

## Society News

### Maintenance

Hoping the weather will be improving from now on (at least for a few months!) and of course the darkness is happening later each month. With all that in mind I'd like to put out a general call for help at the observatory.

We still have work to do repairing parts of the dome and painting floors etc., hopefully getting everything up and running fully before the Autumn and the darker nights.

If you can spare some time to help out with general maintenance please get in touch with any of the Committee (*Contact list on Page 2*).

I'm hoping work can be started on Thursday evenings and perhaps the odd weekend as we head towards Summer

### Outreach

Helpers are always needed to help with our public outreach events so if you can spare a couple of hours you's be very welcome to help.

### Items For Sale

There are two telescopes for sale on behalf of members, both used but are in good condition and working order.

1. **An Alter M56 MN f6 Maksutov-Newtonian.**  
This telescope is in particularly good condition. There is no case but it does have a motorised (tracking) HEQ E3 mount with tripod The telescope is unmarked with minimal dust on the optics.
2. **A Celestron Celestar 8 (8") (OTA Only)**  
In very good condition and comes with a wooden case and accessories.

Viewing of either at the Observatory can be arranged by contacting me on

**07594 339950 or [editor@wightastronomy.org](mailto:editor@wightastronomy.org)**

*Brian Curd*

## VAS Website: [wightastronomy.org](http://wightastronomy.org)

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

**The Editor, New Zenith  
Belvedere**

**St John's Crescent**

**Sandown**

**Isle of Wight**

**PO36 8EE**

Tel: 07594 339950 or email: [editor@wightastronomy.org](mailto:editor@wightastronomy.org)

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

The Vectis Astronomical Society and the Editor of the New Zenith accept no responsibility for advice, information or opinion expressed by contributors.

**Registered Charity No 1046091**

## Observatory Diary

|                     |   |
|---------------------|---|
| Monday,<br>19.30hrs | Members Only and by arrangement<br>Telescope and night sky training.        |
| Thursday            | Members (19.30hrs) and Public (20.00hrs).<br>Informal meeting and observing |

## VAS Website: [wightastronomy.org](http://wightastronomy.org)

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## 2023 Monthly Meetings

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

| Date   | Subject  | Speaker                           |
|--------|--|-----------------------------------|
| 28 Apr | Fun with the Sun<br>Sundials for star-gazers   | Peter Ransom                      |
| 26 May | Not Booked   |                                   |
| 23 Jun | <b>ZOOM only</b><br>Stellar Evolution - the life cycle of a star and its implications for life in our Solar System | Dr Elizabeth Cunningham           |
| 28 Jul | Variable Stars   | Bryn Davis                        |
| 25 Aug | AGM  | <b>Meeting in the Observatory</b> |
| 22 Sep | <b>ZOOM Only</b><br>TBA  | Martin Lunn                       |
| 27 Oct | <b>ZOOM Only</b><br>The Great Debate (The Shapley-Curtiss Debate of 1920)  | Nick Hewitt                       |
| 24 Nov | EM-bridge technology and applications  | Alan Thomson                      |

## Observatory Visits Booked

No bookings so far

**Please phone me for the current situation (number on the front page)**

It would be appreciated if members could avoid using the observatory at these times.

***GDPR rules mean we must maintain accurate membership records, please tell us if any of your contact details change.***

## VAS Contacts 2023

|                             |  |
|-----------------------------|--|
| <b>President</b>            | Barry Bates<br>president@wightastronomy.org      |
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| <b>NZ Distribution</b>      | Brian Curd<br>distribution@wightastronomy.org    |
| <b>Others</b>               | Dudley Johnson                                   |

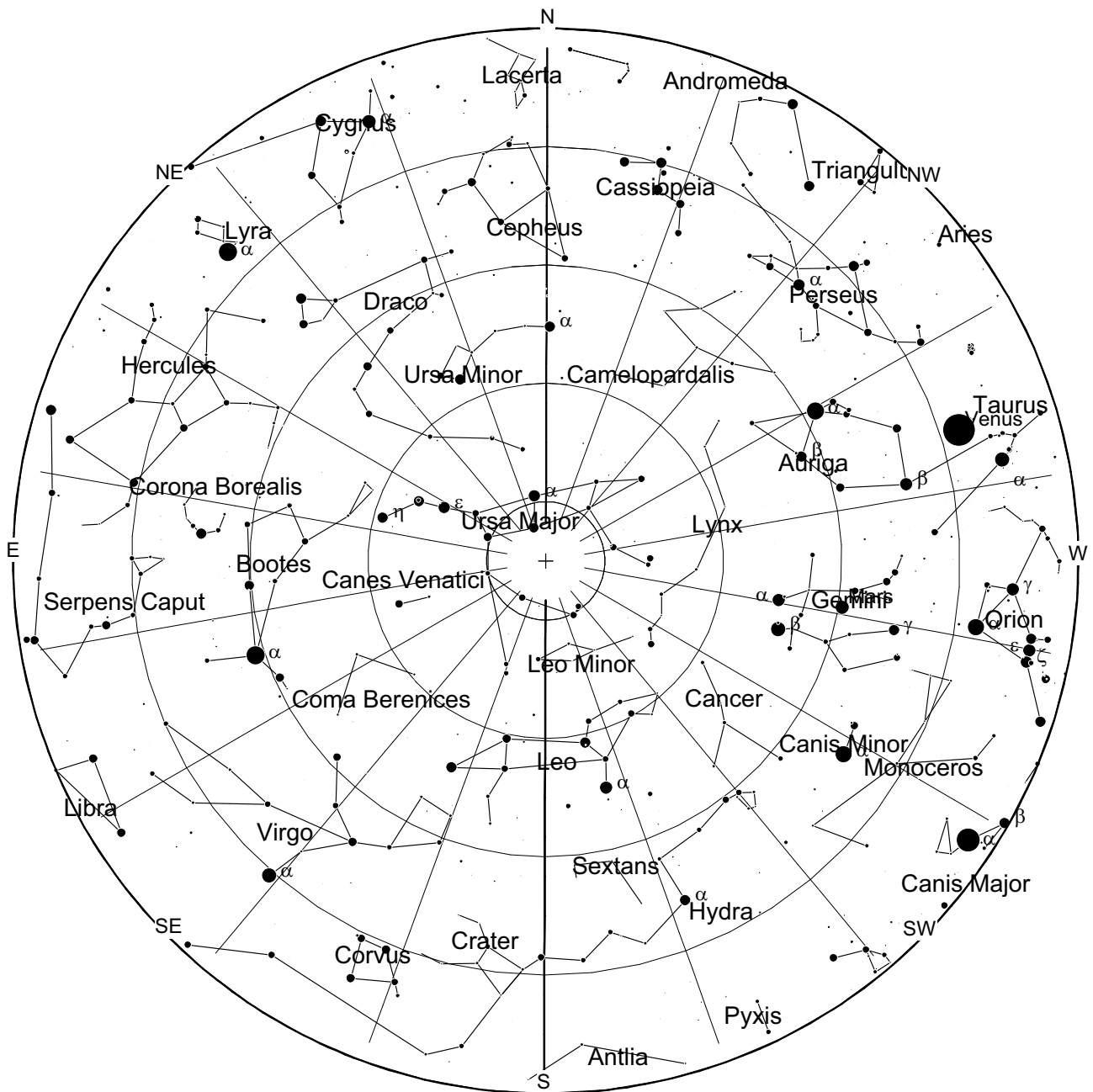
## Important

Members using the observatory **MUST** enter a line or two in the Observatory Log Book.

On several occasions, lights, heaters and the Meade LX200 have been left on!

When leaving, please ensure all is secure and all lights, heaters and telescopes are **TURNT OFF**.

# April 2023 - Sky Map



View from Newchurch Isle of Wight UK - 2200hrs - 20 April 2023







NGC 5866 (also called the Spindle Galaxy or Messier 102) is a relatively bright lenticular galaxy in the constellation Draco. NGC 5866 was most likely discovered by Pierre Méchain or Charles Messier in 1781, and independently found by William Herschel in 1788. Measured orbital velocities of its globular cluster system imply that dark matter makes up only  $34 \pm 45\%$  of the mass within 5 effective radii, a notable paucity.

One of the most outstanding features of NGC 5866 is the extended dust disk, which is seen almost exactly edge-on. This dust lane is highly unusual for a lenticular galaxy. The dust in most lenticular galaxies is generally found only near the nucleus and generally follows the light profile of the galaxies' bulges.

This article is licensed under the [GNU Free Documentation License](https://www.gnu.org/licenses/fdl.html). It uses material from the Wikipedia article "NGC 5866".

## April 2023 - Night Sky

### Moon Phases

| New   | First Qtr   | Full  | Last Qtr  |
|---|---|---|---|
| 20th  | 29th  | 6th   | 13th  |
|  |  |  |  |

### Planets

#### Mercury

Mercury continues the evening apparition started last month. It is best observed during the first week of the month when it will be at its brightest. A pair of binoculars or small telescope will help to find the planet against the still bright sky. This month's is Mercury's best evening apparition of the year.

| Azimuth & Altitude of Mercury at 20:30 BST |     |     |      |     |     |
|--|-----|-----|------|-----|-----|
| Date                                       | Az  | Alt | Date | Az  | Alt |
| 1  | 282 | 4   | 11   | 284 | 11  |
| 3  | 283 | 6   | 13   | 285 | 12  |
| 5  | 283 | 8   | 15   | 285 | 12  |
| 7  | 283 | 9   | 17   | 286 | 11  |
| 9  | 283 | 10  | 19   | 287 | 10  |

#### Venus

Venus is very easily seen in the western sky at, or if the sky is clear even before sunset. After the Sun and Moon it is the brightest object in the night sky. On the 23rd there is a photo opportunity when it sits just below the crescent moon.

#### Mars

As the sky darkens Mars can be found high in the western sky in the constellation of Gemini. It sits above the two red giant stars Betelgeuse and Aldabaran and at magnitude 1 is a little fainter than them both.

#### Jupiter

After last month's close conjunction with the planet Venus, Jupiter will be in conjunction with the Sun this month and as such is not available for observation. It will make a return in the morning sky next month.

#### Saturn

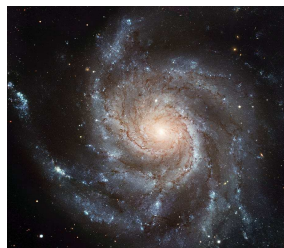
Although Saturn is a long way from solar conjunction, from our latitude it rises only just over an hour before the Sun and is lost to the glare of the bright morning twilight.

### Uranus & Neptune

Both the outer ice giant planets are not visible until later in the year.

### Deep Sky

#### M101 The Pin Wheel Galaxy RA 14h 3m Dec 54° 18' mag 8.5



In contrast to M102 this is a large, almost perfectly face on galaxy. Covering an area of sky about a quarter of that of the full moon this galaxy is visually not as bright as its magnitude might suggest, but as galaxies go it is still quite easy to find and is visible as a dim smudge on the

sky in a pair of binoculars.

#### M102/NGC5866 Spindle Galaxy RA 15h 7m Dec 55° 44' mag 10.5

Is this really M102? Did Messier ever see this galaxy or was it all a great mistake, and just a duplicate observation of M101, perhaps we will never know. An almost perfectly edge on galaxy, visually it lives up to its name, small telescopes show it as a silvery spindle of light against a hopefully dark background. Larger 'scopes may, if the seeing is good enough show a thin dust lane cutting through the central bulge.

#### M104 The Sombrero Galaxy RA 12h 40m Dec -11° 40' mag 9.5



This is a classic galaxy, it is pictured in almost all books on astronomy showing its distinctive dark dust lane forming the 'shadow' that gives this almost edge on galaxy its name. Unfortunately it is a little

low in our skies and so is dimmed by atmospheric absorption. This does not however prevent some detail being seen visually in telescopes with greater than 6" diameter, or CCD cameras capturing the vast halo that surrounds this galaxy.

### Meteor Showers

The Lyrid meteor shower that is associated with Comet Thatcher marks the end of the spring lull in meteors, it is active between the 14th & 30th and peaks during the night of the 22nd/23rd. It produces fast bright meteors with an hourly rate of about 18.

*Peter Burgess*

## Astronomers Sound Alarm About Light Pollution From Satellites



Astronomers have warned that the light pollution created by the soaring number of satellites orbiting Earth poses an “unprecedented global threat to nature.”

The number of satellites in low Earth orbit have more than doubled since 2019, when US company SpaceX launched the first “mega-constellation,” which comprise thousands of satellites.

An armada of new internet constellations are planned to launch soon, adding thousands more satellites to the already congested area fewer than 2,000 kilometers (1,250 miles) above Earth.

Each new satellite increases the risk that it will smash into another object orbiting Earth, creating yet more debris.

This can create a chain reaction in which cascading collisions create ever smaller fragments of debris, further adding to the cloud of “space junk” reflecting light back to Earth.

In a series of papers published in the journal *Nature Astronomy*, astronomers warned that this increasing light pollution threatens the future of their profession.

In one paper, researchers said that for the first time they had measured how much a brighter night sky would financially and scientifically affect the work of a major observatory.

Modeling suggested that for the Vera Rubin Observatory, a giant telescope currently under construction in Chile, the darkest part of the night sky will become 7.5 percent brighter over the next decade.

That would reduce the number of stars the observatory is able to see by around 7.5 percent, study co-author John Barentine told AFP.

That would add nearly a year to the observatory's survey, costing around \$21.8 million, said Barentine of Dark Sky Consulting, a firm based in the US state of Arizona.

He added that there is another cost of a brighter sky that impossible to calculate: the celestial events that humanity will never get to observe.

And the increase in light pollution could be even worse than thought.

Another *Nature* study used extensive modeling to suggest that current measurements of light pollution are significantly underestimating the phenomenon.

### 'Stop this attack'

The brightening of the night sky will not just affect professional astronomers and major observatories, the researchers warned.

Aparna Venkatesan, an astronomer at the University of San Francisco, said it also threatened “our ancient relationship with the night sky”.

“Space is our shared heritage and ancestor - connecting us through science, storytelling, art, origin stories and cultural traditions - and it is now at risk,” she said in a *Nature* comment piece.

A group of astronomers from Spain, Portugal and Italy called for scientists to “stop this attack” on the natural night.

“The loss of the natural aspect of a pristine night sky for all the world, even on the summit of K2 or on the shore of Lake Titicaca or on Easter Island is an unprecedented global threat to nature and cultural heritage,” the astronomers said in a *Nature* comment piece.

“If not stopped, this craziness will become worse and worse.”

The astronomers called for drastically limiting mega-constellations, adding that “we must not reject the possibility of banning them.”

They said that it was “naive to hope that the skyrocketing space economy will limit itself, if not forced to do so,” given the economic interests at stake.

<https://phys.org/news/2023-03-astronomers-alarm-pollution-satellites.html>

## Unfathomable Z 229-15:



*Hubble Space Telescope image shows Z 229-15 in beautiful detail. This celestial object that lies about 390 million light-years from Earth in the constellation Lyra.*

*Credit: ESA/Hubble & NASA, A. Barth, R. Mushotzky*

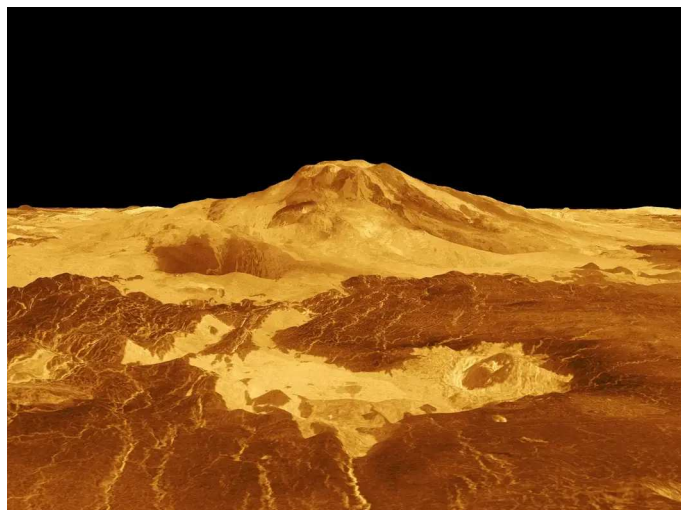
This luminous NASA/ESA Hubble Picture shows Z 229-15 - imaged here in exquisite detail by the Hubble Space Telescope - a celestial object that lies about 390 million light-years from Earth in the constellation Lyra. Z 229-15 is one of those interesting celestial objects that, should you choose to research it, you will find defined as several different things: sometimes as an active galactic nucleus (an AGN); sometimes as a quasar; and sometimes as a Seyfert galaxy. Which of these is Z 229-15 really? The answer is that it is all of these things all at once, because these three definitions have significant overlap.

In essence, an AGN is a small region at the heart of certain galaxies (called active galaxies) that is far brighter than just the galaxy's stars would be. The extra luminosity is due to the presence of a supermassive black hole at the galaxy's core. Material sucked into a black hole actually doesn't fall directly into it, but instead is drawn into a swirling disc, from where it is inexorably tugged towards the black hole. This disc of matter gets so hot that it releases a large amount of energy across the electromagnetic spectrum, and that's what makes AGNs appear so bright.

Quasars are a particular type of AGN; they are typically both extremely bright and extremely distant from Earth - several hundred million light-years is considered nearby for a quasar, making Z 229-15 positively local. Often an AGN is so bright that the rest of the galaxy cannot be seen, but Seyfert galaxies are active galaxies that host very bright AGNs (quasars) while the rest of the galaxy is still observable. So Z 229-15 is a Seyfert galaxy that contains a quasar, and that, by definition, hosts an AGN. Classification in astronomy can be a challenge!

<https://scitechdaily.com/unfathomable-z-229-15-everything-in-one-place-all-at-once/>

## Venus Is Alive!



*Maat Mons is displayed in this computer-generated, three-dimensional perspective of the surface of Venus. The viewpoint is located 634 kilometers (393 miles) north of Maat Mons at an elevation of 3 kilometers (2 miles) above the terrain. Lava flows extend for hundreds of kilometers across the fractured plains shown in the foreground, to the base of Maat Mons. NASA Magellan mission synthetic aperture radar data is combined with radar altimetry to develop a three-dimensional map of the surface. The vertical scale in this perspective has been exaggerated 10 times. Credit: NASA/JPL*

## New Evidence That Venus Is Volcanically Active

New research provides strong evidence of volcanic activity on Venus. The study identified a nearly 1-square-mile volcanic vent that changed shape and grew over eight months in 1991. Such changes on Earth are associated with volcanic activity, either through eruptions or magma movement causing vent walls to collapse and expand. This discovery offers insights into the geology of Venus, Earth's sister planet, which, despite being similar in size and mass, lacks plate tectonics.

Venus appears to have volcanic activity, according to a new research paper that offers strong evidence to answer the lingering question about whether Earth's sister planet currently has eruptions and lava flows. Although planets are not considered "alive" in the biological sense, scientists refer to a planet as "alive" when it is geologically active. A geologically active planet may have a dynamic core, volcanic activity, or tectonic movement. Scientists used to think Venus was geologically dead, but this new research is strong evidence that it is still geologically active.

Venus, although similar to Earth in size and mass, differs markedly in that it does not have plate tectonics. The boundaries of Earth's moving surface plates are the primary locations of volcanic activity.

New research by University of Alaska Fairbanks Geophysical Institute research professor Robert Herrick revealed a nearly 1-square-mile volcanic vent that changed in shape and grew over eight months in 1991. Changes on such a scale on Earth are associated with volcanic activity, whether through an eruption at the vent or movement of magma beneath the vent that causes the vent walls to collapse and the vent to expand.

The research was published recently in the journal *Science*.

Herrick studied images taken in the early 1990s during the first two imaging cycles of NASA's Magellan space probe. Until recently, comparing digital images to find new lava flows took too much time, the paper notes. As a result, few scientists have searched Magellan data for feature formation.

"It is really only in the last decade or so that the Magellan data has been available at full resolution, mosaiced and easily manipulable by an investigator with a typical personal workstation," Herrick said.

The new research focused on an area containing two of Venus' largest volcanoes, Oza and Maat Mons.

"Oza and Maat Mons are comparable in volume to Earth's largest volcanoes but have lower slopes and thus are more spread out," Herrick said.

Maat Mons contains the expanded vent that indicates volcanic activity.

Herrick compared a Magellan image from mid-February 1991 with a mid-October 1991 image and noticed a change to a vent on the north side of a domed shield volcano that is part of the Maat Mons volcano.

The vent had grown from a circular formation of just under 1 square mile to an irregular shape of about 1.5 square miles.

The later image indicates that the vent's walls became shorter, perhaps only a few hundred feet high, and that the vent was nearly filled to its rim. The researchers speculate that a lava lake formed in the vent during the eight months between the images, though whether the contents were liquid or cooled and solidified isn't known.

*More at: <https://scitechdaily.com/venus-is-alive/>*

## James Webb Spots Swirling, Gritty Clouds On Remote Planet



Researchers observing with NASA's James Webb Space Telescope have pinpointed silicate cloud features in a distant planet's atmosphere. The atmosphere is constantly rising, mixing, and moving during its 22-hour day, bringing hotter material up and pushing colder material down.

The resulting brightness changes are so dramatic that it is the most variable planetary-mass object known to date. The team, led by Brittany Miles of the University of Arizona, also made extraordinarily clear detections of water, methane and carbon monoxide with Webb's data, and found evidence of carbon dioxide. This is the largest number of molecules ever identified all at once on a planet outside our solar system.

Catalogued as VHS 1256 b, the planet is about 40 light-years away and orbits not one, but two stars over a 10,000-year period. "VHS 1256 b is about four times farther from its stars than Pluto is from our sun, which makes it a great target for Webb," Miles said. "That means the planet's light is not mixed with light from its stars."

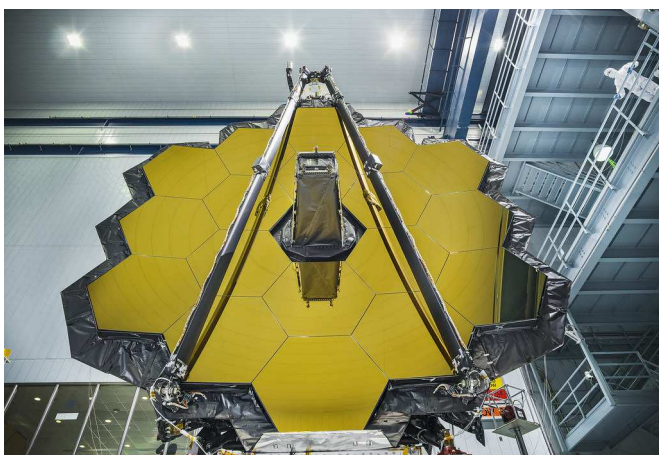
Higher up in its atmosphere, where the silicate clouds are churning, temperatures reach a scorching 1,500 degrees Fahrenheit (815 degrees Celsius).

Within those clouds, Webb detected both larger and smaller silicate dust grains, which are shown on a spectrum. "The finer silicate grains in its atmosphere may be more like tiny particles in smoke," noted co-author Beth Biller of the University of Edinburgh in Scotland. "The larger grains might be more like very hot, very small sand particles."

VHS 1256 b has low gravity compared to more massive brown dwarfs, which means that its silicate clouds can appear and remain higher in its atmosphere where Webb can detect them. Another reason its skies are so turbulent is the planet's age. In astronomical terms, it's quite young. Only 150 million years have passed since it formed - and it will continue to change and cool over billions of years.

In many ways, the team considers these findings to be the first “coins” pulled out of a spectrum that researchers view as a treasure chest of data. In many ways, they've only begun identifying its contents. “We've identified silicates, but better understanding which grain sizes and shapes match specific types of clouds is going to take a lot of additional work,” Miles said. “This is not the final word on this planet - it is the beginning of a large-scale modeling effort to fit Webb's complex data.”

Although all of the features the team observed have been spotted on other planets elsewhere in the Milky Way by other telescopes, other research teams typically identified only one at a time. “No other telescope has identified so many features at once for a single target,” said co-author Andrew Skemer of the University of California, Santa Cruz. “We're seeing a lot of molecules in a single spectrum from Webb that detail the planet's dynamic cloud and weather systems.”



The team came to these conclusions by analyzing data known as spectra gathered by two instruments aboard Webb, the Near-Infrared Spectrograph (NIRSpec) and the Mid-Infrared Instrument (MIRI). Since the planet orbits at such a great distance from its stars, the researchers were able to observe it directly, rather than using the transit technique or a coronagraph to take this data.

There will be plenty more to learn about VHS 1256 b in the months and years to come as this team - and others - continue to sift through Webb's high-resolution infrared data. “There's a huge return on a very modest amount of telescope time,” Biller added. “With only a few hours of observations, we have what feels like unending potential for additional discoveries.”

What might become of this planet billions of years from now? Since it's so far from its stars, it will become colder over time, and its skies may transition from cloudy to clear.

More at: <https://phys.org/news/>

## Nearly 300 Variable Stars Detected With Kepler Spacecraft

Using data from NASA's Kepler spacecraft, astronomers from the Pedagogical University of Cracow, Poland, and elsewhere have detected 278 variable stars in the open cluster NGC 6791 and its surroundings.

Variable stars could offer important hints into aspects of stellar structure and evolution. They could also be helpful for better understanding the distance scale of the universe. In particular, studies of variable stars in star clusters are of special interest for astronomers as they have the potential to help identify systematic errors that affect stellar distance indicators.

Located about 13,300 light years from the Earth in the Lyra constellation, NGC 6791 is one of the most studied open clusters (OCs). It has an estimated age of approximately 8 billion years and an iron to hydrogen abundance ratio that is more than twice that of our sun. This makes it one of the oldest and most metal-rich clusters in the Milky Way galaxy. With a mass of approximately 4,000 solar masses, it is also one of the most massive OCs known to date.

Previous observations of NGC 6791 have found that it hosts multiple stellar populations and detected hundreds of variable stars in the cluster. Recently, a team of astronomers led by Sachu Sanjayan has analyzed the data obtained by Kepler's prolonged mission known as K2, hoping to discover more variables in NGC 6791.

All in all, the team identified 278 variable stars, out of which 119 turned out to be newly detected variables. Among the whole sample, 17 binaries, 45 pulsators, 62 rotational and five unclassified variables were found to be members of NGC 6791. The remaining 28 binaries, 25 pulsators, 83 rotational, four unclassified and nine unidentified variables are either not cluster members or their membership is yet to be determined.

The color-magnitude diagrams (CMDs) show that a majority of the identified variable stars in NGC 6791 are located in the main sequence. Solar-like pulsators are mostly located in the red giant branch (RGB) and red clump (RC), while semi-regular variables are located in the RGB and asymptotic giant branch (AGB). In addition there are five blue straggler (BS) and three extreme horizontal branch (EHB) stars.

Based on the newly collected data, the researchers managed to derive fundamental parameters for NGC 6791. The results indicate that the cluster is 8.9 billion years old, has a metallicity at a level of 0.26–0.28, and is located some 13,500 light years away.

More at: <https://phys.org/news/>



## Preserving The Stars: Light Pollution and What You Can Do About It



*Astrophysicist Ms Kirsten Banks explains what we can do to reverse the impact of "light glow".*

*Credit: UNSW Sydney*

Astronomer Carl Sagan famously said that there were more stars in the universe than grains of sand on earth.

It has been estimated that there are over 100 billion stars in the Milky Way galaxy. While there is a limit to how many stars we can see from earth with the naked eye, that number is dramatically reducing due to light pollution.

"We should be able to see around 2,500 stars with the naked eye on any night, and we can see about 125 of them at best in Sydney," says astrophysicist, proud Wiradjuri woman and UNSW Ph.D. candidate Ms. Kirsten Banks.

In fact, in a recent study published in *Science*, data collected by citizen scientists around the world found light pollution is increasing at a rate that is equivalent to the brightness of the sky doubling every eight years.

This latest research continues to expose the extent to which we're losing the darkness of our night sky. Not being able to look up and see the stars will have significant cultural impacts, but there are steps we can all be taking to reduce the effect of light pollution.

### **What Causes 'Light Glow?'**

Artificial lighting that escapes and seeps into the sky causes what is known as "light glow" - a form of light pollution that stops humans from seeing the stars.

"Light glow is this extra light that is not actually useful for seeing when you're walking in the dark, for example. And it's this glow of light that spreads out and leaks into

the sky in a way that washes out fainter lights that are usually stars," says Ms. Banks.

This latest study involved over 51,000 citizen science observations of stellar visibility with the naked eye, revealing the change in global sky brightness over an 11-year period - from 2011 to 2022.

The data showed that the number of visible stars decreased by an amount that can be explained by an increase in sky brightness of 7% to 10% per year.

This study was done on a global scale, but around 68% of the observations were from North America and Europe, with a one-off campaign in Australia in 2020, and a scattering of data collected across Asia, Africa and South America.

Although the data was primarily collated from elsewhere, Ms. Banks explains that light pollution is still a problem in Australia. "In Sydney, the light pollution that we experience is almost the same light pollution as the moon emits. This means if you're in a place with no light pollution, and there's a full moon out, you have the same sort of night sky visibility that you would in Sydney."

### **Everyone Is An Astronomer**

You don't need any fancy machinery or special equipment to observe the stars.

"I think it's important for everyone to be able to look up into the stars, because it's one of the most accessible sciences out there," says Ms. Banks. "All you need to do is look up and you can see it, you are doing astronomy by looking up into the night sky. And when we take that away with light pollution, that takes a whole science away from people."

Many different cultures around the world have a rich history and connection to the stars and the night sky. In Australia alone, there are more than 250 Indigenous groups that have understood and used the stars for the last 65,000 years, and their knowledge is still exercised to this day, says Ms. Banks.

"The night sky is really important to Aboriginal peoples. We're losing culture because of the stars we're losing sight of in these bright cities. All of these stars have cultural importance within stories and lessons. And some of them we just can't see anymore. So through that, and, of course, all of the other effects of colonization, we're losing all those stories."

### **Reversing The Impact Of Light Glow**

Unlike many other forms of pollution, light pollution is reversible and there are measures we can take to restore the deep darkness of the sky.

“There are lots of ways to reduce the amount of light pollution that we put out into the sky,” says Ms. Banks.

“One good example is by creating very directional streetlights. So, when you walk around, you may see some streetlights that are just these big lights that shine in all directions. But really, you only need light to shine down on the path that you're walking on, because that's where it's actually useful. So we can change the design of our lights to be more proactive about where we actually want the light to be.”

As well as the direction and brightness of the lights we use, we can also change the color to a more amber/orange hue which reduces light glow, explains Ms. Banks.

While some measures have been adopted on a local scale, there is lots more that can be done. In recent years, awareness of light pollution has led some policymakers to introduce measures that attempt to control it.

“These measures have already been taken in places like Coonabarabran,” says Ms. Banks. “There are very strict guidelines for all sorts of lights and they have certain regulations so that they preserve the night sky for that area, because of the observatory nearby.”

As Ms. Banks explains, everyone can have a part to play. “One way that people can get involved is just turning off lights that are unnecessary, like really bright floodlights on your backyard or your patio”

“There are simple solutions to this that people can take every single day.”

<https://phys.org/news/>



## Squiggly Lines and Pretty Pictures

### A Review of Feb & Mar 2023 Talks

We have already been treated to two excellent presentations this year, in the VAS monthly talk series. In February Steve Broadbent brought us an updated version of “The Colour of Light”, all about astronomical spectroscopy, and in March John Slinn gave us an excellent and very practical talk “How to be a Better Observer: maximising your time at the eyepiece.” Steve spoke to us over Zoom, which attracted a good number of members and non-members through our arrangement with the Institute of Physics. John’s talk was in person at the Newchurch Pavilion and again there was a good turnout, with several new faces and returning members. I’d like to say we are doing something right with publicity, but I suspect it was the high quality of the speakers that did it!

Newton – amongst others – observed how the colours of sunlight are separated using prisms. But since the 19<sup>th</sup> century it has been line gratings that are the basis of spectroscopes. The spectra produced have provided the means of most astronomical breakthroughs. Ever more powerful telescopes may gather more light and allow us to see further, with greater resolution, but it is the spectra that enable measurements of motion, temperature and the composition of nebulae, stars and planetary atmospheres. These are the “Squiggly Lines” that give us the science, rather than the “Pretty Pictures” we all so love.

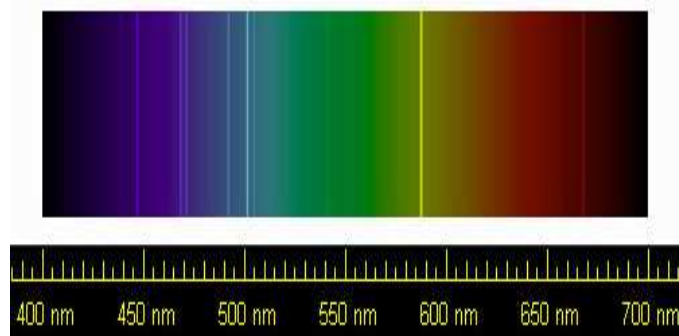


Figure 1 – The spectral lines of Helium: that bright yellow one was first noticed by Frenchman Jules Janssen during the so-called “King of Siam’s eclipse” of 1868 (NASA / Wikimedia)

Steve Broadbent dipped into the technicalities just enough to give an outline of how these measurements are achieved. He showed how the variation of light intensity across a range of colours indicates the temperature of an object (through “blackbody” radiation, described by Kirchhoff’s Laws) and how the appearance of dark lines, “absorption spectra”, within the continuum are characteristic of different elements. Similarly, for hot, low-density gas, in the atmosphere of a star, for instance, there are series of bright lines. This was the way Helium was

discovered in the Sun’s atmosphere, observed during a solar eclipse, before it had been detected on Earth.

We may be familiar with the term “red-shift” and that it’s measurement can be mapped onto the speed that something is separating from us (due to the Doppler Effect), but it is exactly these bright or dark line spectra that are shifted. The brilliant work of Henrietta Swan Leavitt and others, early in the 20<sup>th</sup> century, then led to the association of red-shift indicating the expansion of the Universe, as captured in the Hubble-Lemaitre Law, a gateway into modern cosmology. Steve’s talk was richly illustrated and carefully explained. We had hoped for a live demonstration from one of the Hampshire Astronomy Group’s telescopes, but we were deprived of that by poor viewing conditions that evening. Nevertheless, I can’t have been the only one who would relish the idea of viewing and interpreting spectra for ourselves at the Observatory?

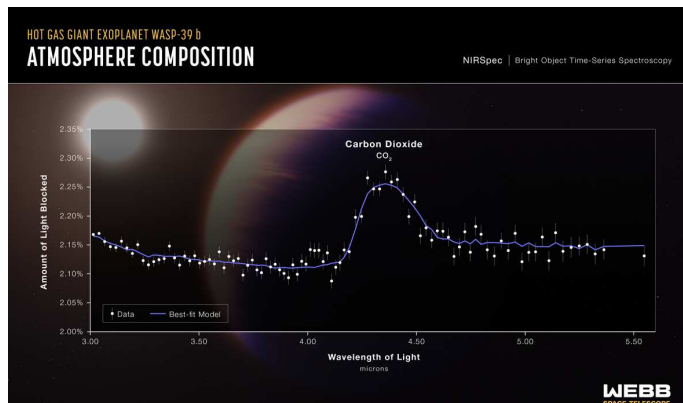


Figure 2 – The James Webb Space Telescope has detected carbon dioxide in the atmosphere of an exo-planet 700 light years away! (NASA/JWST & Wikimedia)

While Steve’s talk took us into the physics of light from distant suns, John Slinn brought us right back down to our back gardens, with a talk that literally dealt with the nuts and bolts of amateur astronomy. Specifically, don’t forget to tighten those nuts and bolts before you set your equipment up!

There was just so much valuable information in one hour that my notes could not contain it. Starting with basic equipment, the “Mark 1 Eyeball”, even here there are principles of use and preparation to think about: dark adaptation, averted vision and training to use both eyes (with aid of an eyepatch). I was reminded that Patrick Moore said that, apart from the eyeballs, the only essential piece of astronomical equipment is a warm pair of socks.

From selection of observing site (grass field best; use a light groundsheet to see what you’ve dropped; use your car as a wind break) to choice of equipment (beware cheap plastic fittings) including eyepieces, and filters of every conceivable type, this could have been whole observing

course. I learned a lot about eye relief, “kidney-beaning” and “aperture fever”, but the one take-away for me was that preparation is everything, so that when those clouds eventually break, you can make the very most of your time.

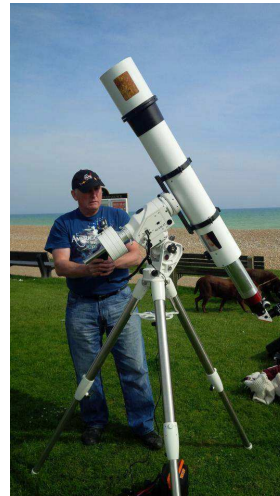


Figure 3 - John Slinn in action

John has not only a wealth of technical knowledge, having worked in an astronomy shop for 5 years, but also decades of observing experience and we are fortunate that he is a member of VAS here on the Island. Judging by the number of questions at the end of the session and John’s generous answers, it was not just me that was inspired to get better prepared and make more of a clear dark sky. That award-winning astrophotography does not happen by chance – there is a lot of careful thought and practice behind those “pretty pictures”. Thank you, John, for a practical and memorable talk!

**by Simon Gardner (April 2023) – if you have any feedback on the talks, positive or negative, or ideas for talks that you would like to see or even give, please contact me (progorg@wightastronomy.org)**

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## Ultramassive Black Hole Discovered to Be 33 Billion Times More Massive Than The Sun



*An illustration of a black hole showing how the gravitational field warps light traveling from behind the black hole. (ESA/Hubble, Digitized Sky Survey, Nick Risinger/skysurvey.org, N. Bartmann)*

The bending of light as its path veers around a giant, invisible mass has revealed the presence of one of the biggest black holes yet detected in the Universe.

In a galaxy at the center of a massive cluster named Abell 1201, some 2.7 billion light-years away, lurks a cosmic colossus. Not content with being supermassive, the monster is an ultramassive black hole, clocking in at around 32.7 billion times the mass of the Sun.

The new figure exceeds previous estimates by at least 7 billion solar masses, demonstrating the power of curved light for measuring masses with precision.

“This particular black hole, which is roughly 30 billion times the mass of our Sun, is one of the biggest ever detected and on the upper limit of how large we believe black holes can theoretically become, so it is an extremely exciting discovery,” explains physicist James Nightingale of Durham University in the UK.

There are a lot of black holes out there in the Universe, but unless they're actively accreting material – a process that produces a great deal of light as the material heats up prior to falling into the black hole – they're not easy to spot. Black holes themselves emit no light we can detect, so we have to find them by looking for the effect they have on stuff around them.

One way we can find these black holes is looking for an effect called gravitational lensing. This occurs when space-time itself is warped by mass; imagine space-time as a rubber sheet, and the mass as a heavy weight on it. Any light traveling through that region of space-time has to travel along a curved path, and that can look very interesting to an observer watching from afar.

The light warps, stretches, and often becomes magnified, which means we receive distorted images of

objects in the background, such as distant galaxies. This lensing mass can be small, like a stellar-mass black hole, in which case the phenomenon is known as microlensing; or large, like a cluster of galaxies. Astronomers can study this warped light to probe the properties of the lensing mass.

The central galaxy, or brightest cluster galaxy (BCG) of Abell 1201, is a large, diffuse elliptical galaxy well-known as a strong gravitational lens. A galaxy far beyond the BCG appears alongside it as an elongated smear, like an eyebrow closely wrapped around its outskirts. This smear was discovered in 2003; in 2017, astronomers found a second, fainter smear, even closer to the galactic center.

This implies, astronomers proposed, the presence of a very large black hole at the center of the BCG, but the data available was not detailed enough to resolve the central mass, or reveal more about what was in there.

Nightingale and his colleagues not only had access to more recent observations, but devised the tools to understand them. They conducted hundreds of thousands of simulations of light moving through the Universe, altering the mass of the black hole at the galaxy's center, looking for results that replicate the lensing we observe with Abell 1021 BCG.

All but one of their models preferred a massive black hole at the center of the galaxy; and the best fit for the mass of that black hole was 32.7 billion times the mass of the Sun. That pushes it well into ultramassive territory, black holes more massive than 10 billion Suns, and close to the theoretical upper limit for black hole masses of 50 billion Suns.

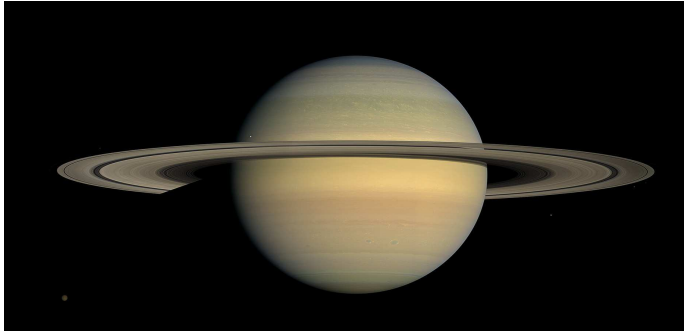
It's also a mass that puts Abell 1021 BCG's black hole in the top 10 most massive black holes we've discovered to date. The event horizon's diameter would span more than 1,290 astronomical units. For context, Pluto's distance from the Sun is a mere 40 astronomical units. It's mind-blowing to think about.

The properties of Abell 1201 as a gravitational lens are pretty special, and it's possible that the detailed measurement of the mass of the black hole in the BCG would not be quite so achievable in other circumstances, but Nightingale's team is confident that their methods have promise for detecting and weighing other black holes in the distant Universe.

“Gravitational lensing makes it possible to study inactive black holes, something not currently possible in distant galaxies,” Nightingale says.

*More at: <https://www.sciencealert.com/>*

## Astronomers Discover Never-Before-Seen Phenomenon on Saturn



### Rain of icy and rocky debris from rings was initially dismissed as bad data

The infall of icy debris from Saturn's rings is heating the planet's upper atmosphere, according to astronomers, who discovered the phenomenon among old data that was once considered noise.

Saturn is distinctive in our Solar System with its large, complex ring system, composed of chunks of ice and rock that have been captured by the planet's gravitational field. The rings orbit the planet at different speeds, and aren't as stable as they appear. Fragments of debris from the rings rain down on Saturn's atmosphere, heating it up in the process.

Astronomers observed the phenomenon by analyzing UV radiation emitted from hydrogen atoms. Data collected from the Hubble Space Telescope was compared with archival data taken from four historical spacecraft – the Cassini probe, Voyagers 1 and 2, and the long-retired International Ultraviolet Explorer – and revealed telltale signs of excess Lyman-alpha radiation, a form of UV light produced by excited hydrogen atoms.

Some of the data was mistaken as noise when first collected up to 40 years ago, and researchers failed to recognize its significance until now. “When everything was calibrated, we saw clearly that the spectra are consistent across all the missions,” announced Lotfi Ben-Jaffel, lead author of the new research published in *Planetary Science Journal* on Thursday, and a researcher at the Institute of Astrophysics in Paris and the Lunar & Planetary Laboratory, University of Arizona, in a statement.

“This was possible because we have the same reference point, from Hubble, on the rate of transfer of energy from the atmosphere as measured over decades. It was really a surprise for me. I just plotted the different light distribution data together, and then I realized, wow – it's the same.”

The researchers traced the increased levels of Lyman-alpha UV radiation to Saturn's atmosphere, and concluded some external process must be exciting the hydrogen atoms. The most plausible explanation is that the icy particles in Saturn's rings are crashing down onto Saturn's atmosphere, causing it to heat up.

These bits and pieces get dislodged by colliding with micrometeorites, or by solar wind particle bombardment, solar ultraviolet radiation, or electromagnetic forces picking up electrically charged dust. Once they are knocked out of place, Saturn's gravity pulls them in.

“Though the slow disintegration of the rings is well known, its influence on the atomic hydrogen of the planet is a surprise,” Ben-Jaffel said. “From the Cassini probe, we already knew about the rings' influence. However, we knew nothing about the atomic hydrogen content.”

“Everything is driven by ring particles cascading into the atmosphere at specific latitudes. They modify the upper atmosphere, changing the composition. And then you also have collisional processes with atmospheric gases that are probably heating the atmosphere at a specific altitude,” he explained.

**The team believe this phenomenon could provide astronomers with a new way to look for ring systems on exoplanets. If a spacecraft detects similar excess UV radiation bands in the upper atmosphere of a faraway planet, it could mean it might be supporting a ring system like Saturn's.**

“We are just at the beginning of this ring characterization effect on the upper atmosphere of a planet. We eventually want to have a global approach that would yield a real signature about the atmospheres on distant worlds. One of the goals of this study is to see how we can apply it to planets orbiting other stars. Call it the search for 'exo-rings,’” Ben-Jaffel concluded

<https://www.theregister.com/>

*Saturn is the only planet of the Solar System that is less dense than water - about 30% less. Although Saturn's core is considerably denser than water, the average specific density of the planet is 0.69 g/cm<sup>3</sup> due to the atmosphere. Jupiter has 318 times Earth's mass, and Saturn is 95 times Earth's mass. Together, Jupiter and Saturn hold 92% of the total planetary mass in the Solar System*

## Does Earth Have a New Quasi-Moon?

**Astronomers have discovered an asteroid that orbits the Sun with Earth, earning it the moniker “quasi-moon.”**

Recently discovered asteroid 2023 FW13 has created a bit of a stir among asteroid watchers. It turns out to be on an orbit that is not only in a 1:1 resonance with the Earth, but follows a path that actually circles Earth — albeit on an orbit that is so eccentric that it sweeps out halfway to Mars and in halfway to Venus.

There’s no formal definition for objects such as this, which are sometimes called quasi-moons or quasi-satellites. They follow a path around Earth, but usually for no more than a few decades. Perhaps the best known of these objects, known as Kamo oalewa, was found in 2016, and is considered the smallest, closest, and most stable known quasi-satellite. It has an orbit that has been in a stable resonance with Earth for almost a century, and will remain so for centuries to come, according to calculations by Paul Chodas (Jet Propulsion Laboratory).

But this newfound asteroid, if preliminary orbital calculations are correct, will handily eclipse that record. Some estimates say it has circled Earth since at least 100 BC and will likely continue to do so until around AD 3700. If that’s correct, 2023 FW13 would be the most stable quasi-satellite of Earth ever found.

The asteroid was first observed March 28th by the PanSTARRS observatory atop Haleakala on Maui, Hawai‘i. After further observations from the Canada France Hawaii Telescope on Mauna Kea, and from observatories on Kitt Peak and Mount Lemmon, the discovery was officially announced on April 1st. “When I saw the announcement, the very Earth-like semimajor axis looked suspicious to me,” says Adrien Coffinet, a French astronomer and journalist. Coffinet was the first to identify the nature of the quasi-moon’s orbit after running its orbital parameters through a simulator that extrapolates into the past and future.

The simulations led to others finding several pre-discovery observations, dating all the way back to 2012. This allowed refinement of the orbit, confirming that not only was it a quasi-satellite, but it had been so for millennia. “It seems to be the longest quasi-satellite of Earth known to date,” Coffinet tells Sky & Telescope, with its orbit expected to be in that configuration for a span of almost 4,000 years.

But Alan Harris (Space Science Institute) tells Sky & Telescope that, while 2023 FW13 does indeed circle Earth, there’s a catch: “The dimension of the loop (about 18

astronomical unit in radius) is so large that Earth plays essentially no role in its motion,” he says. For reference, Mercury orbits the Sun from 0.4 a.u. “[It’s] in no way associated with Earth other than by chance.”

The asteroid is actually orbiting the Sun and is not gravitationally bound to Earth. However, it’s in resonance with our planet, which is why its path loops widely around Earth.

Even the chance of ending up in a quasi-orbit, Harris estimates, is not unique. A quick calculation suggests there are about 2 million near-Earth asteroids of its size or larger (with an absolute magnitude of 26), and that there should be about three such objects currently looping around Earth’s position. So, he says, “the most unusual aspect is that the surveys chanced to detect it.”

Such objects, Harris points out, although they do orbit in resonance with Earth, are quite unlikely ever to pose a serious threat. “The good news is, such an orbit doesn’t result in an impacting trajectory ‘out of the blue,’” he says. We’d likely discover any such impending impact decades before it happened. In fact, Harris adds, “such an orbit has greater long-term stability than other non-resonant orbits.”

Longtime asteroid specialist Richard Binzel (MIT) tells Sky & Telescope he estimates this object’s size to be about 10 to 15 meters across: “Somewhere between a boxcar and a large Winnebago.” (Coffinet’s estimate is a bit bigger, about 20 meters across.)

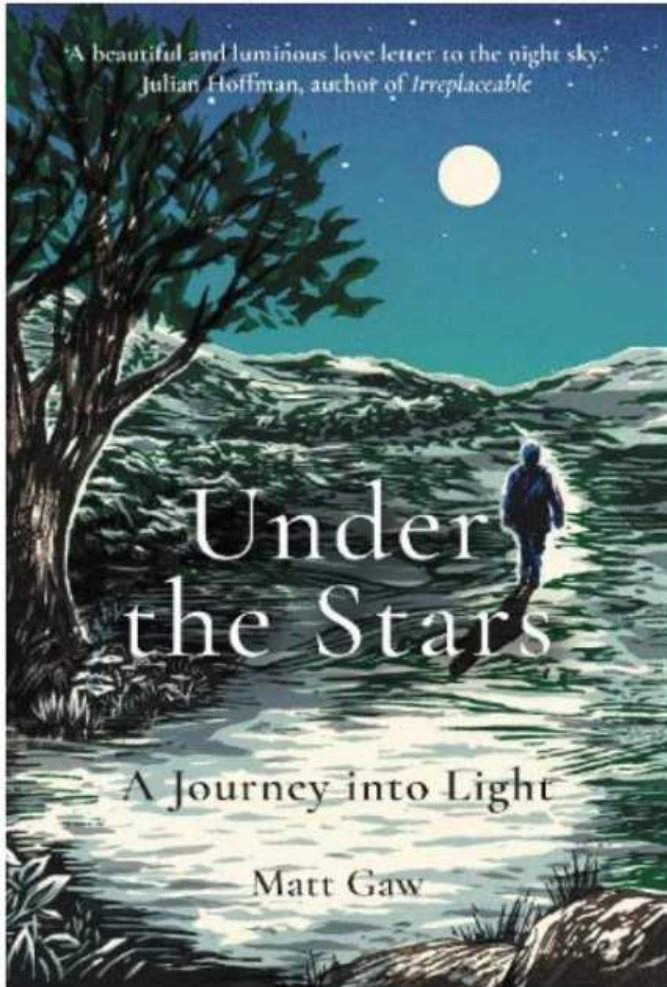
Binzel says that objects in such orbits could even become potentially useful as “stepping stones” to Mars. Their near-match to Earth’s orbit makes their relative velocity low enough that they could be accessed by spacecraft in a matter of months rather than years. That short travel time plus the objects’ low gravity could mean that a mission “makes sense as a way to practice deep-space missions, before committing a crew and hardware to a longer mission to Mars,” he says. “It’s a shakedown cruise.”

<https://skyandtelescope.org/astronomy-news/does-earth-have-new-quasi-moon/>

*Since 2023 FW13's discovery, citizen astronomers scouring archival data have found sightings of the asteroid since 2012. Using all that data, they calculated past and future orbits of the space rock, and think it has been in our general neighborhood since 100 B.C. and will stay until at least A.D. 3700, according to Sky & Telescope's David Chandler (opens in new tab). “If that's correct, 2023 FW13 would be the most stable quasi-satellite of Earth ever found,” Chandler writes.*

## Under The Stars: A Journey into Light

By Matt Gaw (2020, Elliott & Thompson)



Matt Gaw is a writer and naturalist whose fascination with darkness leads him to seek out experiences of being outside at night. In *Under The Stars* he is inspired to write by taking walks in the moonlight, camping under the stars and searching for dark places away from the intrusion of artificial light. This is one of two books that I read in advance of the 2023 International Dark Skies Week, 15th – 22nd April, the other being *Beneath the Night* by Stuart Clark.

He visits the Scottish Dark Sky Observatory in the Galloway Forest, which was the UK's first Dark Sky Park. Mesmerised by the power of the telescopes being demonstrated and the clarity of the view, he finds himself almost overwhelmed. As much as he appreciated and learned from the flood of information and technical detail, he more naturally drifted away from the observatory, and away from the crowd of people, in order to find some alone-time under the darkest of dark skies. His appreciation veers towards the subjective wonder of

nature: he rediscovers the infinite perspective of seeing one's own insignificance beneath the blaze of the milky way.

Later, after various nocturnal explorations and challenges, he takes his family to holiday on the Isle of Cull in the Hebrides, a "Dark Sky Community" who are proud of keeping the light pollution at bay and appreciative of the many visitors this attracts. Gaw is sometimes too pushy with his family, in wanting them to share his enthusiasm for dark skies and perfect starscapes, so that he is disappointed with his children's initial lack of interest. But his insistence pays off, because they do venture out in the night and they do see and they do stare – almost unbelieving – at the spectacle of uncountable stars. They are always there, but for most people this common heritage is so obscured that they don't even think about it, let alone realise that it is being compromised by our modern lifestyles. How many millions live in town and cities where they many never have seen the Milky Way, and perhaps never will?

The author thinks about other themes on the subject on the subject of light and dark. He considers how moonlight is thought of in folklore; of how starlight has provided pioneer sailors their navigation for thousands of years. He loses himself in dark forests and moors and beaches in order to see, hear and contemplate the creatures of the night. Above all, he laments the thoughtless, wasteful artificial lighting that continues to infest the skies. It not only impinges on star-gazing but (as we are informed from the dark sky campaign) disrupts the natural diurnal and seasonal cycles of animals and birds, as well as creating bad consequences for human health.

This very readable book may be light on science, but it is rich in ideas. Matt Gaw writes with self-deprecating humour and a deep appreciation for nature. It reminds me that creating and protecting a Dark Sky area is not just about pleasing us astronomers, but it restores some balance to our relationship with nature. And with ourselves.

*Reviewed by Simon Gardner*

**This book, along with most others that I review, is free to borrow**

**Please contact  
simongardner344@gmail.com**

## THE BACK PAGE

LINKS, COMMENTS AND OBSERVATIONS

### Other Science Links

#### **How rare earth elements' hidden properties make modern technology possible**

These 17 metals fine-tune light and generate powerful magnetic fields

<https://www.sciencenews.org/article/rare-earth-elements-properties-technology>

#### **Million-year-old viruses help fight cancer, say scientists**

Relics of ancient viruses - that have spent millions of years hiding inside human DNA - help the body fight cancer, say scientists.

<https://www.bbc.co.uk/news/health-65266256>

#### **James Webb Space Telescope images challenge theories of how universe evolved**

Using new observations from the James Webb Space Telescope, astronomers looked more than 13 billion years into the past to discover a unique, minuscule galaxy that could help astronomers learn more about galaxies that were present shortly after the Big Bang.

<https://www.sciencedaily.com/releases/2023/04/230413154323.htm>

#### **How do we know how old Earth is?**

By measuring radioactive elements in rocks from Earth and other parts of the solar system, scientists can develop a timeline of our planet's early years.

<https://www.livescience.com/planet-earth/how-do-we-know-how-old-earth-is>

#### **Satellite network will monitor air pollution in near real time**

Hourly, neighborhood-scale measurements could shed light on origins and behavior of smog and other airborne contaminants

<https://www.science.org/content/article/satellite-network-will-monitor-air-pollution-near-real-time>

#### **Ageing studies in five animals suggest how to reverse decline**

Smoothing the speed bumps in an important cellular pathway seems to be implicated in ageing.

<https://www.nature.com/articles/d41586-023-01040-x>

#### **A Number System Invented by Inuit Schoolchildren Will Make Its Silicon Valley Debut**

Math is called the "universal language," but a unique dialect is being reborn

<https://www.scientificamerican.com/article/a-number-system-invented-by-inuit-schoolchildren-will-make-its-silicon-valley-debut/>

### At The Observatory

1. Please bring a torch.
2. Make sure you close and lock the car park gate if you are the last to leave.

### Articles Needed

**NZ needs relevant content. Contact details on page 1.**

### Strange Facts

*Isaac Newton believed he was part of a line of great men to receive great and ancient wisdom. He even created a special name for himself "Jehovah Sanctus Unus," or "to Jehovah, the Holy One"*

*Though not commonly used, the day after tomorrow is called "overmorrow"*

*Termites chew through wood twice as quickly when they are exposed to rock music*

*There are no seagulls in Hawaii*

*Isaac Newton was a member of the British parliament for one year. He spoke only once, and that was to tell someone to please close the window*

*Leonardo Da Vinci invented scissors*

*The flashes of colored light you see when you rub your eyes are called "phosphenes"*

*If you heat up a magnet, it will lose its magnetism*

*Albert Einstein had mastered calculus by the age of 15*

*Sudan has more pyramids than any country, with 255*