



July 2026

Editor: ewellastro.editor@gmail.com

Email: ewellastro@gmail.com

Website: <https://www.ewellastronomy.org>

Important Reminder:

To allow sufficient time to compile Janus and place it on the EAS Website by the 1st of the month any submissions for publication are required at least 3 days before the end of the month. Any items received after this date will be held over until the following month.

Editorial

Welcome to the July edition of Janus. This month's meeting on Friday 10 July features a talk by Dr Elizabeth Cunningham from Surrey University entitled "Dark Matter - why we think 95% of the Universe is missing." She will explain how the objects we can observe in the night sky account for less than 5% of the total Universe. Scientists believe the rest is made up of elusive substances - dark matter and dark energy. We can't see them, we don't know what they are and yet hundreds of scientists around the world are looking for them.

With the Summer Solstice now behind us, as Martin Howe notes, July slowly sees the return to darker skies, and by the end of month we will be experiencing nearly three hours of astronomically dark skies – albeit starting late in the evening. Hopefully, it will stay warm!

Concern continues to be expressed about the impact of satellite trails on astronomical images. A new study by NASA scientists shows that the problem has now reached space as well. Apparently, 73.3% of the images taken by the new SPHEREx space telescope between May and September last year were spoiled by at least one artificial satellite trail.

SPHEREx's mission is to map the entire sky in the near-infrared range, which means long exposures and a wide field of view. Perfect conditions not only for science, but also for catching a passing spacecraft in the frame. On average, each image contains 2.18 trails tracing the repeated paths of satellite mega-constellations.

The mechanics of the interference are especially interesting. SPHEREx can protect itself from cosmic-ray hits: when it detects a sudden spike in a pixel, it stops collecting data there. However, modern satellites have become so bright that they too trigger this protection. As a result, the image is left with "railway tracks": the blinding centre of the trail is cut out, but the parallel stripes are permanently stamped into the scientific data, hiding everything underneath. All may not be lost: the positions of the satellites are known, and their track can be predicted. Given this information, it should be possible to turn off the image integration process during periods where interference would occur. Either that, or it might be possible to process out the tracks during subsequent image processing, although underlying data would probably still be lost. Clearly, a solution needs to be found, as the problem is only going to get worse!

In this edition:

2. Sky Update – The Solar System in July
3. Notable Events for July and August
4. Collected Observations and thoughts - Gary Walker
7. Object of the Month: The Gamma Cygni region – Martin Howe
9. Contributing as an Amateur – Suzanne Fox
12. Summertime Doubletime – John Pillar
15. The Milky Way was rewired by a cataclysmic collision billions of years ago. Now it is on course for another from **THE CONVERSATION**
18. Up Next

John



The Solar System – July

Only Venus and Saturn are easy targets throughout this month. Mercury and Uranus go from impossible to difficult, whilst Mars and Neptune get easier as the month progresses. Jupiter begins the month as a difficult target and ends the month not observable.

MERCURY: begins the month rising 2 hours after the Sun and approaching inferior solar conjunction on 13 July. It is not observable, reaching its highest point in the sky during daytime and being 8° below the horizon at dusk. By the end of the month, emerging into the morning sky as it approaches greatest elongation W, it is difficult to observe – it will reach its highest point in the sky during daytime and be no higher than 4° above the horizon at dawn.

VENUS: begins the emerging into the evening sky as it approaches greatest elongation E on 15 Aug. It will become visible at around 21:48, 13° above the W horizon, as dusk fades to darkness. It will then sink towards the horizon, setting 2 hours and 4 minutes after the Sun at 23:24. By the end of the month, closing in on greatest elongation E, it will become visible at around 21:14, 8° above the W horizon, as dusk fades to darkness. It will then sink towards the horizon, setting 1 hour and 25 minutes after the Sun at 22:15.

MARS: begins the month rising 2 hours and 20 minutes before the Sun. It is, however, very difficult to see reaching its highest point in the sky during daytime and being no higher than 8° above the horizon at dawn. By the end of the month, it is visible in the dawn sky, rising at 01:35

– 3 hours and 45 minutes before the Sun – and reaching an altitude of 21° above the E horizon before fading from view as dawn breaks at around 04:16.

JUPITER: begins the month difficult to see. It will reach its highest point in the sky during daytime, set only an hour after the Sun at 22:27, and be no higher than 4° above the horizon at dusk. By the end of the month, following solar conjunction on 29 July it is not observable since it is very close to the Sun, at a separation of only 1° from it.

SATURN: begins the month, visible in the dawn sky, rising at 00:58 – 3 hours and 47 minutes before the Sun – and reaching an altitude of 24° above the SE horizon before fading from view as dawn breaks at around 03:47. By the end of the month, rising at 23:01 and reaching an altitude of 40° above the S horizon it remains visible until it fades from view as dawn breaks at around 04:32.

URANUS: begins the month not observable as it will reach its highest point in the sky during daytime and, despite rising 2 hours before the Sun, be close to the horizon at dawn. By the end of the month, it is visible in the dawn sky, rising at 00:37 and reaching an altitude of 24° above the E horizon before fading from view as dawn breaks at around 03:33.

NEPTUNE: begins the month difficult to observe, reaching its highest point in the sky during daytime and being no higher than 16° above the horizon at dawn. By the end of the month, visibility is improved. Rising at 22:37, it will reach an altitude of 36° above the S horizon before fading from view as dawn breaks at around 03:33.

Notable Events:

Some observations will require a telescope, whilst others will be visible with the naked eye.
More information at: <https://in-the-sky.org>

July

1	Mercury at aphelion Messier 22 is well placed The cluster IC 4756 is well placed
4	Conjunction of Mars and Uranus Close approach of Mars and Uranus
6	The Earth at aphelion
7	Neptune enters retrograde motion Close approach of Moon and Saturn Moon at Last Quarter Conjunction of the Moon and Saturn
9	Asteroid 18 Melpomene at opposition Asteroid 8 Flora at opposition
10	The Great Peacock Globular Cluster is well placed
11	Close approach of the Moon and M45 Close approach of Moon and Mars Conjunction of the Moon and Mars
12	Lunar occultation of Beta Tauri
13	Mercury at inferior solar conjunction The Moon at perigee
14	New Moon The Moon at perihelion
17	Lunar occultation of Regulus Close approach of Moon and Venus Conjunction of the Moon and Venus Messier 55 is well placed
21	Moon at First Quarter
24	Lunar occultation of Antares
25	The Moon at apogee
26	Saturn enters retrograde motion
27	Asteroid 3 Juno at opposition 134340 Pluto at opposition Lunar occultation of Sigma Sagittarii
28	The Moon at aphelion
29	Asteroid 324 Bamberga at opposition Piscis Austrinid meteor shower 2026 Jupiter at solar conjunction Full Moon
30	Southern δ -Aquariid meteor shower 2026 α -Capricornid meteor shower 2026 Jupiter at apogee

August

2	Comet 10P/Tempel passes perihelion Mercury at greatest elongation west
3	Comet 10P/Tempel reaches peak brightness Comet 10P/Tempel passes perigee Close approach of Moon and Saturn
4	Conjunction of the Moon and Saturn
5	Mercury at dichotomy
6	Mercury at highest altitude in morning sky Moon at Last Quarter
7	Close approach of the Moon and M45
8	Lunar occultation of Beta Tauri
9	Conjunction of the Moon and Mars Close approach of Moon and Mars Conjunction of Mars and Ceres
10	The Moon at perigee
11	Conjunction of Moon and Mercury
12	New Moon Total solar eclipse Venus at dichotomy
13	Perseid meteor shower 2026
14	The Moon at perihelion Mercury at perihelion Venus at greatest elongation east Messier 15 is well placed
15	Conjunction of Jupiter and Mercury Messier 2 is well placed
16	Close approach of Moon and Venus Conjunction of the Moon and Venus
18	κ -Cygnid meteor shower 2026
20	Moon at First Quarter
21	Lunar occultation of Antares
22	The Moon at apogee
23	Lunar occultation of Sigma Sagittarii
25	The Moon at aphelion
27	Mercury at superior solar conjunction
28	Partial lunar eclipse Full Moon Asteroid 9 Metis at opposition
31	Close approach of Moon and Saturn Conjunction of the Moon and Saturn

Collected Observations (and thoughts) – Gary Walker

Mercury and Jupiter – Posted 31 May

This evening, I managed to see Mercury in the evening twilight, before 10pm.

As usual, due to atmospheric disturbance low down, it appeared as a tiny blurry disc and, for the same reason that the Sun appears pink at sunset, it appeared as a delicate pink colour. Its phase was about 92%, and it was only about 5'-6' arcseconds in size. This is fairly typical – even at maximum, it never gets larger than 12' arcseconds in size so is always very small.

Mercury is a very difficult planet to observe, even though it can occasionally be seen with the naked eye! It is, however, never far away from the Sun and is, consequently, low down in the evening sky, by the time that it is dark enough to see it. This low altitude means that it is badly affected by atmospheric currents, so you can't get a steady view of it!

Also, as the closest planet to the Sun, its orbit is the fastest at 88 days, meaning that it never stays in one place for very long. No sooner is it in the evening sky, the next thing you know, it's back in the morning sky! Thus, I can only see it occasionally!

I then had a look at Jupiter, and saw that all 4 moons were visible, although 3 of them were in a very tight grouping, appearing like one of the multiple double/triple stars. I have often seen 2 moons in close pairs, but I don't think that I've ever seen a triple pairing. One moon appeared in the "middle", with the other 2 moons flanking it, almost like "ears"!

Mercury Again – Posted 2 June

I saw Mercury again this evening. Jupiter and Venus are now making a striking sight in the evening sky and were now about 7° apart!

Venus and Jupiter – Posted 5 June

By yesterday evening, Venus and Jupiter were about 5.5 degrees apart, so both were just about visible in my same 10 X 50 binocular field of view!

Venus/Jupiter Conjunction, and other Observations - Posted 8 June

This evening, Venus and Jupiter were about 2 degrees apart, so they made a spectacular sight in the evening sky! Both were now easily visible in the same binocular field of view.

Of course, Planetary Conjunctions are not of any scientific importance, but they can be very beautiful to see, especially when, as in this case, the two brightest planets are involved!

The Great Conjunction of Jupiter and Saturn in December 2020, was a particularly close and spectacular example, as both planets could be fitted in my high-power eyepiece's field of view, even at 333X!

Obviously, the present Conjunction is a lot wider!

I also managed to glimpse Mercury but, typically, a big slow-moving cloud rolled in before I could do any observing!

I got these observations in before watching tonight's Sky at Night programme!

The Sun has again been busy, with a lot of sunspots, and today there were 7 separate spot groups, with a couple of them being very large!

Closest night of the Venus - Jupiter Conjunction! – Posted 9 June

Unusually, for once, the weather tonight was perfectly clear for the closest night of the Venus - Jupiter Conjunction! More often than not, the nights preceding and following nights of a Conjunction are clear, but the closest night is inevitably cloudy!

Venus and Jupiter were only 1.6 degrees apart, making a beautiful sight in the evening sky, appearing like a set of car headlights!

I also saw Mercury again and, at 222X power, I could see its tiny gibbous phase, although it quickly sank behind a tree!

Coronation Street and Sir Patrick Moore – Posted 10 June

In tonight's episode of Coronation Street, the characters Sean Tully and Maria Connor, mentioned Sir Patrick Moore, in a conversation of how many stars there are in the sky!

The long hiatus without Mars! – Posted 16 June

It is now a whole year since I last observed Mars, on 14th and 17th of June 2025. After that, as is usual, it sank into obscurity in the solar glare.

One year on, it's still in the solar or dawn glow, very low down in the dawn sky, making it still very difficult to observe. Mars is always the slowest planet to emerge into the dawn sky after passing behind the Sun. The other planets, such as Jupiter, only take a few months to reappear!

Venus very close to the Moon! – Posted 17-18 June

On 17 June, Venus passed very close to the New Moon. Surprisingly, at about 3.28pm, despite it being about 2.6% illuminated, I was able to find the Moon, in my 11x80 binoculars! At this point, Venus was about 4 degrees to the East of the Moon.

However, by about 10pm in the evening, Venus and the New Moon made a truly spectacular pair, as Venus was now less than half a degree from the top "horn" of the Moon! Venus appeared literally, above the Moon, which was, as usual, vertically oriented!

Venus was about 28 arc minutes from the Moon, or under half a degree. I was able to fit them both into the same eyepiece field of view, at 62X. Venus appeared like a half phase through my telescope, although it was actually about 74%, so still at gibbous phase, and at 14.3" arcseconds in angular size.

As I have said before, Conjunctions are of no Scientific importance, but they can be very beautiful, as this one was! This is especially as the pair form about the brightest objects in the night sky.

Jupiter was now much lower down, about 8 degrees from Venus - indeed, at first, I thought that I'd found Mercury again, being as it was so low down!

In addition to the pleasing view, it was also a beautifully warm and calm Summer's evening!

It is not surprising that a lot of images have appeared on social media showing this event, and not only on Astronomical sites, but general sites as well, since it was so easy to see, even with the naked eye. Also, of course, the weather, for once, was clear!

In America, Venus was actually occultated by the Moon but, sadly, not in the UK!

Owen Brazell – Posted 18 June

In the latest (July) Astronomy Now magazine, Owen Brazell is still there, with his column, about the globular cluster of NGC 6717.

More on Venus – Posted 18 June

I observed Venus again in tonight's early twilight. This time I could clearly see that Venus is still, obviously, gibbous in phase. Presumably the air must have been steadier than last night!

The gibbous phase could even be seen at 100X and, obviously, much more clearly at 222X and 300X.

My 10 X 880 Binoculars – Posted 26 June

Exactly 50 years ago today, at the age of 14, I bought a pair of 10 X 50 binoculars! These were the first decent ones I'd bought; my very first binoculars were 8 X 50 field glasses, which had a much narrower field of view.

There used to be binoculars hanging on chains outside "Dixons" in Sutton High Street, which you could look through, and the view was really great, as you could look down the High Street to the "Eagle" insurance building! As a result, I could see what good binoculars were like, so I decided to get a pair as soon as possible.

I bought the 10 X 50 Binoculars from "Debenhams" in Croydon, for £15.95 in a Sale, having saved up for them since the previous Christmas! I was very excited to be able to finally get a decent pair of binoculars.

They were of Hanimex make, from Korea, and gave a much better, wider field of view than the field glasses did. I marvelled how it made everything much more 3-dimensional!

For astronomical purposes, they were, and still are, perfect. I remember being amazed at how many stars that were invisible to the naked eye, were easily visible in these binoculars! I had been looking at the constellation of Cygnus, in the region of Deneb, and Sadr. Of course, I had been looking along the Milky Way. The binoculars' much-improved field of view of 5.5 degrees when compared with the field glasses made these stars possible to see.

Over the years, these binoculars have been used for both astronomical, and terrestrial purposes. In astronomical purposes, they are excellent for finding open star clusters, such as M11, some globular clusters such as M13, galaxies such as M31 and M33, as well as also bringing out the colours of the brighter stars. Actually, I always find that M31 looks much better in binoculars than in my 8"SCT, as it appears far more like a galaxy in them.

They are also useful for finding some planets such as Venus and Mercury, in the evening sky, and I have even found Venus in the daytime sky with them. Of course, I can also see the main feature on the Moon, such as craters and the Maria!

These binoculars still function after 50 years, although the focuser has become a bit stiff, so I have had to oil it!

In 2007, I bought a pair of 11 X 80 binoculars, which are better for astronomical purposes as they have an increased light capture capability.

Prior to getting much better binoculars I had, the year before, already obtained my 60mm refractor.

More Observations – Posted 26 June

It is amazing how quickly Jupiter has now virtually disappeared from the evening sky and, after its close Conjunction earlier this month (which is still clearly visible) is well away from Venus.

The Sun has still been hosting some spots, including some very large ones with multiple umbrae, and large penumbras!

Noctilucent Clouds – Posted 29 June

Late in the evening of 27 June at about 11.35pm, I saw a small display of Noctilucent Clouds.

However, early this morning, I saw a really bright display of them! I first saw them around 2.08am, really low down in the sky, but they steadily rose higher and higher above the horizon, growing brighter and brighter!

They were at their best from about 2.30am until well after 3am. They consisted of a set of parallel bands, of which a couple were really bright. Later, above the main display, there was an additional ribbon of wavy band Noctilucent Cloud.

As they were so bright, the characteristic "electric blue" colour of Noctilucent Clouds was very obvious, and very beautiful!

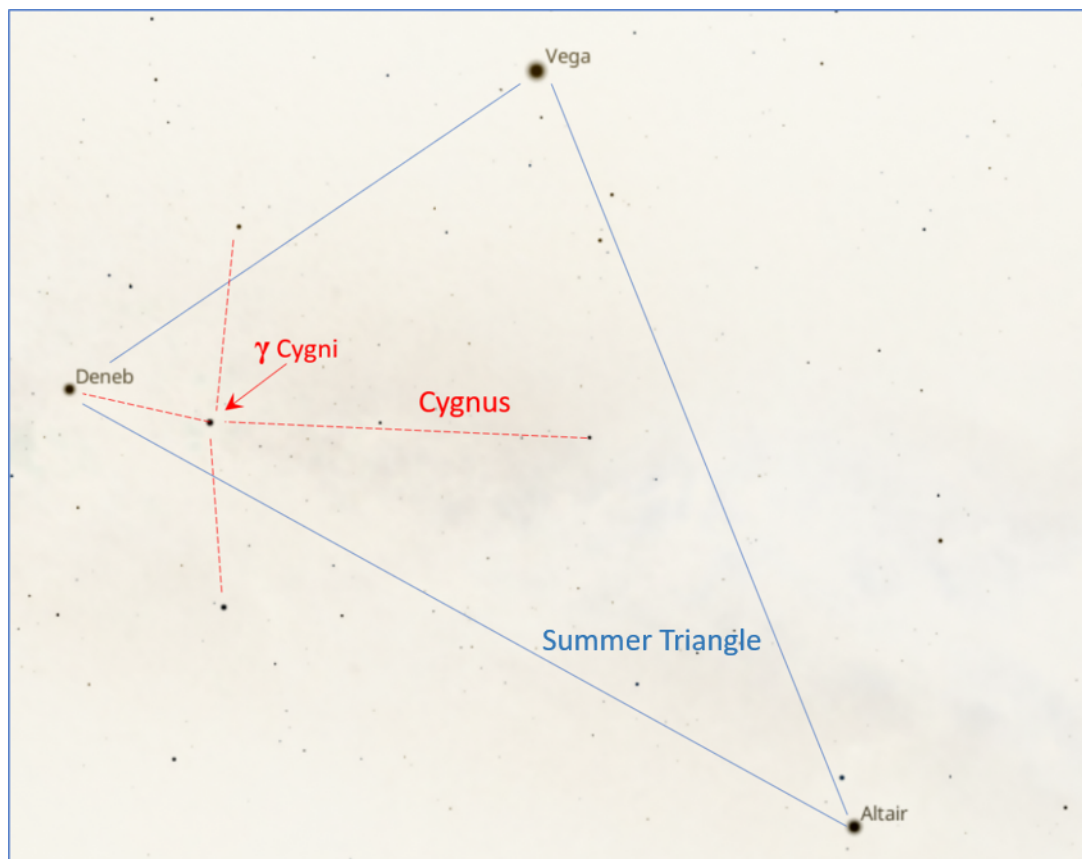
This display of Noctilucent Clouds gradually spread out until nearly all the Northern sky was involved in it, from the North-West through North and North-East. It was amazing how suddenly this display brightened up and rose higher-and-higher in the sky!

From beginning to end, the star, Capella, was clearly visible above the Noctilucent Cloud display.

Object of the Month: The Gamma Cygni region – Martin Howe

July slowly sees the return to darker skies, and by the end of month we will be experiencing nearly three hours of astronomically dark skies. It also sees the welcome return of some great observing and imaging targets, such as the summer triangle, the Andromeda galaxy (M31), and the rich hunting ground for deep sky objects around Cygnus, Lyra, and Vulpecula.

This month I am focussing on the region in the vicinity of gamma Cygni (Sadr). By the third week in July, with the return of astronomically dark skies, gamma Cygni can be found at a decent altitude of 65° above the ESE horizon about 11pm BST. The constellation of Cygnus is very prominent in the summer skies and sits largely within the boundary of the “Summer Triangle” formed by the bright summer stars of Altair, Deneb and Vega. The brighter stars of Cygnus map out the asterism, or pattern, known informally as the northern cross, with gamma Cygni sitting at the intersection of the cross’s arms. See the diagram below from Stellarium.



Gamma Cygni itself is a massive class F8 star about 15 times the mass of our Sun, and is surrounded – from our line of sight – by an enormous area of nebulosity. However, the nebulosity is not physically associated with gamma Cygni; the former being much more distant at about 4000 light years away compared to the latter’s 1800 light years.

The most prominent feature of the area is the emission nebula IC 1318, often called the Butterfly Nebula because of its distinctive shape (not to be confused with the planetary nebula NGC 6302 in Scorpius that bears the same name). The nebula is energised by the intense ultraviolet radiation from nearby massive stars, causing its hydrogen gas to glow with a deep red colour – readily imaged by using a hydrogen-alpha filter on a mono camera.

Additionally, there are dark dust lanes that cut across the nebula, blocking the view of the background stars and adding an interesting visual structure to the region.

The gamma Cygni region is enormous. IC 1318 spans roughly 3 degrees across the sky, equivalent to about six times the apparent diameter of the full Moon. This equates to a physical size of several hundred light-years. (Remember, our nearest star is “only” 4.3 light years away!)

The image of the Gamma Cygni region below is a wide-field view taken with an ATIK 314L+ CCD camera attached to a 100mm f/2.8 Canon lens. It is a total exposure of about 90 minutes through Ha and OIII filters.

Gamma Cygni can be seen clearly in the middle of the frame and, to the left of this, the dark dust lane forming the body of the butterfly nebula, IC 1318, with the two brighter regions either side of this forming the butterfly’s wings.

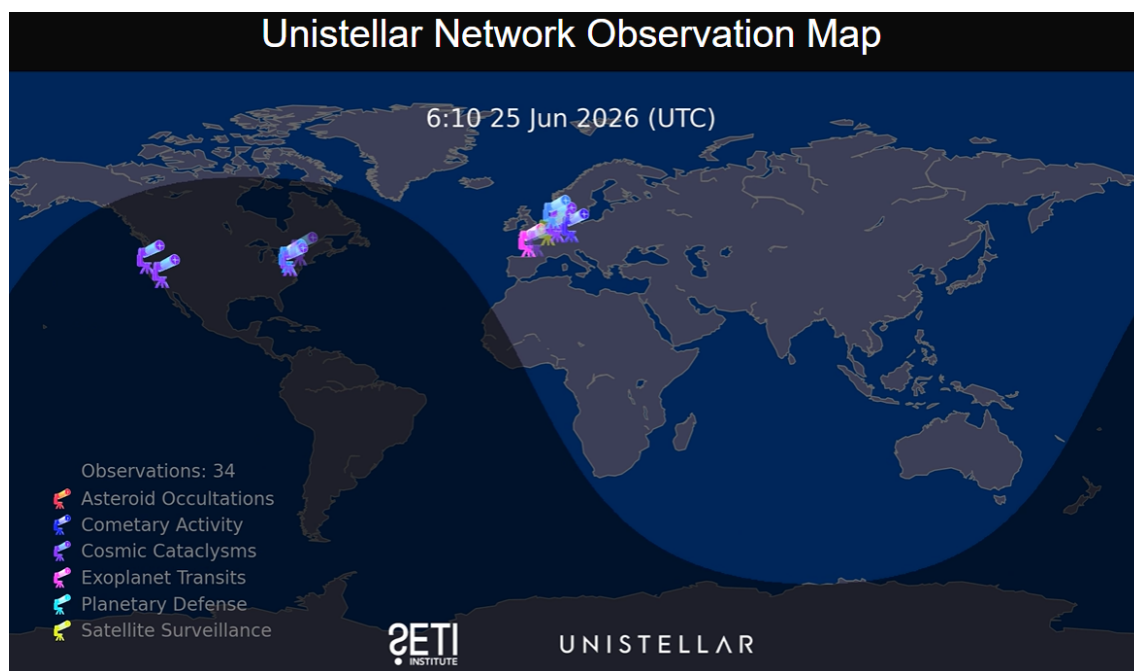
Unfortunately, the nebulosity would not be visible in binoculars, and the best way to see this is with long exposure photography.



Contributing as an Amateur – Suzanne Fox

Our speaker in June was Dr George Seabrooke, who gave a wonderful talk on the Gaia mission. He explained how the data collected by Gaia opens up opportunities for amateurs to contribute through 'citizen science' projects.

There was a similar theme in our May talk from Peter Goodhew, who spoke about the significant contribution amateur astronomers can make to our knowledge of the Universe. Admittedly, Peter's setup is beyond many people's budgets, but with smart telescopes becoming increasingly affordable, we're seeing the rise of global networks of amateur observers working alongside professionals on meaningful scientific projects. One example is the collaboration between UniStellar and SETI: <https://science.unistellar.com/>.



I think this approach will only grow over the next few years.

Gaia citizen science: How You Can Help Classify the Milky Way

The Gaia mission has transformed our understanding of the Milky Way by measuring the positions, distances, motions and brightness of nearly two billion stars. One of its discoveries is that more than 10 million of these stars are variable – their brightness changes over time. There are many reasons for this - some are eclipsing binary stars, while others are pulsating stars such as Cepheids and RR Lyrae stars.

Even with modern machine-learning techniques trained to classify why stars vary, computers are not always good at recognising unusual or rare patterns in astronomical data. Human eyes are still remarkably good at spotting features that algorithms can miss (so there's still some hope for us!), and this is where citizen science comes in.

What is Gaia Vari?

Gaia Vari is a citizen science project supported by the European Space Agency and hosted on the Zooniverse platform. Volunteers are shown Gaia light curves and simple graphical

summaries of a star's brightness variations. Their task is to identify the type of variability they see.

There's a simple introduction to the different types of variable stars, so no previous experience is required. Citizen scientists help by providing many independent classifications for each star. When large numbers of volunteers agree on the same classification, researchers gain confidence in the result, and when volunteers repeatedly flag something unusual, it can lead to follow-up investigations. Read more about the details here - <https://www.zooniverse.org/projects/gaia-zooniverse/gaia-vari/about/research>

Sometimes volunteers make genuinely exciting discoveries and may even be invited to become co-authors on scientific papers. Last year, images of an exploding dwarf nova were identified by someone passing time on a bus while using a citizen science app!

Amateur Stargazers Spot Rare Exploding Star

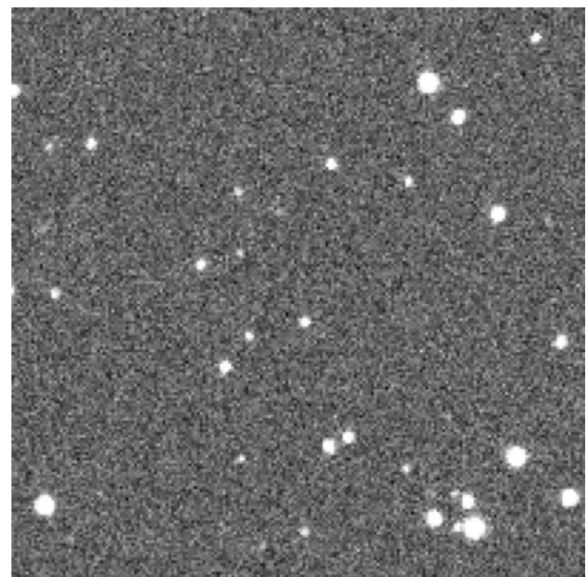
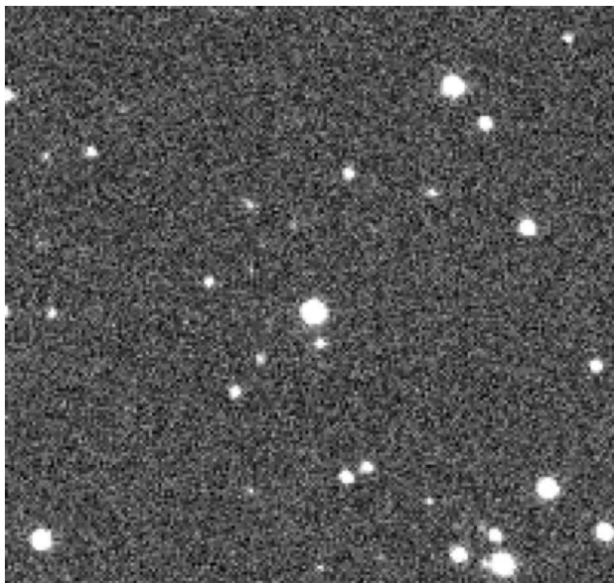
Mobile app lets citizen scientists flag anomalies in space that are hard for computers to detect

By Eric Niller

July 10, 2025 11:00 am ET

🔗 Aa 💬 14 🎧 Listen (1 min) ⋮

Below the reference image, the image on the left shows the exploding star.



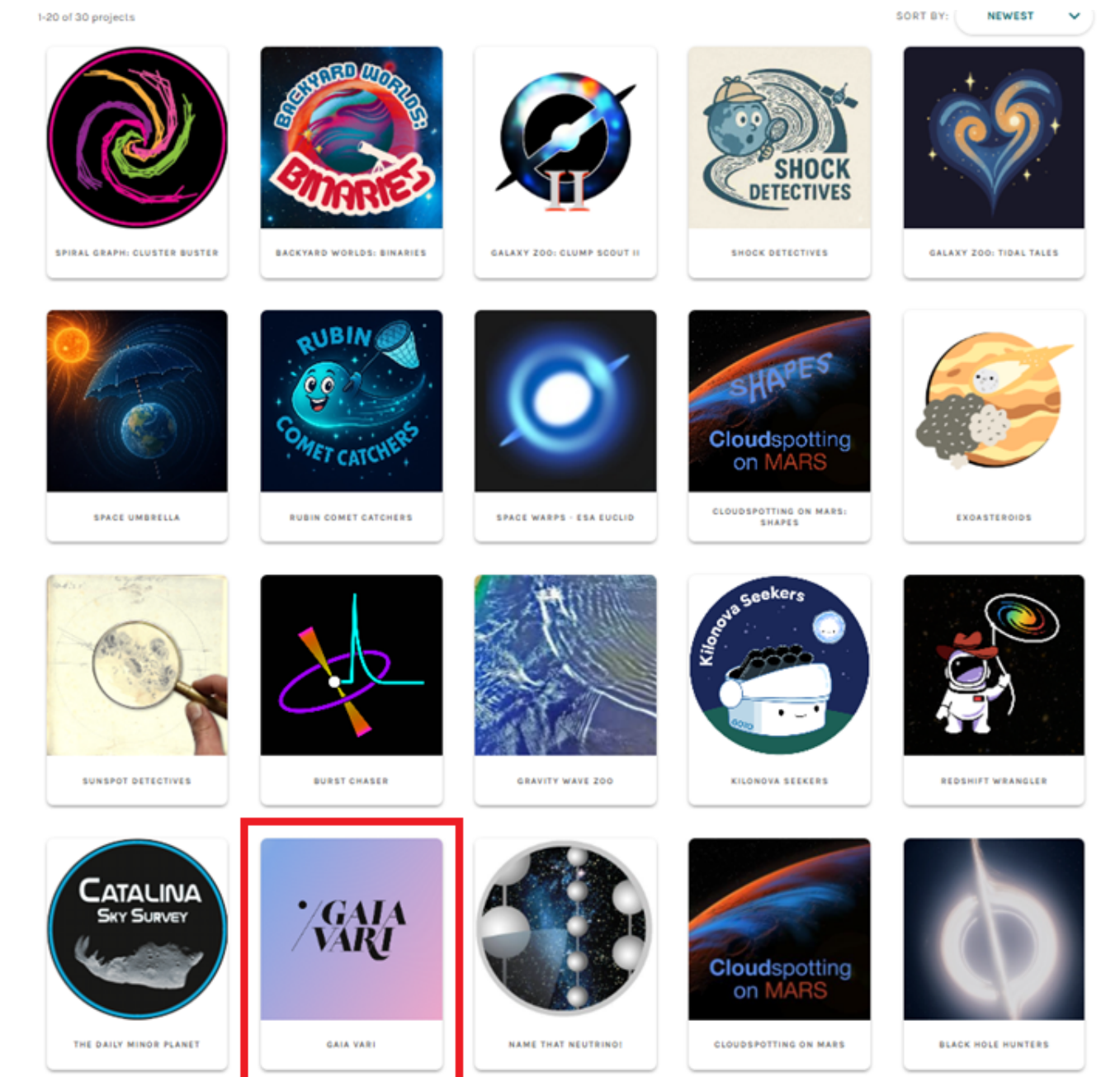
Source : <https://www.wsj.com/science/space-astronomy/exploding-star-dwarf-nova-citizen-science-db684b4e>

How to Get Involved

Many of us enjoy astronomy because it allows us to participate, however modestly, in the exploration of the Universe. Gaia Vari provides an opportunity to do exactly that. Whether you classify ten stars or ten thousand, your contribution helps astronomers make sense of one of the largest astronomical datasets ever collected.

For anyone inspired by Dr Seabrooke's talk, Gaia Vari offers a chance to move from being an observer of astronomy to becoming a contributor to astronomical research.

To get started - create a free account on a website called Zooniverse (<https://www.zooniverse.org/>). Many interesting projects are hosted here, to see the Space project, choose that filter which gives you the options shown in the screenshot below - look for the Gaia Vari link. There's a short tutorial and then you can get classifying! If a few EAS members decide to have a go, do let me know - perhaps we can compare notes at a future meeting, or I can host an online meetup if there's enough interest.



This is Gaia data

Summertime Doubletime – John Pillar

June and July, around the solstice, are months when many astrophotographers put away their kit and wait till the nights lengthen and true darkness returns.

However, seeking out and observing double stars is a fun challenge for binoculars or small telescope during the summer months – they reward with the sense of achievement in having found them in the sky, managing to resolve them into a double, and observing their contrasting colours.

Here's a short list of double stars well worth having a go at with binoculars or small telescope:

- Achird (Eta Cassiopeiae)
- Lyrae Double (double)
- Mizar
- Albireo
- Gamma2 Delphini

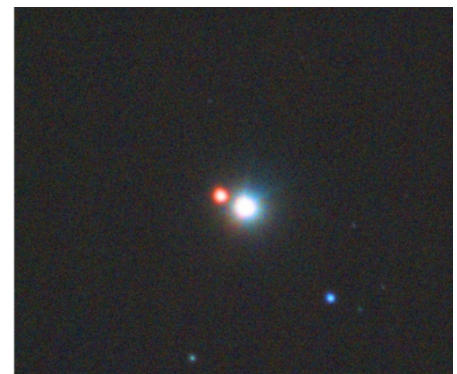
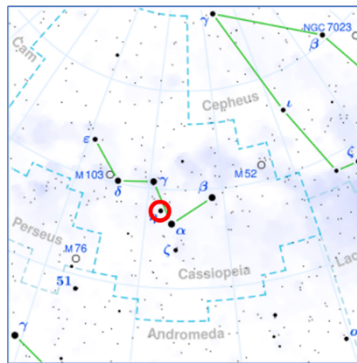
All the star images were captured using a Celestron 9.25" SCT. I found that to avoid oversaturating the camera I had to use short exposures, 0.25 seconds seemed to be OK, and I stacked 60 images for each, making a total of 15 seconds. I then found that stretching the raw images as I would do normally for deep-sky objects reduced the doubles to a merged, bright, blob - so I learnt to minimise the amount of stretch I applied. The human eye is much better at coping with the brightness of stars than a CCD chip – our eyes don't 'saturate' when the photon count exceeds 65000 😊.

Eta Cassiopeiae

Eta Cassiopeiae is a binary system in Cassiopeiae discovered by William Herschel in 1779. The two components of this system orbit around their centre of gravity with a period of 480 years, and at the moment are separated by 13 arcseconds in the sky. The primary, brighter star, glows at magnitude 3.4 and the secondary at 7.5. Low power may show the brighter star as a yellow colour, and the partner as red.

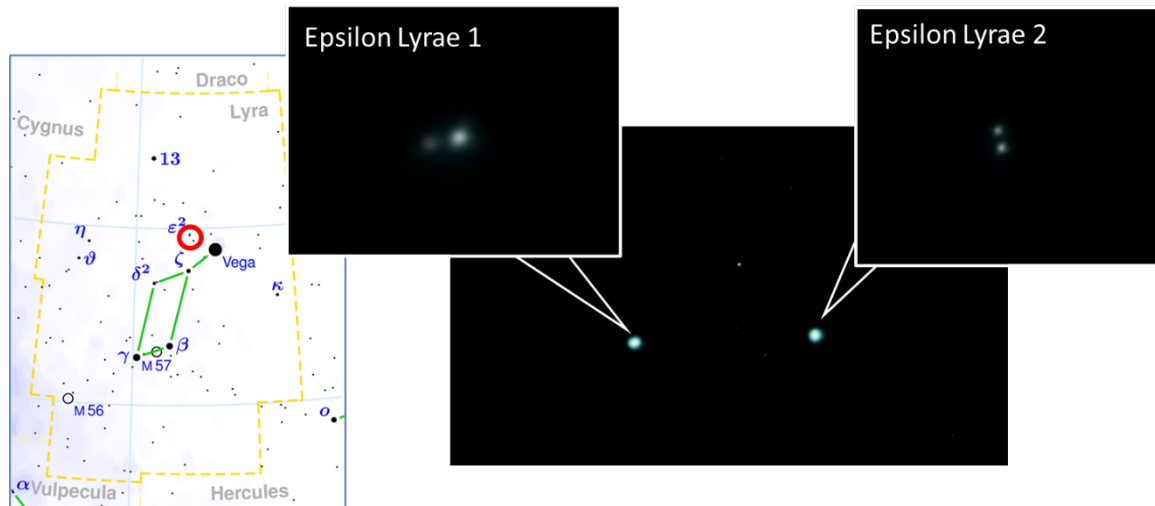
The name of the main component of the system, Achird, was first coined in a star

atlas in 1950 and was officially recognised as a name for Eta Cas A in 2017. Achird is a G-type, main sequence star, similar to our sun, and it is nearly the same size. Eta Cassiopeia B is a cooler and dimmer main sequence orange-red dwarf star.



Epsilon Lyrae Double (double)

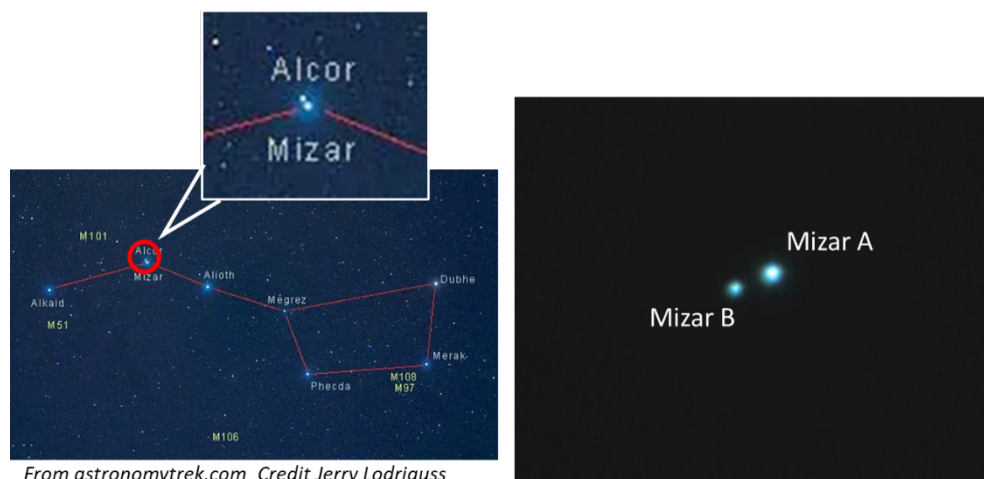
Epsilon Lyrae is a classic double and is fairly easy to find, less than 2 degrees north-east of Vega. The binary may be just about discernible as a double with the naked eye on a still, clear, night. Through binoculars, though, this binary readily resolves into 2 stars separated by 3.5 arc-minutes.



The fun really starts through a telescope, because the apparent two stars of the system split into four – each ‘star’ is revealed to be a double, making the system a double-double (in fact, one of the E2 pair has an additional partner.... but this is very dim and only discovered by advanced imaging techniques in 1985). The components of Epsilon 1 are separated by 2.6” and those of Epsilon 2 by 2.3”. To separate the secondary components I had to really reduce the amount of stretch applied to the raw image – it was too easy, using a normal ‘deep sky’ stretch, to merge the secondary components into single unresolved blobs.

Mizar

Mizar is a familiar star located in the middle of the handle of the Big Dipper within the Ursa Major constellation. Mizar forms an optical double with its dimmer partner, Alcor, located 12 minutes away in the sky – with reasonably good eyesight these two stars can be separated without binoculars. Although they don’t form an orbiting pair, they are in fact loosely gravitationally bound, being members of a wider ‘Ursa Major moving group’ of stars that move in a common direction because they most likely originated in the same dust cloud.



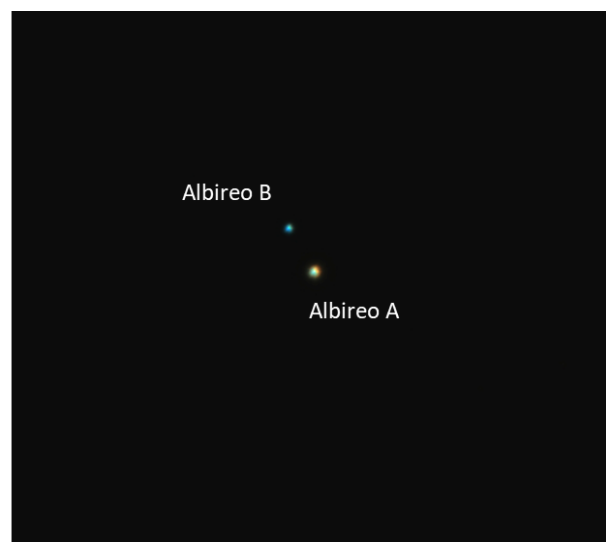
From astronomytrek.com Credit Jerry Lodriguss

Through a telescope Mizar splits into a double – a second magnitude Mizar A and 4th magnitude Mizar B, separated by 14 arcseconds.

In 1890, astronomer Edward Pickering, working at Harvard Observatory and using spectroscopic techniques, discovered that Mizar A was in fact a very close binary star. Further spectroscopic studies of Mizar B revealed that it, too, was a binary star, making Mizar a 4-star system.

Albireo

Albireo is a double star designated Beta Cygni, in the constellation of Cygnus. To the naked eye it appears as a single star of magnitude 3, but in a telescope it resolves into 2 components; a main yellow star, and a fainter, blue, secondary. The two components are separated by 35", and they form a beautiful contrasting double because of their different colours.



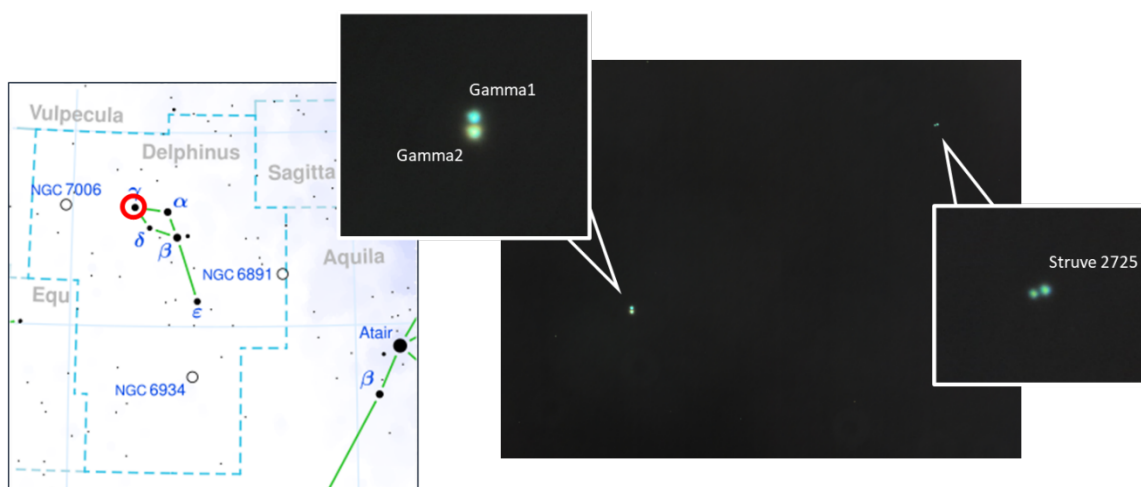
Actually, it is not known if the two stars form a true orbiting gravitationally bound system or whether they are merely an optical double. The GAIA mission has measured both components at a distance of 330 to 390 light years, but as of the second data release the data is too noisy to determine whether the stars are in a mutual orbit.

Gamma Delphini

Gamma Delphini is a beautiful, colourful, double star that marks the tip of the constellation Delphinus, the Dolphin. The pair is a true double star, orbiting with a period of 3200 years, located 104 lightyears away.

A small telescope will resolve the two components of this pairing, which are separated by 9.2", and will reveal the colour contrast of the two components. The brighter of the two, Gamma2, is a yellow-orange colour and is transitioning to become a giant star as it starts to fuse helium. Gamma1 is slighter less bright, and appears as a white star.

Nearby, and often in the same field-of-view as Gamma Delphini, there is another double star system, Struve 2725, located just 15 arc-minutes south-west from Gamma Delphini. The two stars are separated by 5.8 arcseconds, and may be observed through a 4 to 6 inch telescope.



The Milky Way was rewired by a cataclysmic collision billions of years ago. Now it is on course for another

Acknowledgement: This article was written by Vasily Belokurov, Professor of Astronomy, Institute of Astronomy, University of Cambridge. First published in **THE CONVERSATION** on 10 June 2026, it is republished in full under a Creative Commons Licence. The original article, with additional links and images can be found here: <https://theconversation.com/the-milky-way-was-rewired-by-a-cataclysmic-collision-billions-of-years-ago-now-it-is-on-course-for-another-284721>

Vasily Belokurov is one of three winners of the 2026 Kavli Prize in Astrophysics. The award is for uncovering fossil evidence of past galactic mergers that prove how the Milky Way evolved.

No matter the time or vantage point, from a pre-Neolithic cave to a post-lockdown London high-rise, the predictability of the night sky has always been humanity's symbol of permanence and reassuring stability.

Yet this apparent calm is deceptive. Our galaxy, the Milky Way, emerged from chaos and turbulence, and its constellations are full of migrants, exiles and survivors. Right now, it has begun to stretch and distort again, pulled by a massive companion and heading for an inevitable collision.

How can I be so sure? As a galactic archaeologist, my job is to reconstruct the past of our galaxy and read the signs of its future.

Instead of digging through soil, I use the laws of dynamics and stellar evolution to sift through hundreds of millions of stars – searching for the most ancient and chemically peculiar among them, interpreting their orbits and piecing together the events that shaped the Milky Way. One ancient encounter left scars so deep that, billions of years later, they still define the galaxy around us.

I want to understand what governs the lives of these massive cosmic systems: which changes are nature – the slow internal evolution of a galaxy disc – and which are nurture, imposed by collisions and mergers.

Questions about the source of dark matter underpin it all. This is the invisible substance whose gravity holds galaxies together, but whose true identity remains one of the greatest unsolved puzzles in astrophysics.

The Milky Way is the one galaxy where stellar motions can be measured in extraordinary detail. This allows cosmologists including myself to construct our most precise map yet of dark matter: how far it reaches, how dense it is around the Sun, what shape it has and how smooth or lumpy it may be. If we can build this map in enough detail, we may begin to understand not just where dark matter is, but what it is.

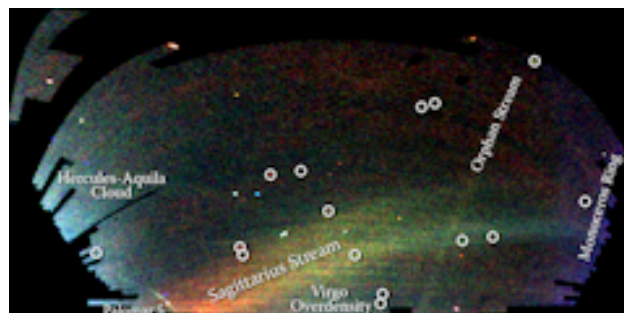
A cataclysmic collision

Our work has been transformed by a revolution in open sky surveys. From 2000, the Sloan Digital Sky Survey showed what becomes possible when vast astronomical datasets are made public, enabling discoveries far beyond the goals for which the survey was first built.

And since 2014, Gaia, the European space telescope, has taken this transformation to another level by mapping the positions and motions of nearly 2 billion stars, turning the galaxy into a vast archaeological record. No ruins, no shards and no bones – only stars that hold the clues.

The clearest giveaway that something cataclysmic took place long ago in our galaxy is the migrants we observe: stars that were not born in the Milky Way.

While native stars mostly travel together, circling the galactic centre in the great rotating flow of the disc, migrants cut across that order. They slide past the locals, plunge into the inner galaxy, then fly back out to its outskirts, again-and-again.



The Milky Way mapped with SDSS data. Vasily Belokurov, CC BY-NC-ND

These unusual orbits go hand-in-hand with unusual chemistry. Most of the migrant stars are less enriched in heavier elements than the locally born population. Their chemical composition is a sign of a slower rate of evolution that is typical of a dwarf galaxy.

This makes the migrants doubly valuable. They are both fossils of the Milky Way's violent past, and probes of its outer regions, travelling where the local stars rarely go.

How the Milky Way was rewired

One of the central ideas in the theory of cosmic structure formation is that galaxies grow hierarchically. Smaller galaxies fall into larger ones and are torn apart, leaving their stars behind as migrants.

In the Milky Way, the largest ancient structure of this kind is known as Gaia-Sausage-Enceladus. It is the remains of a vanished galaxy that collided with our own between 8 and 11 billion years ago (the “sausage” refers to a pattern in its stars’ motions).



Artist's impression of the young Milky Way colliding with another galaxy around 10 billion years ago. Vasily Belokurov, based on image by Juan Carlos Muñoz/ESO, CC BY-NC-SA

The Milky Way also did not go through that crash unscathed. The collision rewired and reshaped it.

Some of these changes are easily visible in the data. Stars from the old disc were splashed into our galaxy's halo, becoming exiles in the place where they were born. A new posse of star clusters were also acquired.

At the same time, we think something even more momentous was taking place. The encounter changed the orientation of the Milky Way's disc, and its alignment with the dark matter halo.

While dark matter is too diffuse to dominate our Solar System, in the outer galaxy it is the main gravitating mass – moving, streaming and, in the standard picture, clumping into a hierarchy of lumps.

Around the Milky Way, this dark matter forms a vast halo, much larger than the luminous part of our galaxy. We often imagine this halo as a sparse, round cloud, but Gaia has helped show this picture is too simple.

The dark halo can be stretched out of shape by a major encounter. Like a ship beginning to list, the Milky Way started to lean – not suddenly, not visibly, but over billions of years.



View of the Southern sky shows the Milky Way and (far right, close to horizon) two galactic neighbours, the Small and Large Magellanic Clouds. H.H. Heyer/ESO via Wikimedia Commons, CC BY-NC-ND

A new galactic dance

Unusually, compared with many galaxies of similar mass, the Milky Way was allowed ample time to recover from the shock of the “sausage merger”. No other cosmic cataclysm appears to have shaken our Galaxy since, letting it settle into a quiet, uneventful life. That is, until now.

The Large Magellanic Cloud (LMC), currently our galaxy’s most massive companion, is already pulling at the Milky Way, disturbing its halo again. In an echo of what happened some 10 billion years ago, the Milky Way is being drawn into an accelerating dance with this neighbouring dwarf galaxy, recoiling in response to the LMC’s approach.

This is a dance that only one galaxy is likely to survive intact. A new chapter of migration, survival and adaptation has begun.

None of this spoils the beauty of the night sky – it deepens it. The calm band of light above us is not a symbol of permanence, but the visible reminder of a long survival.

The Milky Way has been broken, rebuilt and is now being disturbed again. Its stars remember the past; their motions reveal the future. What looks eternal is, in truth, a moment in a much longer story.

Up Next:

NEXT MEETING: 8pm Friday 10 July – Nonsuch High School

Dr Elizabeth Cunningham from Surrey University will give a talk entitled “Dark Matter - why we think 95% of the Universe is missing.”

As usual, there will also be a presentation on the sky at night for the coming month.

NEXT USER GROUP:

Suspended until further notice.

NEXT OBSERVING SESSIONS

The next sessions, allowing for moon rise & set times and cloud conditions, should

be sometime around the new moon which is on 14 July.

The precise date and timings of any session will be advised by email and WhatsApp a few days in advance but should be within the period 11 – 16 July.

AD HOC OBSERVING AT WARREN FARM:

These will be at short notice when the weather is favourable, and may replace, or be additional to, sessions at Denbies. Please watch our WhatsApp feed for Alerts.