far side permanently frozen, or do winds allow possible life there? Is the near side baked and barren, leaving only the 'ring' at the edge potentially habitable?

Proxima b is a vastly different world from Earth, and could range anywhere from actually inhabited to completely unsuitable for any form of life. As 30m-class telescopes and the next generation of space observatories come online, we just may find out!

Looking to teach kids about exoplanet discovery? NASA Space Place explains stellar wobble and how this phenomenon can help scientists find exoplanets: http://spaceplace.nasa.gov/barycenter/en/

SPACE NEWS

SpaceX Makes Progress Replicating Failure that Caused Falcon 9 Pad Explosion

Article Updated: 31 Oct , 2016

by Ken Kremer

SpaceX Falcon 9 rocket moments after catastrophic explosion destroys the rocket and Amos-6 Israeli satellite payload at launch pad 40 at Cape Canaveral Air Force Station, FL, on Sept. 1, 2016. A static hot fire test was planned ahead of scheduled launch on Sept. 3, 2016. Credit: USLaunchReport

SpaceX is making significant progress in replicating the failure in the helium pressurization system that led to the catastrophic launch pad explosion of the firms Falcon 9 rocket during a routine fueling test at their Florida Space Coast launch complex on September 1.

The problem at the heart of the anomaly appears to be in the helium loading system. However the root cause of the explosion still remains elusive at this time.

“The Accident Investigation Team continues to make progress in examining the anomaly on September 1 that led to the loss of a Falcon 9 and its payload at Launch Complex 40 (LC-40), Cape Canaveral Air Force Station, Florida,” SpaceX announced in an Oct. 28 update.

If it Wasn’t Already Strange Enough, now Saturn’s Hexagon Storm is Changing Color

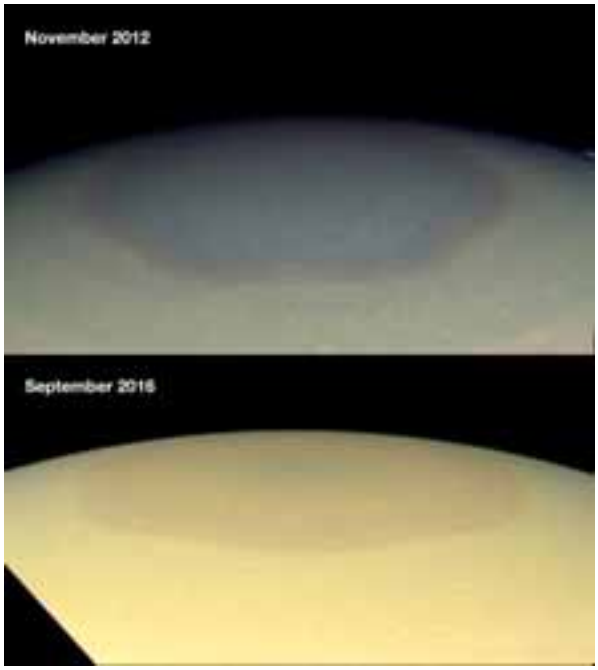
Published: 28 Oct , 2016

by Matt Williams

Ever since the *Voyager 2* made its historic flyby of Saturn, astronomers have been aware of the persistent hexagonal storm around the gas giant’s north pole. This a six-sided jetstream has been a constant source of fascination, due to its sheer size and immense power. Measuring some 13,800 km (8,600 mi) across, this weather system is greater in size than planet Earth.

And thanks to the latest data to be provided by the *Cassini* space probe, which entered orbit around Saturn in 2009, it seems that this storm is even stranger than previously thought. Based on images snapped between 2012 and 2016, the storm appears to have undergone a change in color, from a bluish haze to a golden-brown hue.

The reasons for this change remain something of a mystery, but scientists theorize that it may be the result of seasonal changes due to the approaching summer solstice (which will take place in May of 2017). Specifically, they believe that the change is being driven by an increase in the production of photochemical hazes in the atmosphere, which is due to increased exposure to sunlight.



Natural color images taken by NASA’s Cassini wide-angle camera, showing the changing appearance of Saturn’s north polar region between 2012 and 2016.. Credit: NASA/JPL-Caltech/Space Science Institute/Hampton University

This reasoning is based in part on past observations of seasonal change on Saturn. Like Earth, Saturn experiences seasons because its axis is tilted relative to its orbital plane (26.73°). But since its orbital period is almost 30 years, these seasons last for seven years.

Between November 1995 and August 2009, the hexagonal storm also underwent some serious changes, which coincided with Saturn going from its Autumnal to its Spring Equinox. During this period, the north polar atmosphere became clear of aerosols produced by photochemical reactions, which was also attributed to the fact that the northern polar region was receiving less in the way of sunlight.

However, since that time, the polar atmosphere has been exposed to continuous sunlight, and this has coincided with aerosols being produced inside the hexagon, making the polar atmosphere appear hazy. As Linda J. Spilker, the Cassini mission’s project scientist, told Universe Today via email:

“We have seen dramatic changes in the color inside Saturn’s north polar hexagon in the last 4 years. That color change is probably the result of changing seasons at Saturn, as Saturn moves toward northern summer solstice in May 2017. As more sunlight shines on the hexagon, more haze particles are produced and this haze gives the hexagon a more golden color.”

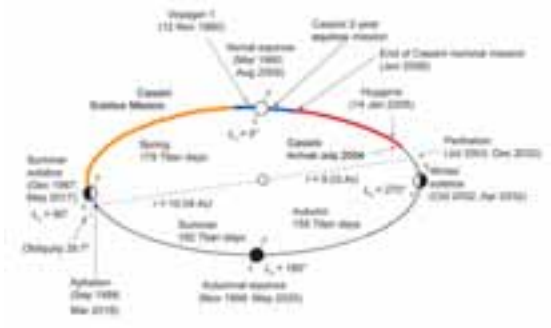


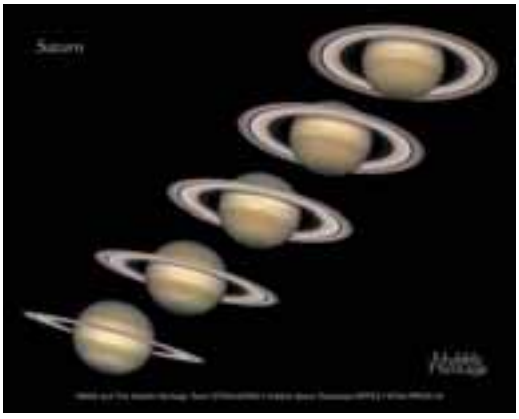
Diagram showing he main events of Saturn's year, and where in the Saturnian year the Voyager 1 and Cassini missions occurred. Credit: Ralph Lorenz

All of this has helped scientists to test theoretical models of Saturn's atmosphere. In the past, it has been speculated that this six-sided storm acts as a barrier that prevents outside haze particles from entering. The previous differences in color – the planet's atmosphere being golden while the polar storm was darker and bluish – certainly seemed to bear this out.

The fact that it is now changing color and starting to look more like the rest of the atmosphere could mean that the chemical composition of the polar region is now changing and becoming more like the rest of the planet. Other effects, which include changes in atmospheric circulation (which are in turn the result of seasonally shifting solar heating patterns) might also be influencing the winds in the polar regions.

Needless to say, the giant planets of the Solar System have always been a source of fascination for scientists and astronomers. And if these latest images are any indication, it is that we still have much to learn about the dynamics of their atmospheres.

"It is very exciting to see this transformation in Saturn's hexagon color with changing seasons," said Spilker. "With Saturn seasons over 7 years long, these new results show us that it is certainly worth the wait."



The seasons on Saturn, visualized with images taken by the Hubble Heritage Team. Credit: R. G. French (Wellesley College) et al./NASA/ESA/Hubble Heritage Team (STScI/AURA)

It also shows that Cassini, which has been in operation since 1997, is still able to provide new insights into Saturn and its system of moons. In recent weeks, this included information about seasonal variations on Titan, Saturn's largest moon. By April 22nd, 2017, the probe will commence its final 22 orbits of Saturn. Barring any mission extensions, it is scheduled enter into Saturn's atmosphere (thus ending its mission) on Sept. 15th, 2017.

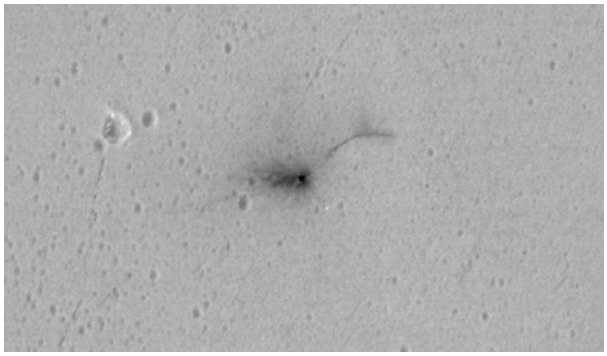
Further Reading: NASA/JPL/Caltech

Best Photos Yet of the Mars Lander's Demise

Published: 28 Oct , 2016

by Bob King

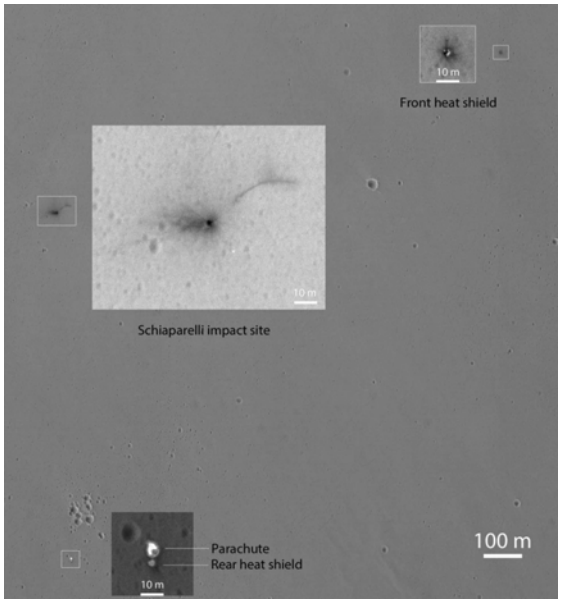
A closeup of the dark, approximately circular crater about 7.9 feet (2.4 meters) in diameter that marks the crash of the Schiaparelli test lander on Mars. The new, higher-resolution photo was taken on October 25 by NASA's Mars Reconnaissance Lander (MRO). A hint of an upraised rim is visible along the crater's lower left side. The tiny white specks may be pieces of the lander that broke away on impact. The odd dark curving line has yet to be explained. Credit: NASA/JPL-Caltech



What's the most powerful telescope for observing Mars? A telephoto lens on the **HiRise camera** on the **Mars Reconnaissance Orbiter** that can resolve features as small as 3 feet (1-meter) across. NASA used that camera to provide new details of the scene near the Martian equator where Europe's **Schiaparelli test lander** crashed to the surface last week.

During an October 25 imaging run HiRise photographed three locations where hardware from the lander hit the ground all within about 0.9 mile (1.5 kilometers) of each other. The dark crater in the photo above is what you'd expect if a 660-pound object (lander) slammed into dry soil at more than 180 miles an hour (300 km/h). The crater's about a foot and a half (half a meter) deep and haloed by dark rays of fresh Martian soil excavated by the impact.

But what about that long dark arc northeast of the crater? Could it have been created by a piece of hardware jettisoned when Schiaparelli's propellant tank exploded? The rays are curious too. The European Space Agency says that the lander fell almost vertically when the thrusters cut out, yet the asymmetrical nature of the streaks — much longer to the west than east — would seem to indicate an oblique impact. It's possible, according to the agency, that the hydrazine propellant tanks in the module exploded preferentially in one direction upon impact, throwing debris from the planet's surface in the direction of the blast, but more analysis is needed. Additional white pixels in the image could be lander pieces or just noise.



This Oct. 25, 2016, image shows the area where the European Space Agency's Schiaparelli test lander reached the surface of Mars, with magnified insets of three sites where components of the spacecraft hit the ground. It is the first view of the site from the High Resolution Imaging Science Experiment

(HiRISE) camera on NASA's Mars Reconnaissance Orbiter taken after the Oct. 19, 2016, landing event and our highest resolution of the scene to date. Click for a full-resolution image. Credit: NASA/JPL-Caltech

In the wider shot, several other pieces of lander-related flotsam are visible. About 0.8 mile (1.4 km) eastward, you can see the tiny crater dug out when the heat shield smacked the ground. Several bright spots might be pieces of its shiny insulation. About 0.6 mile (0.9 kilometer) south of the lander impact site, two features side-by-side are thought to be the spacecraft's parachute and the back shell. NASA plans additional images to be taken from different angle to help better interpret what we see.

Schiaparelli dangles from its parachute in this artist's view. A software error caused the chute to deploy too soon. Credit: ESA

The test lander is part of the European Space Agency's **ExoMars 2016 mission**, which placed the **Trace Gas Orbiter** into orbit around Mars on Oct. 19. The orbiter will investigate the atmosphere and surface of Mars in search of organic molecules and provide relay communications capability for landers and rovers on Mars. Science studies won't begin until the spacecraft trims its orbit to a 248-mile-high circle through aerobraking, which is expected to take about 13 months.

Everything started out well with Schiaparelli, which successfully transmitted data back to Earth during its descent through the atmosphere, the reason we know that the heat shield separated and the parachute deployed as planned. Unfortunately, the chute and its protective back shell ejected ahead of time followed by a premature firing of the thrusters. And instead of burning for the planned 30 seconds, the rockets shut off after only 3. Why? Scientists believe a software error told the lander it was much closer to the ground than it really was, tripping the final landing sequence too early.

Landing on Mars has never been easy. We've done flybys, attempted to orbit the planet or land on its surface **44 times**. 15 of those have been landing attempts, with 7 successes: Vikings 1 and 2, Mars Pathfinder, the Spirit and Opportunity rovers, the Phoenix Lander and Curiosity rover. We'll be generous and call it 8 if you count the 1971 landing of Mars 3 by the then-Soviet Union. It reached the surface safely but shut down after just 20 seconds.

Mars can be harsh, but it forces us to get smart.

How Many Planets are There in the Galaxy?

Article Updated: 25 Oct , 2016

by Matt Williams

On a clear night, and when light pollution isn't a serious factor, looking up at the sky is a breathtaking experience. On occasions like these, it is easy to be blown away by the sheer number of stars out there. But of course, what we can see on any given night is merely a fraction of the number of stars that actually exist within our Galaxy.

What is even more astounding is the notion that the majority of these stars have their own system of planets. For some time, astronomers have believed this to be the case, and ongoing research appears to confirm it. And this naturally raises the question, just how many planets are out there? In our galaxy alone, surely, there must be billions!

Number of Planets per Star:

To truly answer that question, we need to crunch some numbers and account for some assumptions. First, despite the discovery of thousands of extra-solar planets, the Solar System is still the only one that we have studied deeply. So it could be that ours possesses more star systems than others, or that our Sun has a fraction of the planets that other stars do.

So let's assume that the eight planets that exist within our Solar System (not taking into account Dwarf Planets, Centaurs, KBOs and other larger bodies) represent an average. The next step will be to multiply that number by the amount of stars that exist within the Milky Way.

Number of Stars:

To be clear, the actual number of stars in the Milky Way is subject to some dispute. Essentially, astronomers are forced to make estimates due to the fact that we cannot view the Milky Way from the outside. And given that the Milky Way is in the shape of a barred, spiral disc, it is difficult for us to see from one side to the other – thanks to light interference from its many stars.

As a result, estimates of how many stars there are come down to calculations of our galaxy's mass, and estimates of how much of that mass is made up of stars. Based on these calculations, scientists estimate that the Milky Way contains between 100 and 400 billion stars (though some think there could be as many as a trillion).

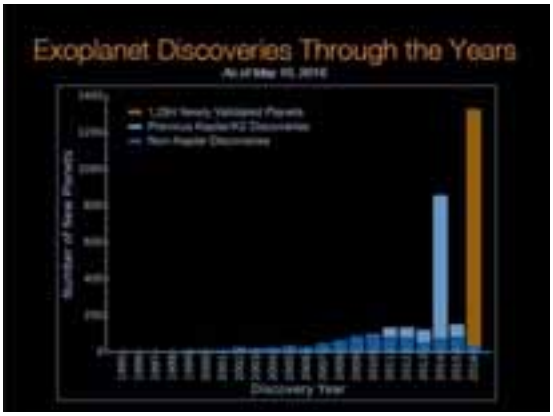
Doing the math, we can then say that the Milky Way galaxy has – on average – between 800 billion and 3.2 trillion planets, with some estimates placing that number as high a 8 trillion! However, in order to determine just how many of them are habitable, we need to consider the number of exoplanets discovered so far for the sake of a sample analysis.

Habitable Exoplanets:

As of October 13th, 2016, astronomers have confirmed the presence of 3,397 exoplanets from a list of 4,696 potential candidates (which were discovered between 2009 and 2015). Some of these planets have been observed directly, in a process known as direct imaging. However, the vast majority have been detected indirectly using the radial velocity or transit method.

In the case of the former, the existence of planets is inferred based on the gravitational influence they have on their parent star. Essentially, astronomers measure how much the star moves back and forth to determine if it has a system of planets and how massive they are. In the case of the transit method, planets are detected when they pass directly in front of their star, causing it to dim. Here, size and mass are estimated based on the level of dimming.

In the course of its mission, the Kepler mission has observed about 150,000 stars, which during its initial four year mission consisted primarily of M-class stars. Also known as red dwarfs, these low-mass, lower-luminosity stars are harder to observe than our own Sun.



Histogram showing the number of exoplanets discovered by year. Credit: NASA Ames/W. Stenzel, Princeton/T. Morton

Since that time, Kepler has entered a new phase, also known as the K2 mission. During this phase, which began in November of 2013, Kepler has been shifting its focus to observe more in the way of K- and G-class stars – which are nearly as bright and hot as our Sun.

According to a recent study from NASA Ames Research Center, Kepler found that about 24% of M-class stars may harbor potentially habitable, Earth-size planets (i.e. those that are smaller than 1.6 times the radius of Earth's). Based upon the number of M-class stars in the galaxy, that alone represents about 10 billion potentially habitable, Earth-like worlds.

Meanwhile, analyses of the K2 phase suggests that about one-quarter of the larger stars surveyed may also have Earth-size planet orbiting within their habitable zones. Taken together, the stars observed by Kepler make up about 70% of those found within the Milky Way. So one can estimate that there are literally tens of billions of potentially habitable planets in our galaxy alone.

In the coming years, new missions will be launching, like the James Webb Space Telescope (JWST) and the Transitting Exoplanet Survey Satellite (TESS). These missions will be able to detect smaller planets orbiting fainter stars, and maybe even determine if there's life on any of them.

Once these new missions get going, we'll have better estimates of the size and number of planets that orbit a typical star, and we'll be able to come up with better estimates of just many planets there are in the galaxy. But until then, the numbers are still encouraging, as they indicate that the chances for extra-terrestrial intelligence are high!

We have written many articles about galaxies for Universe Today. Here's How Many Stars are there in the Milky Way?, How Many Planets are there in the Solar System?, What are Extra-Solar Planets?, Planets Plentiful Around Abundant Red Dwarf Stars, Study Says, Life After Kepler: Upcoming Exoplanet Missions.

If you'd like more info on galaxies, check out Hubblesite's News Releases on Galaxies, and here's NASA's Science Page on Galaxies.

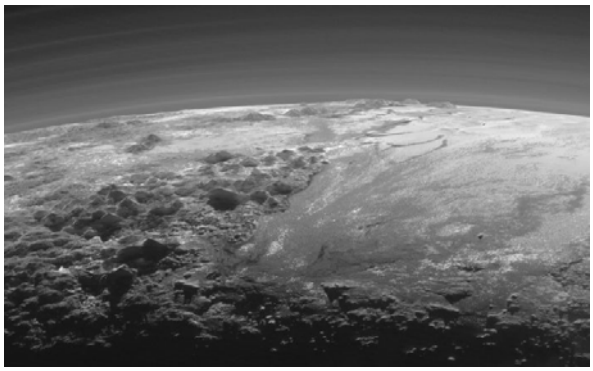
We have also recorded an episode of Astronomy Cast about galaxies – Episode 97: Galaxies.

Sources:

- *Wikipedia – The Milky Way Galaxy*
- *NASA Exoplanet AArchive*
- *NASA – The Milky Ways 100 billion planets*
- *NASA – How Many Stars in the Milky Way*
- *HubbleSite – The Milky Way Contains at Least 100 Billion Planets According to Survey*

Latest Results from New Horizons: Clouds on Pluto, Landslides on Charon

by Nancy Atkinson



This image of haze layers above Pluto's limb was taken by the Ralph/Multispectral Visible Imaging Camera (MVIC) on NASA's New Horizons spacecraft. About 20 haze layers are seen; the layers have been found to typically extend horizontally over hundreds of kilometers, but are not strictly parallel to the surface. For example, scientists note a haze layer about 3 miles (5 kilometers) above the surface (lower left area of the image), which descends to the surface at the right. Credit: NASA/JHUAPL/SwRI.

Article Updated: 18 Oct , 2016

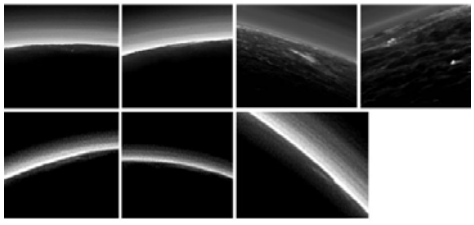
By the end of this week, all the data gathered by the New Horizons spacecraft during its July 2015 flyby of the Pluto system will have finished downloading to Earth and be in the hands of the science team. Bonnie Buratti, a science team co-investigator said they have gone from being able to look at the pretty pictures to doing the hard work required to study the data. During today's press briefing from the Division of Planetary Sciences conference, the New Horizons team shared a few interesting and curious findings they've found in the data so far.

While the famous global view of Pluto appears to show a cloud-free dwarf planet, Principal investigator Alan Stern said the team has now take a closer look and found handful of potential clouds in images taken with New Horizons' cameras.

"Clouds are common in the atmospheres of the solar system," Stern said during the briefing, " and a natural question was whether Pluto, with a nitrogen atmosphere, has any clouds."

Stern said they've known since flyby that Pluto has haze layers, as seen in the backlit lead image above, as New Horizons flew away from Pluto. "They stretch more than 200 km into the sky, and we've counted over two dozen concentric layers," he said.

While hazes are not clouds, Stern said they have identified candidates for clouds in high-phase images from the Long Range Reconnaissance Imager and the Multispectral Visible Imaging Camera.



Candidates for possible clouds on Pluto, in images from the New Horizons Long Range Reconnaissance Imager and Multispectral Visible Imaging Camera, during the spacecraft's July 2015 flight through the Pluto system. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

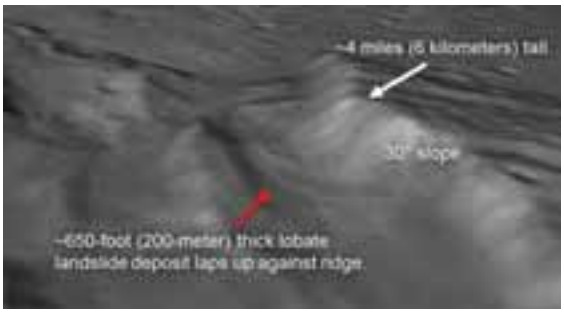
"The seven candidates are all similar in that they are very low altitude," Stern said, and they are all low-lying, isolated small features, so no broad cloud decks or fields. When we map them over the surface, they all lie near the terminator, so they occur near dawn or dusk. This is all suggestive they are clouds because low-lying regions and dawn or dusk provide cooler conditions where clouds may occur."

Stern told Universe Today that these possible, rare condensation clouds could be made of ethane, acetylene, hydrogen cyanide or methane under the right conditions. Stern added these clouds are probably short-lived phenomena – again, likely occurring only at dawn or dusk. A day on Pluto is 6.4 days on Earth.

"But if there are clouds, it would mean the weather on Pluto is even more complex than we imagined," Stern said.

Disappointingly, the New Horizons team has no way of confirming if these are clouds or not. "None of them can be confirmed as clouds because they are very low lying and we don't have stereo images to tell us more," Stern said, adding that the only way to confirm if there are condensation clouds on Pluto would be to return with an orbiter mission.

Landslides on Charon



Signs of a long run-out landslide on Pluto's largest moon, Charon. This perspective view of Charon's informally named Serenity Chasm shows a 200-meter thick lobate landslide that runs up against a 6 km high ridge. The images were taken by New Horizons, Long Range Reconnaissance Imager (LORRI) and Multispectral Visible Imaging Camera (MVIC) during the spacecraft's July 2015 flyby of the Pluto system. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

While Pluto shows many kinds of activity, one surface process scientists haven't seen on the dwarf planet is landslides. Surprisingly, though, they have been spotted on Pluto's largest moon, Charon.

"We've seen similar landslides on other rocky and icy planets, such as Mars and Saturn's moon Iapetus, but these are the first landslides we've seen this far from the sun, in the Kuiper Belt," said Ross Beyer, a science team researcher from Sagan Center at the SETI Institute and NASA Ames Research Center, California. "The big question is will they be detected elsewhere in the Kuiper Belt?"

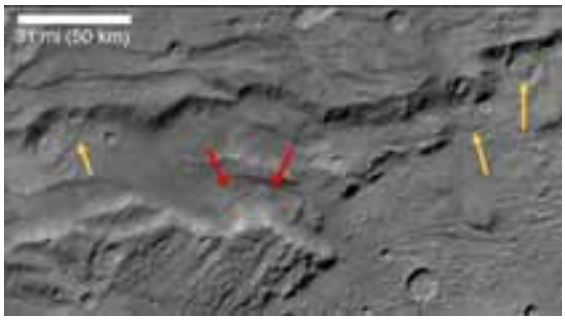
Long runout landslides seen on Charon's Serenity Chasm shows a 200-meter thick lobate landslide that runs up against a 6 km high ridge.

"With our images, we can just resolve a smooth apron and the deposit as a whole," said Beyer, "we can't see individual grains. But given the cold conditions on Charon, the deposit likely made of boulders of ice and rock."

Beyer said earthquakes or an impact could have jump started the landslide on regions that were ready to slide. "The boulders may have melted and the edges and got slippery enough to begin to slide down the slope," he said.

The images of Serenity Chasma were taken by New Horizons' Long Range Reconnaissance Imager (LORRI) on July 14, 2015, from a distance of 48,912 miles (78,717 kilometers).

Beyer added that while Pluto doesn't have landslides, it does have material that appears to be moving downhill as rock falls and glacier-like flows.



Scientists from NASA's New Horizons mission have spotted signs of long run-out landslides on Pluto's largest moon, Charon. Arrows mark indications of landslide activity. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute.

Bright and active

New Horizons data shows that portions of Pluto's large heart-shaped region, Sputnik Planitia, are among the most reflective in the solar system. "That brightness indicates surface activity," said Buratti, "similar to how Saturn's moon Enceladus is very reflective, about 100% reflective, and is very active with plumes and geysers. Because we see a pattern of high surface reflectivity equating to activity, we can infer that the dwarf planet Eris, which is known to be highly reflective, is also likely to be active."

Next Target

New Horizons is now making a beeline for its next target, KBO 2014 MU69. Cameras on the New Horizons spacecraft have been taking long range images and MU69 is the smallest KBO to have its color measured: it has a reddish tint. Scientists have used that data to confirm this object is part of the so-called cold classical region of the Kuiper Belt, which is believed to contain some of the oldest, most prehistoric material in the solar system.

"The reddish color tells us the type of Kuiper Belt object 2014 MU69 is," said Amanda Zangari, a New Horizons postdoctoral researcher from Southwest Research Institute. "The data confirms that on New Year's Day 2019, New Horizons will be looking at one of the ancient building blocks of the planets."

Zangari added that they will be using the Hubble Space Telescope to better understand MU69.

"We would like to use Hubble to its find rotation rate and better understand its shape, as far as planning," she said. "We would like to know ahead of time, if it is oblong, we would like to fly when the longest point is facing the telescope."

Several times during the briefing, Stern indicated how having a future mission that orbited Pluto would answer so many outstanding questions the team has. He outlined one potential mission that is in the very earliest stages of study where a spacecraft could be launched on NASA's upcoming Space Launch System (SLS) and the spacecraft could have an RTG-powered ion engine that would allow a fast-moving spacecraft

the ability to slow down and go into orbit (unlike New Horizons). This type of architecture would allow for a flight time of 7.5 years to Pluto, quicker than New Horizons' nearly 9.5 years.

Exclusive Photos Of The Recently Found 30-Ton Argentine Meteorite

Article Updated: 16 Oct , 2016

by Nancy Atkinson

A gigantic piece of the famous Campo del Cielo meteorite fall that was found on September 10, 2016 has been un-earthed, and is now on display in Gancedo, Chaco, Argentina. Photographer Pelin Rodriguez shared some images with Universe Today that he took of the newly found behemoth during a recent "Celebration of the Meteorite."

And in a surprise finding during a weigh-in of both the new Gancedo meteorite and another meteorite named el Chaco that what was thought to be the biggest meteorite from the Campo del Cielo site, the Gancedo meteorite may actually be bigger. El Chaco was originally billed as 37 tons, but a recent tip of the scales put el Chaco at only 28 tons. Rodriguez said both meteorites will be weighed again in order to verify the tonnage. If confirmed, that would make the Gancedo meteorite the second largest meteorite chunk in the world after the 66-ton Hoba meteorite discovered in Namibia, Africa.

A close-up view of the Gancedo meteorite shows colorful details of the 30-ton rock. Credit and copyright: Pelin Rodriguez.

Rodriguez said the Gancedo meteorite contains many colors ranging from red, yellow, green, white and different shades of brown.

Scientists estimate about 4,500 years ago, a 600 ton space rock entered Earth's atmosphere and broke apart, sending a shower of metallic meteorites across a 1,350 square km region northwest of Buenos Aires. The region has at least 26 craters, with the largest crater being about 100 meters wide. The AstronoR group said that the Gancedo meteorite was buried only 3 meters deep.

Rodriguez is a member of the AstronoR astronomy group in Argentina that held a two-day astronomy outreach event at the Village of Gancedo, located 312 km from Resistencia, the capital city of Chaco.

The el Chaco meteorite on display. Credit and copyright: Pelin Rodriguez.

The Gancedo meteorite will be on permanent display in the village of Gancedo, Chaco, Argentina. Credit and copyright: Pelin Rodriguez.

Another close-up view of the Gancedo meteorite. Credit and copyright: Pelin Rodriguez.

Another view of the Gancedo meteorite. Credit and copyright: Pelin Rodriguez.

The area where the Campo del Cielo or "field of the sky" meteorites are on display. Credit and copyright: Pelin Rodriguez.

Thanks to Pelin Rodriguez for sharing his images with Universe Today. You can see some additional photos and videos from the event on the AstronoR Facebook page.

HOW WAS THE EARTH FORMED?

By Nola Taylor Redd

Although planets surround stars in the galaxy, how they form remains a subject of debate. Despite the wealth of worlds in our own solar system, scientists still aren't certain how planets are built. Currently, two theories are duking it out for the role of champion.

The first and most widely accepted theory, core accretion, works well with the formation of the terrestrial planets like Earth but has problems with giant planets. The second, the disk instability method, may account for the creation of these giant planets.

Scientists are continuing to study planets in and out of the solar system in an effort to better understand which of these methods is most accurate.

Approximately 4.6 billion years ago, the solar system was a cloud of dust and gas known as a solar nebula. Gravity collapsed the material in on itself as it began to spin, forming the sun in the center of the nebula.

With the rise of the sun, the remaining material began to clump up. Small particles drew together, bound by the force of gravity, into larger particles. The solar wind swept away lighter elements, such as hydrogen and helium, from the closer regions, leaving only heavy, rocky materials to create smaller terrestrial worlds like Earth. But farther away, the solar winds had less impact on lighter elements, allowing them to coalesce into gas giants. In this way, asteroids, comets, planets, and moons were created.

Earth's rocky core formed first, with heavy elements colliding and binding together. Dense material sank to the center, while the lighter material created the crust. The planet's magnetic field probably formed around this time. Gravity captured some of the gases that made up the planet's early atmosphere.

Early in its evolution, Earth suffered an impact by a large body that catapulted pieces of the young planet's mantle into space. Gravity caused many of these pieces to draw together and form the moon, which took up orbit around its creator.

The flow of the mantle beneath the crust causes plate tectonics, the movement of the large plates of rock on the surface of the Earth. Collisions and friction gave rise to mountains and volcanoes, which began to spew gases into the atmosphere.

Although the population of comets and asteroids passing through the inner solar system is sparse today, they were more abundant when the planets and sun were young. Collisions from these icy bodies likely deposited much of the Earth's water on its surface. Because the planet is in the Goldilocks zone, the region where liquid water neither freezes nor evaporates but can remain as a liquid, the water remained at the surface, which many scientists think plays a key role in the development of life.

Exoplanet observations seem to confirm core accretion as the dominant formation process. Stars with more "metals" — a term astronomers use for elements other than hydrogen and helium — in their cores have more giant planets than their metal-poor cousins. According to NASA, core accretion suggests that small, rocky worlds should be more common than the more massive gas giants.

The 2005 discovery of a giant planet with a massive core orbiting the sun-like star HD 149026 is an example of an exoplanet that helped strengthen the case for core accretion.

"This is a confirmation of the core accretion theory for planet formation and evidence that planets of this kind should exist in abundance," said Greg Henry in a press release. Henry, an astronomer at Tennessee State University, Nashville, detected the dimming of the star.

In 2017, the European Space Agency plans to launch the CHaracterising ExOPlanet Satellite (CHEOPS), which will study exoplanets ranging in sizes from super-Earths to Neptune. Studying these distant worlds may help determine how planets in the solar system formed.

"In the core accretion scenario, the core of a planet must reach a critical mass before it is able to accrete gas in a runaway fashion," said the CHEOPS team.

"This critical mass depends upon many physical variables, among the most important of which is the rate of planetesimals accretion."

By studying how growing planets accrete material, CHEOPS will provide insight into how worlds grow.

Credit: Space.com Store

The disk instability model

Although the core accretion model works fine for terrestrial planets, gas giants would have needed to evolve rapidly to grab hold of the significant mass of lighter gases they contain. But simulations have not been able to account for this rapid formation. According to models, the process takes several million years, longer than the light gases were available in the early solar system. At the same time, the core accretion model faces a migration issue, as the baby planets are likely to spiral into the sun in a short amount of time.

According to a relatively new theory, disk instability, clumps of dust and gas are bound together early in the life of the solar system. Over time, these clumps slowly compact into a giant planet. These planets can form faster than their core accretion rivals, sometimes in as little as a thousand years, allowing them to trap the rapidly-vanishing lighter gases. They also quickly reach an orbit-stabilizing mass that keeps them from death-marching into the sun.

According to exoplanetary astronomer Paul Wilson, if disk instability dominates the formation of planets, it should produce a wide number of worlds at large orders. The four giant planets orbiting at significant distances around the star HD 9799 provides observational evidence for disk instability. Fomalhaut b, an exoplanet with a 2,000-year orbit around its star, could also be an example of a world formed through disk instability, though the planet could also have been ejected due to interactions with its neighbors.

Pebble accretion

The biggest challenge to core accretion is time — building massive gas giants fast enough to grab the lighter components of their atmosphere. Recent research on how smaller, pebble-sized objects fused together to build giant planets up to 1000 times faster than earlier studies.

"This is the first model that we know about that you start out with a pretty simple structure for the solar nebula from which planets form, and end up with the giant-planet system that we see," study lead author Harold Levison, an astronomer at the Southwest Research Institute (SwRI) in Colorado, told Space.com in 2015.

In 2012, researchers Michiel Lambrechts and Anders Johansen from Lund University in Sweden proposed that tiny pebbles, once written off, held the key to rapidly building giant planets.

"They showed that the leftover pebbles from this formation process, which previously were thought to be unimportant, could actually be a huge solution to the planet-forming problem," Levison said.

Levison and his team built on that research to model more precisely how the tiny pebbles could form planets seen in the galaxy today. While previous simulations, both large and medium-sized objects consumed their pebble-sized cousins at a relatively constant rate, Levison's simulations suggest that the larger objects acted more like bullies, snatching away pebbles from the mid-sized masses to grow at a far faster rate.

"The larger objects now tend to scatter the smaller ones more than the smaller ones scatter them back, so the smaller ones end up getting scattered out of the pebble disk," study co-author Katherine Kretke, also from SwRI, told Space.com. "The bigger guy basically bullies the smaller one so they can eat all the pebbles themselves, and they can continue to grow up to form the cores of the giant planets."

As scientists continue to study planets inside of the solar system, as well as around other stars, they will better understand how Earth and its siblings formed.

Follow Nola Taylor Redd on Twitter @NolaTRedd, Facebook or Google+. Follow us at @Spacedotcom, Facebook or Google+.

New theory sheds light on how the Moon was formed - and why we have a 24-hour day

Plc Credits: Getty

The moon was formed 4.5 billion years ago in a "giant impact" that left Earth with a two-hour day, according to new research.

Scientists have long debated the circumstances which led to the formation of our satellite.

One theory assumes the proto-Earth experienced a low-energy impact but new research backs the second hypothesis that there was a much more violent collision.

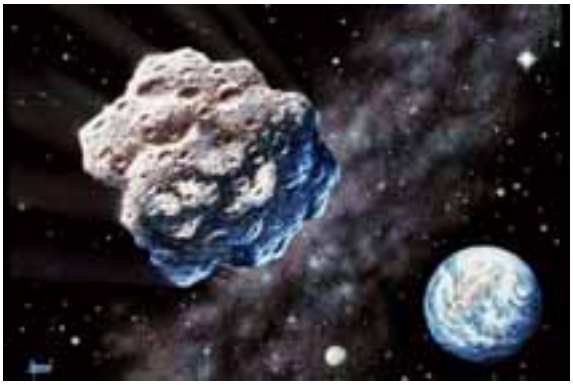
The latest computer model says there was a high energy collision which left a mass of vaporised and molten material from which the Earth and Moon formed.

The Earth was set spinning with a two-hour day - its axis pointing towards the Sun.

This explains why both bodies are made of virtually the same stuff, making the moon distinct from every other major object in the Solar System.

Professor Sarah Stewart, of California University in Davis, said: "Every other body in the solar system has different chemistry."

The textbook theory of lunar formation says a Mars-sized object grazed what would become Earth - throwing off a mass of material from which the moon condensed.



© Provided by Trinity Mirror Plc

This impact set the angular momentum for the Earth-Moon system and gave the early planet a five-hour day.

Over millennia the moon has receded from the Earth and the rotation has slowed to our current 24-hour day.

But there are a couple of problems with this. One is the moon's surprisingly Earth-like composition.

Another is if the moon condensed from a disk of material rotating around Earth's equator it should be in orbit over the equator.

But the moon's current orbit is tilted five degrees off the equator - meaning some more energy must have been put in to move it.

The alternative theory says as angular momentum was dissipated through tidal forces the moon receded from the Earth until it reached a point called the "LaPlace plane transition".

Here a transfer of angular momentum caused Earth's axis to tilt perpendicular to the Sun.

This is where the forces from the Earth on the moon became less important than gravitational forces from the Sun.

Credits: Nasa

This caused some of the angular momentum of the Earth-Moon system to transfer to the Earth-Sun system.

This made no big difference to the Earth's orbit round the Sun - but it did flip Earth upright.

At this point the models built by the team show the moon orbiting Earth at a high angle - or inclination - to the equator.

Over a few tens of million years the moon continued to slowly move away from Earth until it reached a second transition point - the Cassini transition.

The inclination of the Moon - the angle between its orbit and Earth's equator - dropped to about five degrees putting the moon more or less in its current orbit.

Prof Stewart said the new theory elegantly explains the moon's orbit and composition based on a single, giant impact at the beginning, Stewart said. No extra intervening steps are required to nudge things along.

She said: "One giant impact sets off the sequence of events."

MEMBERS VIEWING LOGS and IMAGES

No logs or images received from members. Our two usual loggers were on holiday/ recovering from operation.

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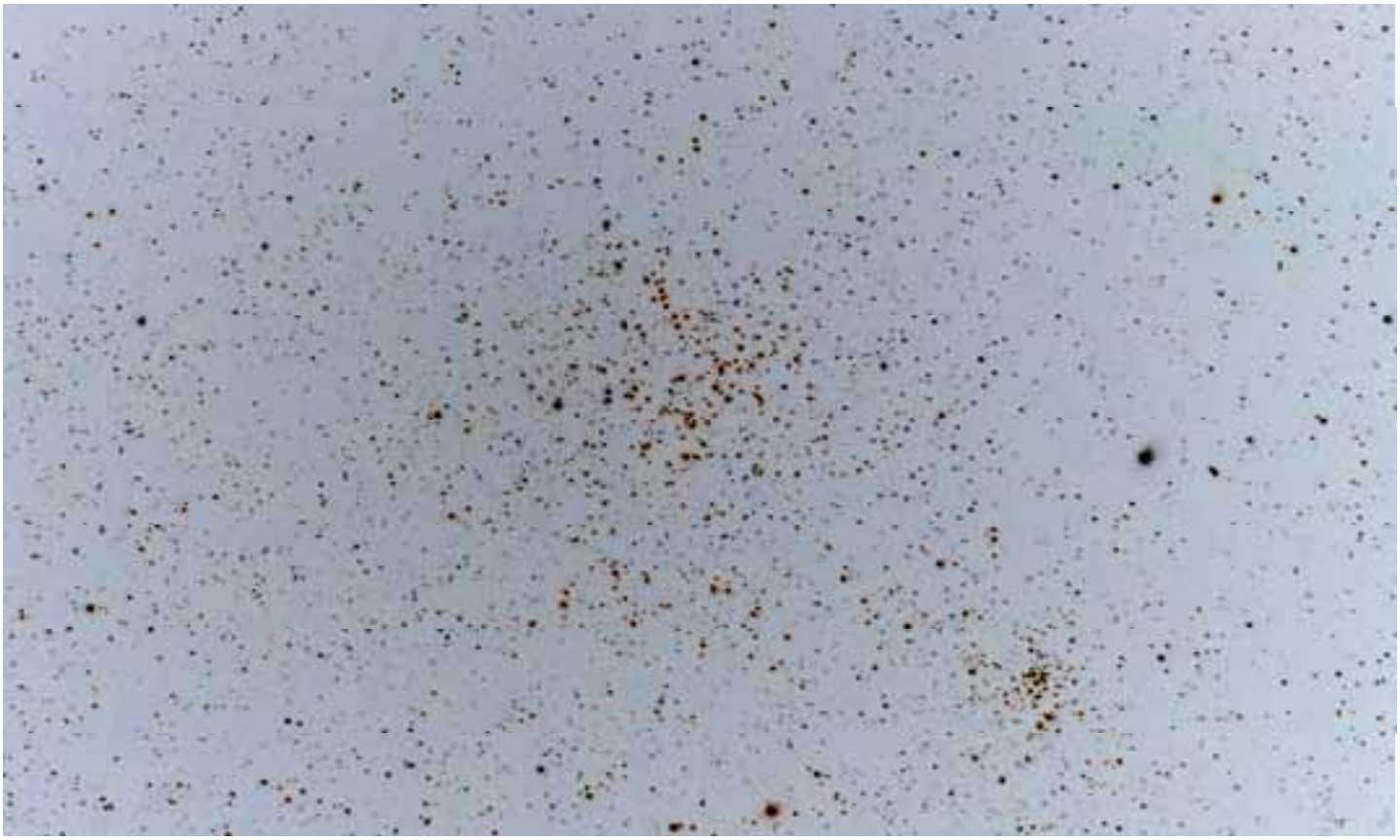
M42 below from Chippenham… trying to hold some of the central stars, 9.25”Celestron, Nikon D810A, 60seconds exposure.

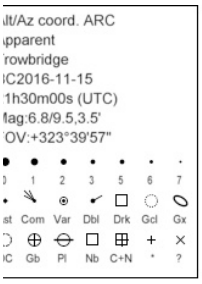
Above: M1 in Taurus, same rig and exposure.

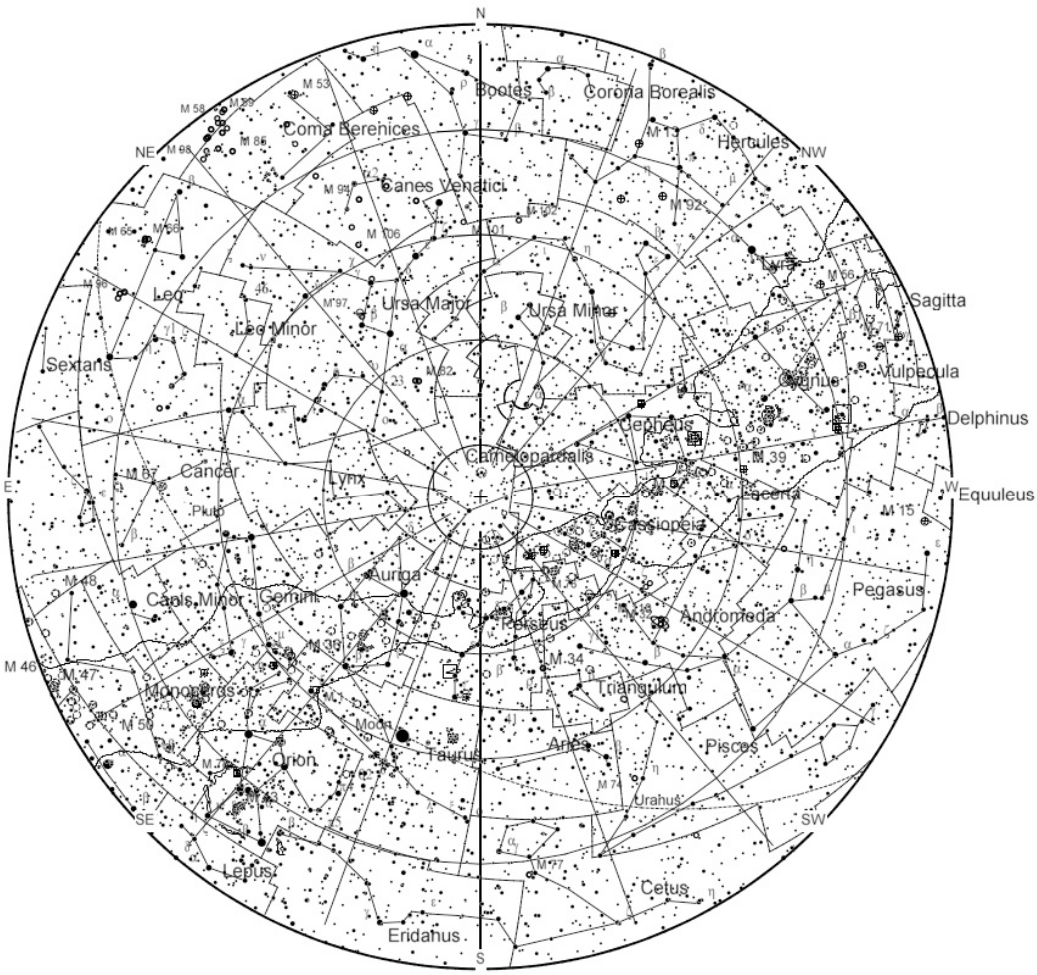


M38 and NGC1907.

Moon from 11th October.

WHATS UP, NOVEMBER 2016





The chart above is for 21:30 UT (GMT) on 15th November.

Note the Moon is in Taurus, the cow caught jumping over the Moon…

Tomorrow night (Wednesday 2nd) the crescent Moon joins Saturn and Venus low in the evening sky (around4:30pm), but Saturn will leave our night skies.

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. The first quarter moon will set just after midnight leaving dark skies for viewing. 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 14 - Full Moon, Supermoon. 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 13:52 UTC. This full moon was known by early Native American tribes as the Full 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 Hunter's Moon. This is also the second of three supermoons for 2016. The Moon will be at its closest approach to the Earth and may look slightly larger and brighter than usual.

November 16, 17 - 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 16th and morning of the 17th. The waning gibbous moon will block many of the fainter meteors this year, but if you are patient you should be able to catch quite a few good ones. 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 29 - 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 12:18 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.

Deep skies we still have the summer triangle high up as the sky gets dark, so some Milky Way views should be possible.

THE LEONIDS METEOR SHOWER

NOTE: The Orionids for October were hugely overhyped by the media last month, as will the Leonid and December Geminids. All these showers take place at FULL MOON of near full, not only that but when another overhyped phenomena makes the brightness of the moon even brighter – the so named supermoon.

The Leonids peak around mid-November.

The Leonids can be seen by Northern and Southern Hemisphere observers.

©iStockphoto.com

We suggest that observers try their luck after nightfall on November 18.

Sunrise and sunset in my city

The Leonid meteor shower is annually active in the month of November and usually peaks around November 17 or 18. The shower is called Leonids because its radiant or the point in the sky where the meteors seem to emerge from, lies in the constellation Leo.

The Leonids occur when the Earth passes through the debris left by the comet Tempel-Tuttle. The comet takes around 33 years to make one orbit around the Sun.

People can view about 20 meteors an hour at the peak of the Leonids meteor shower.

Where to View the Leonids

The Leonids can be seen by viewers from both hemispheres.

While it is not necessary to look in a particular direction to enjoy a meteor shower, astronomers suggest lying down on the ground and looking at the sky between the East and the point right above you to view the Leonids.

When to View the Leonids

The best time to view the Leonids is after dark, but a bright Waning Gibbous Moon may make it difficult for viewers to see many meteors.

Location in the Sky

The Leonids meteor shower is not visible at this time of year. The best date is around 17 Nov 2016; the table below is for that date:

Leonids meteor shower for Bath (Night between 17 Nov and 18 Nov)		
Time	**Azimuth/ Direction**	**Altitude**
Thu 23:00	60° ↗	4.6°
Fri 00:00	71° ↗	13.0°
Fri 01:00	82° →	22.0°
Fri 02:00	93° →	31.4°
Fri 03:00	106°	40.6°
Fri 04:00	122°	49.2°
Fri 05:00	142°	56.2°
Fri 06:00	168°	60.2°

Note: times are for 17 Nov 2016.
Set your location

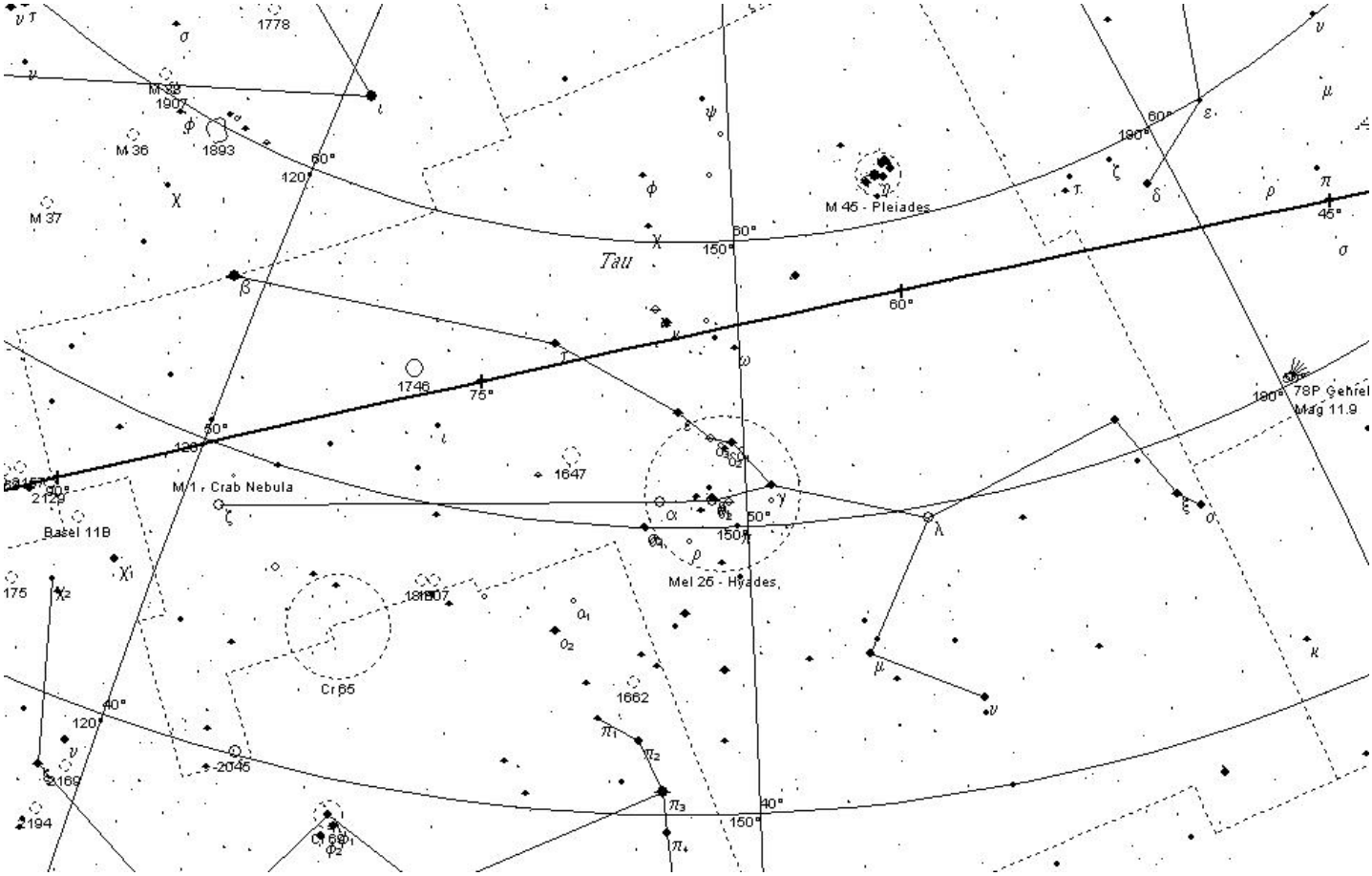
How to Watch Meteor Showers

Check the weather: Meteors, or shooting stars, are easy to spot, all you need is clear skies and a pair of eyes.

Get out of town: Find a place as far away as possible from artificial lights

Prepare to wait: Bring something to sit or lie down on. Star gazing is a waiting game, so get comfortable.

CONSTELLATIONS OF THE MONTH: TAURUS



Is Taurus attacking Orion, the Hunter, or are the Horns of the Bull the real story?

The horn was a symbol of fertility and bountiful riches in many cultures for thousands of years, and it is probably the case here, for the constellation would have announced the Vernal Equinox at around 4000 BC.

The constellation Taurus may also allude to the Greek story of Europa and the Bull. Europa was daughter of King Agenor. One fine spring day, accompanied by her hand maidens, Princess Europa went to the seashore to gather flowers. Zeus, who had fallen in love with Europa, seized the opportunity.

Zeus transformed himself into a magnificent white bull, and as such he joined King Agenor's grazing herd. Europa noticed the wonderful white beast, who gazed at them all with such a mild manner that they were not frightened.

Europa wove wreathes of flowers for the beast, and wrapped them around his horns. She led him around the meadow, and he was as docile as a lamb. Then, as he trotted down to the seashore, she jumped onto his shoulders. Suddenly, to her surprise and fright, he plunged into the sea and carried the princess to Crete.

As they reached the Cretan shore, Zeus then turned into an eagle and ravaged Europa. She bore three sons, the first of which was Minos.

Minos is said to have introduced the bull cult to the Cretans. He had Daedalus build a labyrinth in the depths of his palace at Knossus, which became the home of the Minotaur (offspring of Mino's wife Pasiphae, and a bull). Seven young men and seven maidens were ritually sacrificed to the Minotaur until Theseus killed it.

Minos, in fact, was the title of the ancient rulers of Crete, and the story probably tells of their mythic origin.

The constellation shows mainly the horns, and exceedingly long horns they are. The left (southern) horn starts from the group of stars known as The Hyades, of which Aldebaran seems (erroneously) to be a member. It extends from Aldebaran to zeta Tauri, near the eastern edge of the constellation.

The right horn lifts up just west of the Hyades, from delta Tauri through tau Tauri and finally to its tip at beta Tauri (El Nath: remember this star as part of Auriga?)

The rest of the bull is rather disappointing; a slight body and two spindly legs. It may be that the bull is half-emerged in water, as it carries Europa across to Crete.

The stars of Taurus:

Taurus' eye is bright and piercing. This is *Aldebaran (alpha Tauri)*, an orange giant about 40 times the size of the Sun. Aldebaran is an old star. For billions of years it has burned its supply of hydrogen until there is little left. Its future won't be as a spectacular explosion of a supernova but rather a gradual dimming into a white dwarf.

Following the lower horn out to its tip we find *zeta Tauri*. This is a shell star. Shell stars are main-sequence stars which rotate rapidly, causing a loss of matter to an ever-expanding shell.

Most of the interesting features of Taurus are found in the centre of the constellation and toward the west. Around Aldebaran are a number of stars which go by the collective name of *The Hyades* (see below).

Aldebaran is not a member of this group. Not only is it closer to us, but its proper motion is at a different angle. Aldebaran is moving at an angle of 161 degrees, the stars of the Hyades at around 102-109 degrees.

Double stars in Taurus

Taurus has an abundant selection of binary stars, including many Struve binaries that we haven't mentioned. Below is a very small selection of some of the easier doubles to resolve.

Theta^2 and *theta*^{1} form a fixed binary of wide separation, *theta*^{2} just below and to the east. Note that *theta*^{2} is the primary: 3.4, 3.8; PA 346º and separation 337".

Kappa^1 and *kappa*^{1} form an easily resolved binary: 4.2, 5.3; PA 328º, separation 5.3".

Sigma^2 and *sigma*^{1} is another wide fixed binary. And again, *sigma*^{2} is the primary: 4.8, 5.2; PA 193º and separation 431".

80 Tauri is a difficult visual binary with an orbit of 189.5 years: 5.5, 8.0; current PA 17º and separation of 1.8" (very nearly its maximum separation).

Struve 422 is a wide visual binary with an orbit of over 2000 years: 5.9, 8.8; PA 269º, 6.7". It's located at 9º SW of *nu Tauri*, just north of the brighter *10 Tauri*.

Variable stars in Taurus

Many of the more notable variable stars in Taurus are of a type not noticed by casual observation, such as *alpha Taurus*, which is classified as an Lb type variable. These are irregular giants whose variation can only be detected by means of photoelectric photometry. *Alpha Taurus* only changes in visual magnitude by 0.2, from 0.75 to 0.95, and the period is irregular.

BU Tauri (Pleione) is a gammaCas type variable, from 4.77 to 5.50. GammaCas variables are also characterised by an irregular period, which may sometimes be very rapid. These are B stars, quite young, and rotate very rapidly. This rotation results in the throwing off of material, which then forms a shell around the star. The cause of its variation is still not understood.

Zeta Tauri is also a gammaCas type variable, with a variation from 2.88 down to 3.17 roughly every 133 days.

Lambda Tauri, in the Hyades cluster, is a good example of an eclipsing variable. The variability is caused by the partial eclipse of the primary by its companion, dimming the 3.3 visual magnitude down to 3.8 every 3.95 days.

R Tauri is a Mira-type variable with a 320.9 day period. Usually at 7.6, it drops to a very dim 15.8 once a year. In 2000 the maximum should occur in the first week of May.

Deep Sky Objects in Taurus:

Taurus contains two well known Messier objects: the Crab Nebula and the Pleiades. Besides these two there is the `other' cluster, known as The Hyades, and the curious "Hind's Variable Nebula".

Just northwest of zeta Tauri is the first of Messier's objects: M1, the *Crab Nebula*. Early observers thought the object to be a star cluster, something like a dimmer version of the Great Orion Nebula. Messier was so intrigued by it, on the night of 12 September, 1758, that he began his catalogue - the purpose of which was to keep observers from mistaking such objects for comets.

It takes a rather large telescope to see any of the filamentary features of the nebula; most viewers come away disappointed.

The Crab Nebula is a remnant of a supernova, whose explosion occurred (or rather, was visibly recorded) in July of 1054. Chinese and Japanese astronomers witnessed the event. In fact, it would have been difficult not to notice, for the night sky would have been lit up by a star with the visual magnitude of about -5, bright enough to be seen even in the daytime for nearly a month.

The star that exploded, producing the nebula, is now an optical pulsar. Even now, nearly a thousand years later, the nebula is hurtling through space at roughly a thousand kilometers per second. And it continues to grow; the nebula is now over thirteen light years in diameter (four parsecs) according to the *Facts On File Dictionary of Astronomy*.

M45, The Pleiades.

This open cluster contains as many as three thousand stars. The brightest seven go under the name The Seven Sisters" (from brighter to dimmer): Alcyone (eta Tauri), Electra, Maia, Merope, Taygeta, Celaeno, and Asterope. Added to the list are also Pleione (BU Tauri = 28 Tauri), just east of Alcyone, and Atlas (27 Tauri) who are actually Mum and Dad for the seven sisters. (The two are often seen as one star; it takes a clear night to see them as two separate stars.)

The Hyades

This open cluster of about two hundred stars is only 150 light years away, and considered to be about 600 million years old. It is shaped like a "V", just to the west of Aldebaran.

Just as the Pleiades have individual names, so did the Hyades at one time. In fact, these stars were supposed to be the half-sisters of the Pleiades, and Robert Burnham (*Celestial Handbook*) gives their names - and a great deal more on this group. Theta^2 is the brightest star of the group, which forms a binary with theta^1 (see below). The group is thought to be about 400 million years old.

These nine stars, then, constitute the minimum count, easily seen with the naked eye, while there are actually as many as 250 stars which belong to the group. The cluster is estimated to be 415 light years away. Even a small telescope brings this famous star cluster alive.

Upcoming Local Astronomy Events.

Dear Herschelians,

This is your reminder for the joint WHS/Bath University lecture in November, with an attached image.

Time and place: 7.00pm Thursday 3rd November at the Edge, University of Bath

Title: From the Lobster's Eye to Alien Oceans (JUICE - ESA's mission to Jupiter)

Speaker: Dr Nigel Bannister, University of Leicester

Description:

What are the conditions for planet formation and the emergence of life, and how does the Solar System work? These are the key questions which provide the motivation for the European Space Agency's JUpiter ICy moons Explorer (JUICE) mission, which will explore Jupiter and it's retinue of icy moons. JUICE was formally adopted by ESA in December 2014, clearing the way toward implementation of the mission, which is scheduled for launch in 2022. In this talk I will describe the mission, including the design of the spacecraft, and its scientific goals. I will summarise the instrumentation to be carried by the spacecraft - including contributions from the UK - and consider some of the engineering challenges of mounting a mission to the largest planet in the solar system.

Background of Speaker:

Dr Nigel Bannister is a Senior Lecturer in the Department of Physics and Astronomy, University of Leicester, where his research interests include planetary science, Ultraviolet and visible wavelength imaging systems, and the development of technologies derived from space instrumentation for the early detection of skin, lung and eye cancers. He is a Co-Investigator on J-MAG: the magnetometer instrument which will be flown on the JUICE mission, and is responsible for the radiation design of the instrument. His spare time is generally occupied keeping 15 ducks, 2 children and a pair of retired greyhounds under control.

Location:

The Edge is on the eastern edge of campus near the University main bus stop, the East car park and next door to the Sports Training Village. Use the East car park for free after 5pm -
"Monday to Friday After 5pm Free Can park in either pay and display or permit holder areas".

The Edge is on the Campus Map as a light blue block, No. 8.

Kind Regards

Tony Symes

ISS PASSES For November - mid December2016

From Heavens Above website maintained by Chris Peat

Date	Brightness	Start	Highest point		End					
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
02 Nov	-0.2	05:42:39	10°	SSE	05:43:58	12°	SE	05:45:17	10°	ESE
03 Nov	-1.5	06:24:29	10°	SW	06:27:25	32°	SSE	06:30:23	10°	E
04 Nov	-0.9	05:32:31	10°	SSW	05:35:04	21°	SE	05:37:38	10°	E
05 Nov	-0.6	04:41:46	13°	SSE	04:42:46	14°	SE	04:44:33	10°	ESE
05 Nov	-2.6	06:15:30	10°	SW	06:18:41	51°	SSE	06:21:52	10°	E
06 Nov	-2.0	05:24:28	20°	SSW	05:26:13	36°	SSE	05:29:15	10°	E
07 Nov	-1.1	04:34:22	23°	SE	04:34:22	23°	SE	04:36:32	10°	E
07 Nov	-3.2	06:07:01	12°	WSW	06:09:57	75°	SSE	06:13:14	10°	E
08 Nov	-2.9	05:16:47	46°	SSW	05:17:25	57°	SSE	05:20:39	10°	E
09 Nov	-0.9	04:26:28	23°	E	04:26:28	23°	E	04:28:01	10°	E
09 Nov	-3.4	05:59:07	20°	W	06:01:14	88°	N	06:04:31	10°	E
10 Nov	-3.3	05:08:44	79°	SE	05:08:44	79°	SE	05:11:55	10°	E
10 Nov	-3.3	06:41:50	10°	W	06:45:07	89°	SSW	06:48:24	10°	E
11 Nov	-0.5	04:18:17	18°	E	04:18:17	18°	E	04:19:18	10°	E
11 Nov	-3.4	05:50:56	28°	W	05:52:30	85°	N	05:55:47	10°	E
12 Nov	-2.7	05:00:27	56°	E	05:00:27	56°	E	05:03:08	10°	E
12 Nov	-3.2	06:33:05	10°	W	06:36:19	70°	SSW	06:39:34	10°	ESE
13 Nov	0.0	04:09:57	14°	E	04:09:57	14°	E	04:10:29	10°	E
13 Nov	-3.4	05:42:35	39°	W	05:43:42	85°	S	05:46:58	10°	ESE
14 Nov	-2.0	04:52:05	40°	E	04:52:05	40°	E	04:54:18	10°	E
14 Nov	-2.7	06:24:43	13°	W	06:27:24	46°	SSW	06:30:32	10°	SE
15 Nov	0.3	04:01:35	10°	E	04:01:35	10°	E	04:01:38	10°	E
15 Nov	-3.2	05:34:13	51°	WSW	05:34:47	64°	SSW	05:38:02	10°	ESE
16 Nov	-1.3	04:43:44	28°	ESE	04:43:44	28°	ESE	04:45:24	10°	ESE
16 Nov	-2.0	06:16:22	16°	W	06:18:20	28°	SSW	06:21:11	10°	SSE
17 Nov	-2.6	05:25:54	41°	SSW	05:25:54	41°	SSW	05:28:52	10°	SE
18 Nov	-0.6	04:35:29	17°	ESE	04:35:29	17°	ESE	04:36:22	10°	ESE
18 Nov	-1.4	06:08:07	15°	WSW	06:09:07	17°	SW	06:11:17	10°	S
19 Nov	-1.4	05:17:44	21°	S	05:17:44	21°	S	05:19:22	10°	SSE
01 Dec	-0.8	17:50:23	10°	SSE	17:50:46	10°	SE	17:50:46	10°	SE
02 Dec	-1.3	18:31:17	10°	SSW	18:32:49	21°	S	18:32:49	21°	S
03 Dec	-1.5	17:39:02	10°	SSW	17:41:28	19°	SE	17:42:10	18°	SE
03 Dec	-0.2	19:14:13	10°	WSW	19:14:47	14°	WSW	19:14:47	14°	WSW
04 Dec	-0.9	16:47:23	10°	SSE	16:48:48	12°	SE	16:50:13	10°	ESE
04 Dec	-2.4	18:21:27	10°	SW	18:24:04	41°	S	18:24:04	41°	S
05 Dec	-2.2	17:28:50	10°	SW	17:31:49	32°	SSE	17:33:17	21°	ESE
05 Dec	-0.6	19:04:44	10°	WSW	19:05:54	20°	WSW	19:05:54	20°	WSW
06 Dec	-3.3	18:11:51	10°	WSW	18:15:05	70°	S	18:15:05	70°	S
07 Dec	-2.8	17:19:00	10°	SW	17:22:12	51°	SSE	17:24:14	20°	E
07 Dec	-1.1	18:55:17	10°	W	18:56:50	26°	W	18:56:50	26°	W
08 Dec	-3.5	18:02:18	10°	W	18:05:37	88°	SSE	18:05:58	69°	E
09 Dec	-3.2	17:09:20	10°	WSW	17:12:38	74°	SSE	17:15:04	17°	E
09 Dec	-1.5	18:45:46	10°	W	18:47:41	32°	W	18:47:41	32°	W
10 Dec	-3.4	17:52:46	10°	W	17:56:04	84°	N	17:56:48	51°	E
10 Dec	0.2	19:29:13	10°	W	19:29:24	11°	W	19:29:24	11°	W

All very early morning passes in early November until 19th, then no dark sky sightings until December when it returns to the evening skies.

END IMAGES, OBSERVING AND OUTREACH

.Star trails from the morning of 21st October, looking for Orionids… for two hours, none recorded in the area of the sky.
Nikon D7200 16mm lens, 220 exposures combined in Startrails software.

Date	Moon Phase	Observing Topic
2016		
Friday November 25th	Waning crescent (sets 3pm)	Deep sky
Tuesday 13th / Wednesday 14th December	*Full*	*Geminids meteors*
Friday December 30th	Waxing crescent (Sets 6 pm)	Deep Sky & Lunar targets (Xmas session, meet at 6pm)
2017		
Friday 27th January	New Moon	Deep Sky
Friday 24th February	Waning crescent (sets 3pm)	Deep Sky
Friday 24th March	Waning crescent (sets around 2pm)	Deep Sky
Friday 28th April	Waxing crescent (sets 11pm)	Deep Sky & Lunar targets
Friday 26th May	Waxing crescent (sets around 10pm)	Deep Sky & Lunar targets

OUTREACH ACTIVITIES

(We had a St Bartholomews school in Wooton Bassett contact us after the last meeting, and we managed day time and after school sessions with 4 days notice, thanks to Dave Buckle and Peter Eslick for your help.

Waiting for clear skies: Chippenham Scouts.

November 7th Southwick Guides, Trowbridge.

Early January 2017? Star Gazing Live

January 26th Lacock Positives Photographic Society Talk.