New Zenith

The Monthly Newsletter of the Vectis Astronomical Society

Vol 28 Issue 5 — June 2020 *When Printed, this Newsletter costs VAS at least £1*

Society News

Obvious News

The Observatory is Closed and All Monthly Meetings are Cancelled Until Further Notice

As I am sure everyone must know, we are unable to hold meetings during the current Covid-19 virus pandemic.

The VAS Observatory is closed and all meetings are currently cancelled.

Stay safe and well and, let's hope we're back to normal soon.

Fundraising

As everyone is at home and no doubt buying stuff on the internet, please don't forget, many online stores make contributions to charities like us, and it costs you nothing.

Just visit: *https://www.easyfundraising.org.uk/causes/vectisastronomicalsociety/*

What I've Been Doing

Well there's no better way than to show a photo.

4 x 43inch monitors to replace the old, and rather tatty, Observatory notice board. There's still some cabling to do but I think it a looks pretty good. Each will eventually be connected to a small computer and act as the main display area for the observatory. All paid for by a grant from *Wightaid* for which we are very grateful/

Stay safe and well.

Brian Curd

Observatory Director and NZ Editor

VAS Website: wightastronomy.org

Submissions or letters to New Zenith are always welcome and should be sent to:

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Isle of Wight PO35 5NT

Tel: 07594 339950 or email: **editor@wightastronomy.org**

Material for the next issue by the 6th of the month please.

Observatory Diary

The diary is currently empty!

VAS Website: wightastronomy.org

Contents this Month

2020 Monthly Meetings

Check *http://www.wightastronomy.org/meetings/* for the latest information

All Monthly Meetings are Cancelled Until Further Notice

Sorry for the rather blunt (but nonetheless obvious) headline!

As I am sure everyone must know, we are unable to hold meetings during the current Covid-19 virus pandemic.

All meetings are currently cancelled and the VAS Observatory is closed. The government will let us know when the situation changes and, of course, we will contact members both here and via the website and social media when that situation changes.

I hope we can resume normal activities quite soon but we find ourselves affected by a very serious situation.

Stay safe and well and let's hope we're back to normal soon.

Observatory Visits Booked

All Observatory Visits are Cancelled Until Further Notice

Please see the important information above this.

IMPORTANT

Could all VAS members please ensure they notify the Membership Secretary of any change of address.

To ensure our compliance with GDPR rules, we must maintain accurate membership records.

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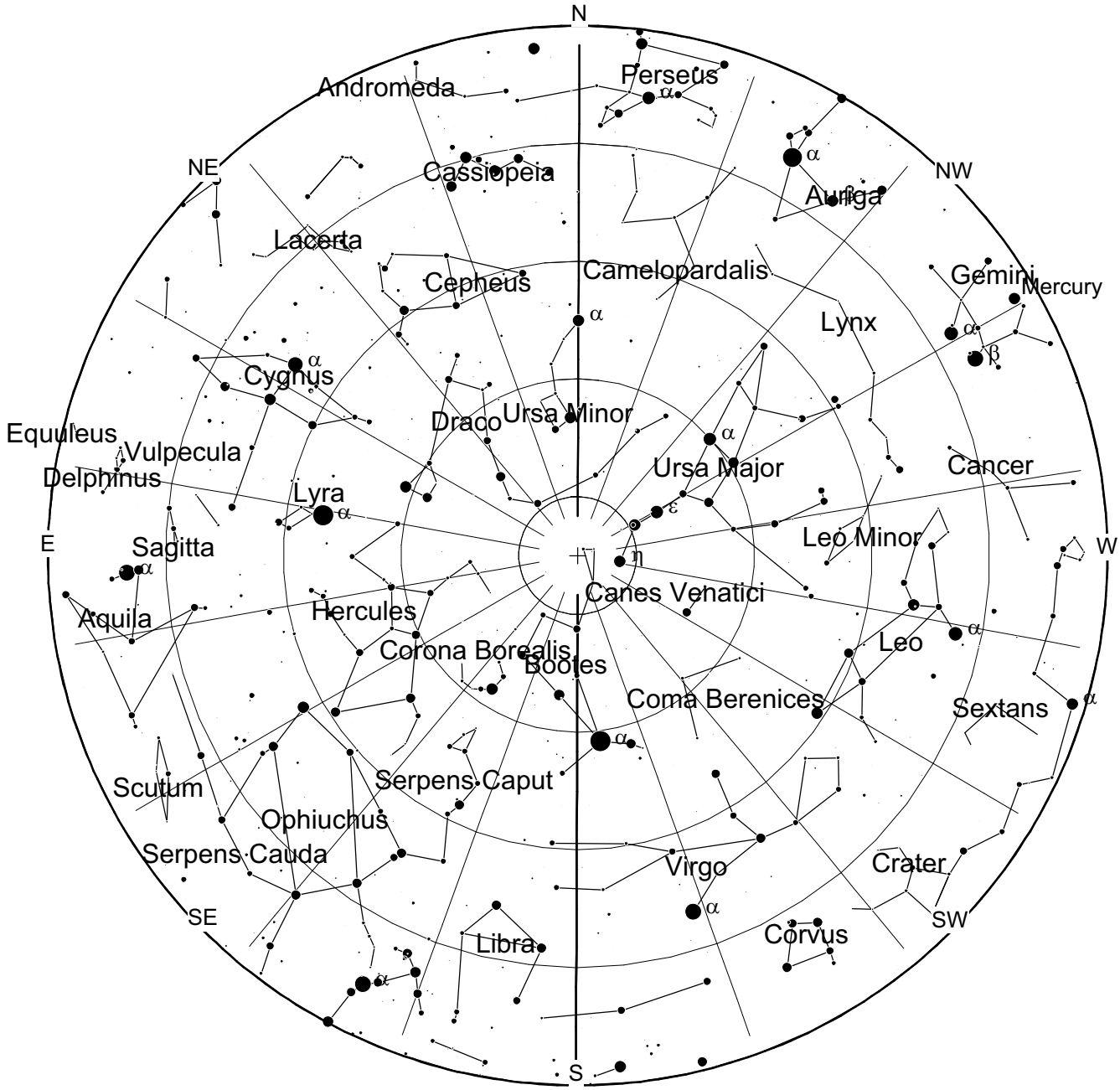
Important

Sorry, but the Observatory has to be closed to all members and visitors until further notice

June 2020 Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 15 June 2020

A **Globular Cluster** is a spherical collection of stars that orbits a galactic core. Globular clusters are very tightly bound by gravity, which gives them their spherical shapes, and relatively high stellar densities toward their centers. The name of this category of star cluster is derived from the Latin, *globulus*—a small sphere. Occasionally, a globular cluster is known simply as a globular.

Globular clusters are found in the halo of a galaxy and contain considerably more stars, and are much older than the less dense open clusters, which are found in the disk of a galaxy. Globular clusters are fairly common; there are about 150 to 158 currently known globular clusters in the Milky Way, with perhaps 10 to 20 more still undiscovered. Larger galaxies can have more: The Andromeda Galaxy, for instance, may have as many as 500. Some giant elliptical galaxies (particularly those at the centres of galaxy clusters), such as M87, have as many as 13,000.

June 2020 Night Sky

Summer Solstice

The Summer Solstice, the point at which the Sun reaches its most northerly point in the sky occurs at 10:43 on June 20th. From this time onwards it starts on its way back to the south and northern hemisphere nights get longer again.

Moon Phases

New	First Qtr	Full	Last Qtr
			
21st	28th	5th	13th

Planets

Mercury

Mercury continues it evening apparition started last month, but in the first few days becomes a difficult object falling into the bright twighlight sky as it passes between us and the Sun and presenting us with just a very thin crescent.

Venus

From mid month Venus rises just before the Sun. The sky will be very bright and the planet will be quite close to the horizon making any observation difficult.

Mars

As it has been all year Mars is low in the South eastern sky before sunrise. It is slowly becoming better placed for observation and increasing in brightness. This will change in the coming months as we approach opposition and it rapidly increases in brightness and races into the evening sky.

Jupiter

This month sees Jupiter at opposition making as well placed for observation as it will be for the year due south just after midnight. It is quite low down so the view will be very dependent of the atmospheric turbulence. Jupiter is by far the brightest object in this part of the sky.

Saturn

A few degrees to the east of Jupiter and also at opposition this month is the ringed planet Saturn. Although It is noticeably less bright than Jupiter, it is still brighter than any star in that part of the sky.

Uranus & Neptune

Both outer planets are lost in the morning twighlight until later in the year.

Noctilucent clouds

June and July see the peak of the northern hemisphere's noctilucent cloud season. Noctilucent, or polar mesospheric, clouds are tenuous clouds that form very high in our atmosphere; as the name implies in the mesosphere, a layer about 80km high – almost at the edge of space, and they occur over both north and south polar regions.

Their origin in not completely understood, but the most likely explanation is ice crystals forming on meteoritic debris. This only happens when the mesosphere is cold enough, below -128°C, and, counter intuitively, this occurs in mid-summer when it gets down to about -150°C. For us in the northern hemisphere usually some time in May or early June.

They are best seen from higher latitudes than ours; the generally accepted limits being between 50 and 65°, too far north and the sky is too bright, too far south the Sun to too far below the horizon. At 50° we are supposedly at the lower limit to see this phenomenon, but they can on occasions be seen much further to the south than here.

They are a relatively common sight for regular observers. The best time to see them is when the Sun is between 6 and 16° below the horizon, usually an hour or two after sunset or before sunrise, and almost all night around the solstice. They are seen generally in a northerly direction towards where the Sun would be if you could see below the horizon. This is not always the case though, last year during a very bright and extensive display they first appeared in the north east about 45 minutes after sunset, and lasted about a further 45 minutes drifting towards the northwest.

The clouds are very thin and reflect best by forward scatter reflection, i.e. with the Sun behind the cloud, this also means that we see them against a darker sky background. They can be there during the day; we just can't see them against the bright daytime sky.

They have a wavy feathery appearance, similar to cirrus clouds and often have a distinctly bluish colour, though if they are very bright, they can appear slightly yellowish as well. They are quite distinct from the normal tropospheric clouds that can be seen at his time of year lit by the twighlight sky. They can also move across the sky relatively quickly, not quite as fast as normal clouds, but when you consider that because of their height the clouds we see here are overhead hundreds of miles away they are racing along by comparison.

When you have seen them, you will know that you have seen them!

Deep Sky

M80 Globular Cluster
RA 16h 17m Dec -22° 59' mag 8.5

In contrast to M4, this cluster is a much smaller with a very condensed core. In 1880 a nova was observed here, one of only two novae ever seen in a globular cluster.

M13 The Hercules Cluster
RA 16h 42’ Dec 36° 26' mag 5.8

On a dark night the Hercules globular can be seen with the naked eye as a fuzzy star part way down the right hand side of the keystone asterism. This is the brightest and, many would argue, the best globular visible from the northern hemisphere. It lies some 25,000 light years away from us, relatively close by globular cluster standards. As with all globular clusters, the view improves with increasing aperture used to observe it. The view is of a sugar coated ball frozen in time, and surrounded by a flurry of sugar grains.

M92 Globular Cluster
RA 17h 17’ Dec 32° 7' mag 6.5

Hercules has two magnificent globular clusters, if it were not for M13 this would be the northern hemisphere’s showpiece globular. It is overshadowed by its more famous companion. M92 has a slightly smaller, more condensed core surrounded by fewer halo stars, but should be a stop on anyone’s tour of the night sky.

Peter Burgess

First look: NASA's James Webb space telescope fully stowed

NASA's James Webb Space Telescope has been successfully folded and stowed into the same configuration it will have when loaded onto an Ariane 5 rocket for launch next year.

Webb is NASA's largest and most complex space science telescope ever built. Too big for any rocket available in its fully expanded form, the entire observatory was designed to fold in on itself to achieve a much smaller configuration. Once in space, the observatory will unfold and stretch itself out in a carefully practiced series of steps before beginning to make groundbreaking observations of the cosmos.

“The James Webb Space Telescope achieved another significant milestone with the entire observatory in its launch configuration for the first time, in preparation for environmental testing,” said Bill Ochs, Webb project manager for NASA Goddard Space Flight Center in Greenbelt, Maryland. “I am very proud of the entire Northrop Grumman and NASA integration and test team. This accomplishment demonstrates the outstanding dedication and diligence of the team in such trying times due to COVID-19.”

The testing team's charter is to make sure every piece of hardware and every piece of software that comprise Webb will work not only individually, but as a full observatory. Now that Webb is completely assembled, technicians and engineers have seized the unique opportunity to command the entire spacecraft and carry out the various stages of movement and deployment it will perform when in space. By folding and stowing the spacecraft into the same configuration when it launches from French Guiana, the engineering team can confidently move forward with final environmental testing (acoustics and vibration). After completing the series of tests, Webb will be deployed one last time on Earth for testing prior to preparing for launch.

“While operating under augmented personal safety measures because of the novel coronavirus (COVID-19), the project continues to make good progress and achieve significant milestones in preparation for upcoming environmental testing,” said Gregory L. Robinson, the Webb program director at NASA Headquarters in Washington, D.C. “Team member safety continues to be our highest priority as the project takes precautions to protect Webb's hardware and continue with integration and testing. NASA will continually assess the project's schedule and adjust decisions as the situation evolves.”

https://www.eurekalert.org/

Planets with Hydrogen-rich Atmospheres Could Harbor Life

Microbes can live and grow in an atmosphere of pure hydrogen, lab experiments show. The finding could widen the range of environments where astronomers seek signs of alien life.

"We're trying to expand people's view of what should be considered a habitable planet," says exoplanet astronomer Sara Seager of MIT (SN: 10/4/19). "It seems to increase our chances that we may find life elsewhere."

Seager and her colleagues placed yeast and E. coli — both considered stand-ins for other single-celled organisms — in small bottles with some nutrient broth. The researchers displaced the air in six bottles and replaced it with pure hydrogen gas, pure helium gas or a mixture of 80 percent nitrogen and 20 percent carbon dioxide. A final set of bottles was left with Earth air.

Every few hours, the researchers removed some of the microbes with a hypodermic needle to count how many were alive. The microbes had replicated in every atmosphere tested, the team reports May 4 in Nature Astronomy, thriving most in ordinary Earth air.

In addition, E. coli in particular produced several gases that already are considered potential biosignatures, or signs of possible life, if found in other planets' atmospheres, including ammonia, methanethiol and nitrous oxide (SN: 4/18/16).

"E. coli is such a simple organism, yet it produces an incredible array" of gases, says astrobiologist Giada Arney at NASA's Goddard Space Flight Center in Greenbelt, Md., who was not involved in the experiments. "Knowing which gases can be produced by life is a necessary first step towards vetting them as possible detectable biosignatures on an exoplanet."

But just seeking a hydrogen-rich atmosphere isn't enough, says astrobiologist John Baross of the University of Washington in Seattle. A planet would also need to have the equivalent of the nutrient broth in the bottle for life to thrive — perhaps a liquid water ocean that exchanges chemicals with a rocky surface.

Astrobiologists plan to search for signs of alien life by looking at starlight filtering through exoplanets' atmospheres (SN: 4/19/16). If life on a rocky planet's surface emits telltale gases, future telescopes like the James Webb Space Telescope could detect those emissions.

It's not clear whether rocky planets with pure hydrogen atmospheres exist. Based on what's known about how planets form, pure hydrogen atmospheres should be rare, says planetary scientist Daniel Koll of MIT, who was not involved in the new work.

Because hydrogen is so light, an atmosphere of all or mostly hydrogen would be puffier and extend up to 14 times farther from the surface than Earth's nitrogen-dominated atmosphere. That means more starlight would filter through the atmosphere on its way to Earthly telescopes, making it easier to probe those atmospheres for biosignatures.

While the results also confirmed the microbes could also live in helium and nitrogen-dominant atmospheres, these atmospheres would be thinner and therefore harder to detect around other planets.

Seager noted the simple experiments might not be surprising to biologists. After all, there are microbes living in hydrogen-rich environments on Earth, such as niches in mines where calcium decay can create air pockets with 33 to 88 percent hydrogen by volume. (Most of Earth's hydrogen is locked up in water; the atmosphere overall contains much less than 1 percent hydrogen gas.)

Also, both E. coli and yeast can survive without oxygen — E. coli can live in the guts of many animals, and yeast is used in the fermentation industry for brewing beer. But since neither microbe is adapted to a purely hydrogen environment, Seager thought it was worth testing.

Koll agrees. "This is a very in-your-face demonstration that if Earth life can exist under hydrogen atmosphere conditions, then certainly alien life should be able to," Koll says. "We shouldn't limit, or be too Earth-centric, in what we consider interesting when we study other planets."

He adds that, if life-forms complex enough to have lungs and voice boxes lived on these worlds, they would have squeaky, high-pitched voices.

"You know the effect where you inhale a helium balloon and your voice sounds like Mickey Mouse?" he says. Hydrogen does the same thing. "You could definitely travel to an alien planet, take one breath of air, say something with a squeaky voice, and put your helmet back on."

From: https://www.sciencenews.org/article/planets-hydrogen-rich-atmosphere-alien-life

Test Equipment, Shim Washers, & a 30 Year Old Space Telescope

This year marks the 30th anniversary of the Hubble Space Telescope. When you see all the great pictures today, it is hard to remember that when it first launched, it was nearly a failure, taking fuzzy pictures. The story of how that problem was fixed while the telescope was whizzing through space is a good one. But there's another story: how did a $1.5 billion satellite get launched with defective optics? After all, we know space hardware gets tested and retested and, typically, little expense is spared to make sure once a satellite is in orbit, it will work well for a long time.

The problem was with a mirror. You might think mirrors are pretty simple, but it turns out there's a lot to know about mirrors. For astronomy, you need a first surface mirror which is different from your bathroom mirror which almost certainly reflects off the back of the glass. In addition, the mirrors need a very precise curve to focus light.

Perkin Elmer - a name you don't hear much anymore outside of the medical field, used to make many kinds of things including computers after they acquired Interdata. However, they also had a history working with optical systems, including for the KH-9 spy satellite. They were in charge of building and testing the Hubble's mirror. It was off by about 2 micrometers. That doesn't sound like much, but when focusing light - especially light from billions of miles away - it is a lot

How Bad Was it Really?

Here are two pictures of the M100 galaxy taken by the Hubble. You can probably guess which one was before the correction and which was after.

To give you an idea of how sensitive the mirror is, they use special glass made with titanium that has a very low thermal expansion - nearly zero. The Hubble holds the mirror temperature at 70 F and that only deviates about 1/800,000 of an inch in normal operation. I don't know how to do the math, but I've heard that if the mirror were the diameter of the Earth, the highest deviation on it would be six inches. Amazing. Turns out the mirror isn't as big as the Earth, but it is over 94" across - almost as big as the mirror at the Mount Wilson observatory.

A Tale of Two Mirrors

There were actually two mirrors, both made by Corning. One went to Perkin Elmer. The other went to Kodak who was making a backup mirror just in case. PE had bid $70 million while Kodak wanted $105 million to make the mirror. The cost of the Kodak mirror proposal was, in part, because they wanted to build two and use them to test each other. PE was only going to make one mirror and after NASA requested a backup mirror, they subbed that job back to Kodak who got the second blank for polishing.

I know $70 million sounds like a lot, but for this job, it really wasn't. That means PE was scrambling to do too much without enough people and without enough time. We've all been on programs like that.

A technician shimmed an optical test device - a null corrector - using common washers. A piece of worn paint caused a laser that tracks the distance between the tester and the mirror to be off by just a slight amount. The official story is the tech "failed to report it," but I would guess he was told not to report it in order to meet schedule. Wherever the blame lies, the error put the test equipment off by 1.3 mm. This led to the 2200 nanometer defect which caused the severe spherical aberration in the instrument.

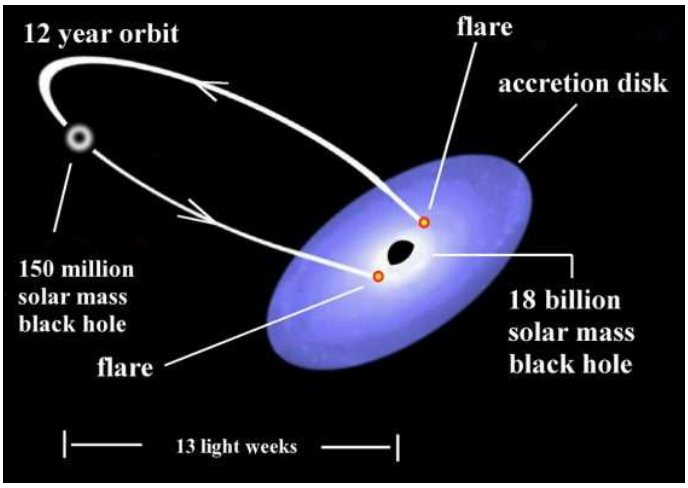
Conventional null detectors could not measure the required 10 nanometer flatness required for the mirror, so PE designed and built a special one — the one that was assembled incorrectly. Ironically, two standard null correctors reported the error, but since they were not as accurate as the custom one was supposed to be and — again, under budget and schedule pressure, they decided the certified tester was right when it said the mirror was perfect and didn't investigate. In fact, the NASA investigation mentions that several engineers on the project had concerns about the mirror's defects, but they were ignored.

And the Kodak mirror? It used a different test method and was actually reported to be slightly better than the PE mirror. But since PE was the prime contractor, it didn't want to admit to Kodak having a better mirror, so those reports were not highlighted until the investigation, after it was too late. Had the Hubble flown with the Kodak mirrors, it would have been fine from day one. If you are ever at the Smithsonian Air and Space Museum, it is sitting there as a reminder.

More at: https://hackaday.com/

Dancing Gargantuan Black Holes Perform on Cue

Astronomers have been able to test key consequences of Einstein's theories by studying the way a couple of black holes move around each other.



One of these objects is a true colossus - a hole weighing 18 billion times the mass of our Sun; the other not quite so big at "only" 150 million Sun masses. Scientists managed to predict their interactions very precisely. They did so by including their warping effects on space-time and by assuming the larger hole had a smooth "surface".

The black hole pairing, known as OJ 287, exists about 3.5 billion light-years from Earth.

Scientists have long recognised a sudden brightening from this system that occurs twice every 12 years. The outburst of energy is equivalent to a trillion suns turning on at once in the holes' host galaxy. The best explanation for this extraordinary behaviour is that the smaller object is routinely crashing through a disc of gas and dust that's accreting on to its larger companion, heating the inspiraling material to extremely high temperatures in the process. But this flaring is somewhat irregular. Sometimes the brightening episodes in the 12-year period occur as little as one year apart; other times, as much as 10 years apart.

"The orbit of the smaller black hole precesses. That's why the times of the impacts vary," explained Prof Mauri Valtonen from the University of Turku, Finland. "Already back in 1996, we had a model that predicted more or less what would happen. But we've just got more and more accurate," he told BBC News.

One of the updated model's important parameters is the energy radiating away from the system in the form of gravitational waves. These ripples in the fabric of space-time - described by Einstein's theory of general relativity - are generated by accelerating bodies; and in the super-massive circumstances of OJ 287, they have a significant influence on the way the system operates.

The big test of the latest model came on 31 July last year when the appearance of the most recent flaring was identified to within 2.5 hours of what the equations had anticipated.

The event was captured by the US space agency Nasa's Spitzer infrared telescope - a fortunate observation, as it turned out, because OJ 287 was on the far side of the Sun to the Earth at the time and therefore out of sight to ground-based facilities. Spitzer's separation from Earth (160 million km), on the other hand, put it in prime position.

"When I first checked the visibility of OJ 287, I was shocked to find that it became visible to Spitzer right on the day when the next flare was predicted to occur," said Dr Seppo Laine, a Caltech, US, staff scientist who oversaw the Spitzer viewing. "It was extremely fortunate that we would be able to capture the peak of this flare with Spitzer, because no other human-made instruments were capable of achieving this feat at that specific point in time."

Another refinement in the model involved folding in details about the larger black hole's physical characteristics. Specifically, its rotation.

Scientists, including the late Stephen Hawking, developed what became known as the "no-hair" theorem of black holes. This essentially states that the surface, or "event horizon", of a black hole along its rotation axis is symmetrical - there are no lumps and bumps. No hair, if you like. The observation of OJ 287 is said to be the best test yet of this idea. If there were serious irregularities, the predicted timing would not have worked out so well.

Prof Achamveedu Gopakumar, from the Tata Institute of Fundamental Research, India, worked on gravitational-wave additions to the model along with graduate student Lankeswar Dey.

The professor spoke of his "elation" on seeing the Spitzer data come through. He is now looking forward to OJ 287 being imaged by the Event Horizon Telescope which produced the first ever picture of a black hole last year.

"The EHT observed the source both in 2017 and 2018. The other campaigns are suspended (because of coronavirus) and we hope to get time during the 2021 campaign," he told BBC News.

The next flaring will be in 2022, and then in 2033 and 2034.

Animations at: https://www.bbc.co.uk/

NASA's TESS Enables Breakthrough Study of Perplexing Stellar Pulsations

Astronomers have detected elusive pulsation patterns in dozens of young, rapidly rotating stars thanks to data from NASA's Transiting Exoplanet Survey Satellite (TESS). The discovery will revolutionize scientists' ability to study details like the ages, sizes and compositions of these stars — all members of a class named for the prototype, the bright star Delta Scuti.

"Delta Scuti stars clearly pulsate in interesting ways, but the patterns of those pulsations have so far defied understanding," said Tim Bedding, a professor of astronomy at the University of Sydney. "To use a musical analogy, many stars pulsate along simple chords, but Delta Scuti stars are complex, with notes that seem to be jumbled. TESS has shown us that's not true for all of them."

Geologists studying seismic waves from earthquakes figured out Earth's internal structure from the way the reverberations changed speed and direction as they travelled through it. Astronomers apply the same principle to study the interiors of stars through their pulsations, a field called asteroseismology.

Sound waves travel through a star's interior at speeds that change with depth, and they all combine into pulsation patterns at the star's surface. Astronomers can detect these patterns as tiny fluctuations in brightness and use them to determine the star's age, temperature, composition, internal structure and other properties.

Delta Scuti stars are between 1.5 and 2.5 times the Sun's mass. They're named after Delta Scuti, a star visible to the human eye in the southern constellation Scutum that was first identified as variable in 1900. Since then, astronomers have identified thousands more like Delta Scuti, many with NASA's Kepler space telescope, another planet-hunting mission that operated from 2009 to 2018.

But scientists have had trouble interpreting Delta Scuti pulsations. These stars generally rotate once or twice a day, at least a dozen times faster than the Sun. The rapid rotation flattens the stars at their poles and jumbles the pulsation patterns, making them more complicated and difficult to decipher.

To determine if order exists in Delta Scuti stars' apparently chaotic pulsations, astronomers needed to observe a large set of stars multiple times with rapid sampling. TESS monitors large swaths of the sky for 27 days at a time, taking one full image every 30 minutes with each of its four cameras. This observing strategy allows TESS to track changes in stellar brightness caused by planets passing in front of their stars, which is its primary mission, but half-hour exposures are too long to catch the patterns of the more rapidly pulsating Delta Scuti stars. Those changes can happen in minutes.

But TESS also captures snapshots of a few thousand pre-selected stars — including some Delta Scuti stars — every two minutes. When Bedding and his colleagues began sorting through the measurements, they found a subset of Delta Scuti stars with regular pulsation patterns. Once they knew what to look for, they searched for other examples in data from Kepler, which used a similar observing strategy. They also conducted follow-up observations with ground-based telescopes, including one at the W.M. Keck Observatory in Hawaii and two in the global Las Cumbres Observatory network. In total, they identified a batch of 60 Delta Scuti stars with clear patterns.

"This really is a breakthrough. Now we have a regular series of pulsations for these stars that we can understand and compare with models," said co-author Simon Murphy, a postdoctoral researcher at the University of Sydney. "It's going to allow us to measure these stars using asteroseismology in a way that we've never been able to do. But it's also shown us that this is just a stepping-stone in our understanding of Delta Scuti stars."

Pulsations in the well-behaved Delta Scuti group fall into two major categories, both caused by energy being stored and released in the star. Some occur as the whole star expands and contracts symmetrically. Others occur as opposite hemispheres alternatively expand and contract. Bedding's team inferred the alterations by studying each star's fluctuations in brightness.

The data have already helped settle a debate over the age of one star, called HD 31901, a member of a recently discovered stream of stars orbiting within our galaxy. Scientists placed the age of the overall stream at 1 billion years, based on the age of a red giant they suspected belonged to the same group. A later estimate, based on the rotation periods of other members of the stellar stream, suggested an age of only about 120 million years. Bedding's team used the TESS observations to create an asteroseismic model of HD 31901 that supports the younger age.

"Delta Scuti stars have been frustrating targets because of their complicated oscillations, so this is a very exciting discovery," said Sarbani Basu, a professor of astronomy at Yale University in New Haven, Connecticut, who studies asteroseismology but was not involved in the study. "Being able to find simple patterns and identify the modes of oscillation is game changing. Since this subset of stars allows normal seismic analyses, we will finally be able to characterize them properly."

The team thinks their set of 60 stars has clear patterns because they're younger than other Delta Scuti stars, having only recently settled into producing all of their energy through nuclear fusion in their cores. The pulsations occur more rapidly in the fledgling stars. As the stars age, the frequency of the pulsations slows, and they become jumbled with other signals.

Another factor may be TESS's viewing angle. Theoretical calculations predict that a spinning star's pulsation patterns should be simpler when its rotational pole faces us instead of its equator. The team's TESS data set included around 1,000 Delta Scuti stars, which means that some of them, by chance, must be viewed close to pole-on.

Scientists will continue to develop their models as TESS begins taking full images every 10 minutes instead of every half hour in July. Bedding said the new observing strategy will help capture the pulsations of even more Delta Scuti stars.

"We knew when we designed TESS that, in addition to finding many exciting new exoplanets, the satellite would also advance the field of asteroseismology," said TESS Principal Investigator George Ricker at the Massachusetts Institute of Technology's Kavli Institute for Astrophysics and Space Research in Cambridge. "The mission has already found a new type of star that pulsates on one side only and has unearthed new facts about well-known stars. As we complete the initial two-year mission and commence the extended mission, we're looking forward to a wealth of new stellar discoveries TESS will make."

TESS is a NASA Astrophysics Explorer mission led and operated by MIT in Cambridge, Massachusetts, and managed by NASA's Goddard Space Flight Center. Additional partners include Northrop Grumman, based in Falls Church, Virginia; NASA's Ames Research Center in California's Silicon Valley; the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts; MIT's Lincoln Laboratory; and the Space Telescope Science Institute in Baltimore. More than a dozen universities, research institutes and observatories worldwide are participants in the mission.

There are no pictures in this article as everything on the website below is an animation or movie. Sorry, but it's not fair to include things like that whilst we still have members that only receive the paper version of NZ

Videos and more at: https://www.nasa.gov/feature/goddard/2020/nasa-s-tess-enables-breakthrough-study-of-perplexing-stellar-pulsations

New, Unstoppable Planetary Rover has Wiggling Wheels

Getting a robotic explorer to another world is an amazing accomplishment, but it won't be worth much if the mission comes to an early end because it gets stuck in the soil. NASA has partnered with the Georgia Institute of Technology to investigate ways a rover might be able to cope with crumbling or loose materials. The school constructed a prototype vehicle called Mini Rover with nifty "wiggling" wheels.

Sending robots to explore a place like Mars has many advantages, not the least of which is robots are much more hearty than humans. However, controlling a machine from several light-minutes away is tricky. Operators can use images from the rover to plan courses, but can only guess about the consistency of the surface. Attempting to climb a hill with loose gravel could be disastrous when there's no one in millions of miles who can right a flipped rover. The Spirit rover met its fate after becoming stuck in a patch of loose sand. Understanding a branch of physics called terradynamics could help avoid this.

According to Georgia Tech physicist Dan Goldman, a rover wheel with higher freedom can help a robot cope with almost any slippage as it navigates alien landscapes. The Mini Rover uses a wheel manoeuvre the team has dubbed "Rear Rotator Pedaling." The front wheels continuously push material back toward the rear wheels, which creates a slope less steep than the real slope. The rear wheels "pedal" to walk up the gentler slope. Thus, the rover creates multiple small hills to get over a large one. If the rover sinks into loose material, the same pedaling motion can pull the wheels free and inch them forward.

Georgia Tech built the prototype in collaboration with Johnson Space Center. Since it's easily repaired, the team was able to subject it to harsh conditions without fear of ruining it. This allowed researchers to test types of locomotion that could never have been tested on a full-sized rover developed for a real mission. They found the careful pedaling movement was the most helpful, and in general, going slow is the best approach.

From: https://www.extremetech.com/

Planet Hunters Discover New 'One In a Million' Super-Earth

Astronomers at the University of Canterbury (UC) have found an incredibly rare new Super-Earth planet towards the centre of the galaxy. The planet is one of only a handful that have been discovered with both size and orbit comparable to that of Earth.

Astronomers at the University of Canterbury (UC) have found an incredibly rare new Super-Earth planet towards the centre of the galaxy.

The planet is one of only a handful that have been discovered with both size and orbit comparable to that of Earth. The planet-hunters' research has recently been published in the Astronomical Journal.

Lead researchers in the discovery, astronomers Dr. Antonio Herr era Martin and Associate Professor Michael Albrow, both of UC's School of Physical and Chemical Sciences in the College of Science, are part of an international team of astronomers who collaborated on the Super-Earth research.

Dr. Herrera Martin, the paper's lead author, describes the planet-finding discovery as incredibly rare.

"To have an idea of the rarity of the detection, the time it took to observe the magnification due to the host star was approximately five days, while the planet was detected only during a small five-hour distortion. After confirming this was indeed caused by another 'body' different from the star, and not an instrumental error, we proceeded to obtain the characteristics of the star-planet system," he says.

Using the solar system as a point of reference, the host star is about 10% the mass of our Sun, and the planet would have a mass somewhere between that of Earth and Neptune, and would orbit at a location between Venus and Earth from the parent star. Due to the host star having a smaller mass than our Sun, the planet would have a 'year' of approximately 617 days.

The new planet is among only a handful of extra-solar planets that have been detected with both sizes and orbits close to that of Earth.

Dr. Herrera Martin explains the planet was discovered using a technique called gravitational microlensing.

"The combined gravity of the planet and its host star caused the light from a more distant background star to be magnified in a particular way. We used telescopes distributed around the world to measure the light-bending effect."

The microlensing effect is rare, with only about one in a million stars in the galaxy being affected at any given time. Furthermore, this type of observation does not repeat, and the probabilities of catching a planet at the same time are extremely low, the UC astronomer says.

This particular microlensing event was observed during 2018 and designated OGLE-2018-BLG-0677. It was independently detected by the Optical Gravitational Lensing Experiment (OGLE) using a telescope in Chile, and the Korea Microlensing Telescope Network (KMTNet) to which the UC astronomers belong, using three identical telescopes in Chile, Australia, and South Africa. The KMTNet telescopes are equipped with very large cameras, which the team uses to measure the light output from around one hundred million (100,000,000) stars every 15 minutes.

"These experiments detect around 3000 microlensing events each year, the majority of which are due to lensing by single stars," the paper's co-author Associate Professor Albrow notes.

"Dr. Herrera Martin first noticed that there was an unusual shape to the light output from this event, and undertook months of computational analysis that resulted in the conclusion that this event was due to a star with a low-mass planet."

More with links at: https://phys.org/news/2020-05-planet-hunters-million-super-earth.html

THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

Groundbreaking New Rocket-propulsion System

A University of Central Florida researcher and his team have developed an advanced new rocket-propulsion system once thought to be impossible.

The system, known as a rotating detonation rocket engine, will allow upper stage rockets for space missions to become lighter, travel farther, and burn more cleanly.

"The study presents, for the first time, experimental evidence of a safe and functioning hydrogen and oxygen propellant detonation in a rotating detonation rocket engine," said Kareem Ahmed, an assistant professor in UCF's Department of Mechanical and Aerospace Engineering who led the research.

The rotating detonations are continuous, Mach 5 explosions that rotate around the inside of a rocket engine, and the explosions are sustained by feeding hydrogen and oxygen propellant into the system at just the right amounts.

Mach 5 explosions create bursts of energy that travel 4,500 to 5,600 miles per hour, which is more than five times the speed of sound. They are contained within a durable engine body constructed of copper and brass.

The technology has been studied since the 1960s but had not been successful due to the chemical propellants used or the ways they were mixed.

Ahmed's group made it work by carefully balancing the rate of the propellants, hydrogen and oxygen, released into the engine.

"We have to tune the sizes of the jets releasing the propellants to enhance the mixing for a local hydrogen-oxygen mixture," Ahmed said. "So, when the rotating explosion comes by for this fresh mixture, it's still sustained. Because if you have your composition mixture slightly off, it will tend to deflagrate, or burn slowly instead of detonating."

Ahmed's team also had to capture evidence of their finding. They did this by injecting a tracer in the hydrogen fuel flow and quantifying the detonation waves using a high-speed camera.

"You need the tracer to actually see that explosion that is happening inside and track its motion," he said. "Developing this method to characterize the detonation wave dynamics is another contribution of this article."

William Hargus, lead of the Air Force Research Laboratory's Rotating Detonation Rocket Engine Program, is a co-author of the study and began working with Ahmed on the project last summer.

"As an advanced propulsion spectroscopist, I recognized some of the unique challenges in the observation of hydrogen-detonation structures," Hargus said. "After consulting with Professor Ahmed, we were able to formulate a slightly modified experimental apparatus that significantly increased the relevant signal strength."

"These research results already are having repercussions across the international research community," Hargus said. "Several projects are now re-examining hydrogen detonation combustion within rotating detonation rocket engines because of these results. I am very proud to be associated with this high-quality research."

From: University of Central Florida. "Groundbreaking new rocket-propulsion system." ScienceDaily

At The Observatory

For your own safety, please bring a torch.
Make sure you close and lock the car park gate if you are the last to leave.

Articles Needed

NZ needs letters, articles, reviews or pictures related to astronomy. Contact details on page 1.

"It's been said that astronomy is a humbling and, I might add, a character-building"
Carl Sagan

"The history of astronomy is a history of receding horizons"
Edwin Hubble

"The world is a dangerous place to live; not because of the people who are evil, but because of the people who don't do anything about it"
Albert Einstein

"Some people die at 25 and aren't buried until 75"
Benjamin Franklin

"Men do not learn much from the lessons of history and that is the most important of all the lessons of history"
Aldous Huxley

"Every time I see an adult on a bicycle, I no longer despair for the future of the human race"
H.G. Wells