ØRBIT

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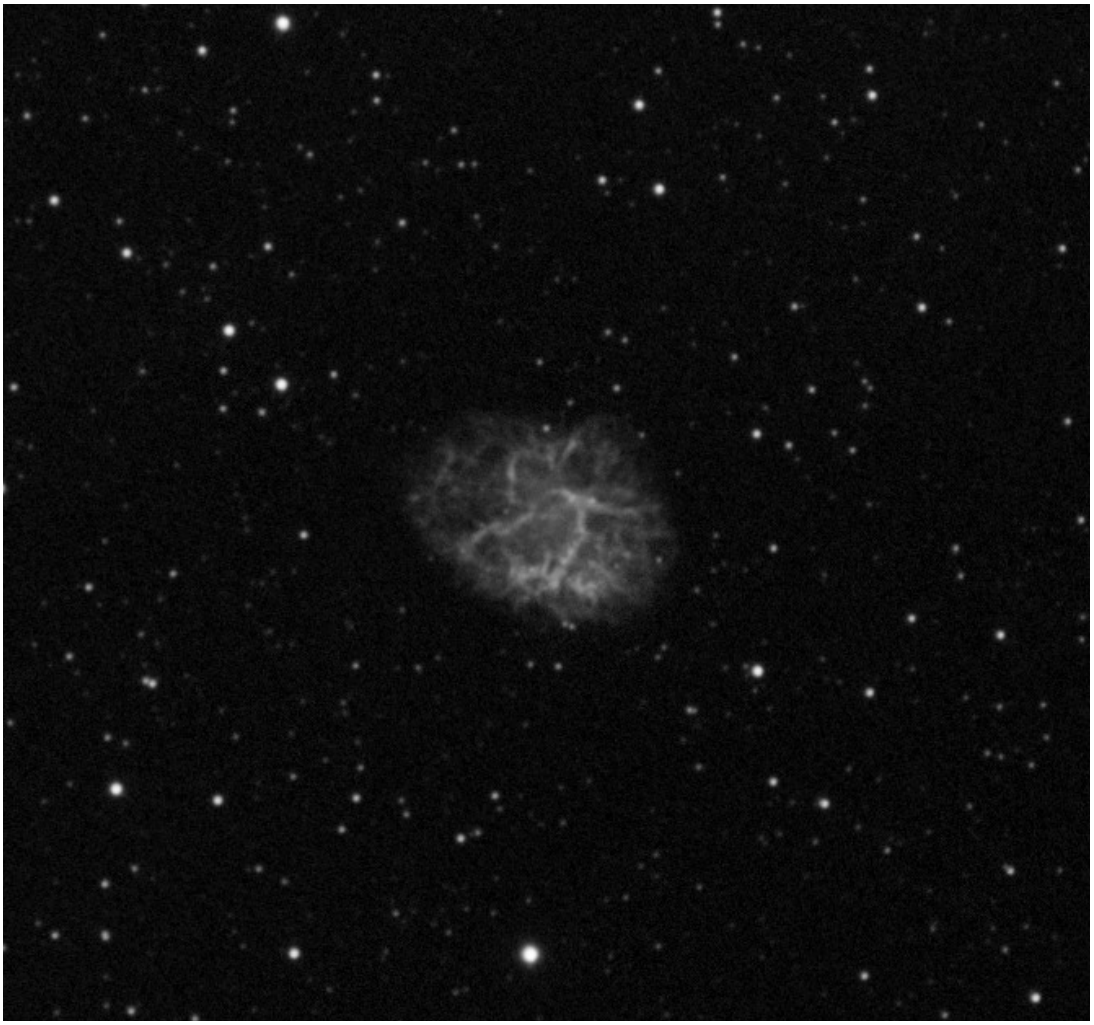
April to June 2018



First among the Messier's

The magazine of the Irish Astronomical Society

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1937-2017: Celebrating 80 years looking up

Contents

On the cover

Michael Murphy captured this excellent image of the supernova remnant M1 in Taurus from his South Dublin backyard on February 3rd, 2018. The object appears as a slight haze in binoculars under good conditions from a dark site but astrophotography is necessary to tease out any significant details of the expanding shell of debris when the progenitor star was destroyed.

M1 is known as the Crab Nebula after its crustacean-like appearance in the Great Leviathan telescope at Birr Castle was noted by the Third Earl of Rosse. One of our feature articles this month by William Fagan goes into the history not just of Birr astronomy but also the engineering firm of Thomas and Howard Grubb.

IAS meetings and other events of interest

Next IAS meetings

Venue for all our lecture meetings is Ely House, 8 Ely Place, Dublin 2. All welcome & admission is free.

- **Monday, Apr 30th at 8pm**: Mr Frank Prendergast will speak about archeoastronomy.
- **AGM in May**: the date of our AGM has yet to be arranged but we will communicate the details to members. The format will include some short talks like in previous years.

Dublin Sidewalk Astronomers

Friday, Apr 20th at 8pm: The Dublin Sidewalk Astronomers meet at the car park, on Strand Road, just south of the Sandymount Martello Tower, Dublin 4. Free, all welcome.

Saturday, Apr 21st at 8pm: The Dublin Sidewalk Astronomers meet in Clontarf. The venue is the seafront car park, on Clontarf Road, opposite the Clontarf Bus Garage, Dublin 3. Free, all welcome.

See our web site for details of further DSA events held monthly in each alternate venue (Sandymount on Fridays and Clontarf on Saturdays).

Details of lectures from some other science interest groups were not available at time of publication but do check sites like TCD Science Gallery, the IoP in Ireland, and the Irish Met Society for example.

- **Apr 12**: Yuri's Night. Inspire Space are holding a Masquerade Ball. See https://www.eventbrite.ie/e/yuris-night-space-masquerade-party-tickets-43443585935?aff=es2 .
- **Apr 13**: IMS talk "The Wind That Shakes the Island" See http://www.rds.ie/Whats-On/Event/34735
- **Apr 13 (to 15)**: Cosmos 2018 in Athlone. See https://www.facebook.com/
- **Apr 25**: The rescheduled "Citizens and Space" event at IT Tallaght will now take place this day. See http://www.it-tallaght.ie/ near the date.
- **May 4**: "May the Fourth be with you" events. See www.wildatlanticway.com/may-the-fourth-festival
- **May 12**: IoP in Ireland Spring Meeting, Limerick. See events page at http://www.iopireland.org
- **May 15**: EPA climate change lecture (part of their series). See www.epa.ie events pag
- **Jun 16**: Solarfest at Dunsink Observatory

New astrophotography exhibition

Following the very successful "Images of Starlight" photo exhibition in February 2016 we intend to organise a similar astronomy photo exhibition in time for Science Week next November.

"Images of Starlight - 2018" is another opportunity for astro-photographers in Ireland to showcase their work at the National Botanical Gardens in Glasnevin Dublin. As before, it is a collaboration between the Irish Astronomical Society and the Irish Federation of Astronomical Societies (www.irishastronomy.org). We expect a considerable level of interest from the public and from the media. On the last occasion, we had more than 8000 visitors, coverage in the Press and on RTE Radio and TV.

Details

The exhibition will begin during Science Week and will run from Nov 11th until Dec 2nd. We will be able to display up to 60 framed images in the available exhibition space at the National Botanic Gardens. The exhibition will be staffed by volunteers to help interpret the images for members of the public. We also hope to incorporate additional items like presenting examples of telescopes, large format poster displays and more.

Criteria

Your photo can be submitted in digital or printed format. The following are guidelines:

1. Digital prints must be at 300dpi and in its largest format aspect ratio.
2. TIFF format is preferred, or high res (300dpi) JPEG is also allowed (RGB or CMYK is acceptable).
3. Physical prints must be of a high quality (uncurled or folded) and can have a gloss or matte finish. Do not send mounted prints.
4. All photos will be fitted, landscape or portrait format, in an A3 mount and frame, and therefore may be subjected to a minimum amount of cropping, if necessary.
5. All images submitted must have the following details attached: Image Title, Location, Date Captured, Lens or Telescope used, Cameras used, Exposure(s), Techniques and software

Interested? Images can be sent via email to skyimagebotanic@gmail.com as an attachment (please do not include off-site links to images). All considerations must be received by Friday, September 28th, 2018.

Emer Reynolds, Director of "The Farthest", along with Committee members Greg Coyle (l.) & Peter Denman (r.) at Dunsink last December. Image courtesy of John Dolan

*Terry Moseley*nhas drawn our attention to a survey and article that features Prof Brian Espey of TCD. Brian has given a number of talks to the Society on the issues of light pollution and how to solve it.

Sound: https://www.mixcloud.com/liffeysoundfm/prof-brian-espey-tcd-school-of-physics-light-pollution-survey/

Article: https://www.irishtimes.com/news/science/only-5-per-cent-of-ireland-s-night-skies-are-free-from-artificial-light-says-expert-1.3419673

Poll Survey: https://orealen.polldaddy.com/s/lightatnight

Barry Pickup sent an item about an unfortunate astrophotographer in Derrynane National Park. A member of the public believed them to be carrying a sniper rifle rather than their camera gear. See https://www.independent.ie/irish-news/bizarre-scenes-as-stargazing-photographer-sparks-armed-garda-response-on-kerry-beach-36753668.html

Grubb and Parsons: Optical and engineering giants *by William Fagan*

IT WAS MY RECENT acquisition of a Grubb lens made in Dublin around 1855, shown to the right, that led me to pen this article about two remarkable Irish and Anglo Irish families. In particular, this involves two father and son duos where the fathers were born in the same year (1800) and the sons both passed away in the same year (1931).

The contributions of the Grubb and Parsons families in the fields of optics and astronomy are well known, but they also had achievements in other fields such as the consistent printing of bank notes and the creation of the steam turbine. The 19th century was truly a great time for inventors and creators and what we might call 'renaissance men' or 'polymaths' who could, seemingly, turn their hand to anything and succeed.

Let us start with Thomas Grubb, the creator of the lens pictured, who was born into a Quaker family in Portlaw in County Waterford, Ireland, on 4th August 1800. He started out in Dublin in 1830 as a modest billiard table manufacturer. He moved on into making telescopes and lenses at his works at 6 Canal Road, Dublin. I might add at this stage that Thomas Grubb also became the Chief Engineer at the Bank of Ireland where he developed a consistent technique for the printing of bank notes.

The telescope market was mainly where he concentrated his own business, but he also produced lenses for the growing photographic market and sought to patent his creations. The following is a discussion of my recently acquired lens and lens technology in the mid 19th century.

This lens is an Aplanatic (form of aspherical lens) Meniscus Landscape lens. It has a focal length of 30cm (almost 12 inches) and it would have been used on a large wooden camera on legs to produce 10 x 8 inch images. The lens number and the patent engraving can be seen clearly in the photo.

It can be seen that this lens is in a focusing mount (not all lenses at that time had that feature) and the 'helicoid' marking is visible on the side of the barrel.

For aperture control many lenses at that time used inter-changeable washers to give different stop sizes. I am not sure if the washer in this lens could be changed as I cannot remove the top piece. Later versions seem to have removable brass caps or pull out pieces which could be used to change the stop-to-glass distance, but I have not been able to calculate the stop size. I believe that stops running between f14 and f31 were used in Grubb Aplanatic lenses. Exposure times were very long, but were helped when the

wet-collodion process was introduced during the 1850s

In 1858 John Waterhouse introduced the Waterhouse Stop, which involved a slot in the lens body into which different sized stops could be dropped. This is often seen on Petzval portrait lenses which were made by a number of manufacturers, including Grubb. These were later replaced with the iris diaphragm which we are familiar with today.

Some people have asked me what am I going to do with this lens. My intention is just to keep it as a collector's item. I had been looking for a lens made by Grubb for some time as they were produced in Dublin, just a few miles from my home. It is certainly not mountable on any camera made today unless it has a bespoke mounting board on the front and can produce 10x 8 inch images. Just to demonstrate the size of this lens, here it is beside a typical Leica lens of today, a 35mm Summicron

On 26th March 1858 Grubb presented a paper to the Combined Scientific and Artistic Committees of the Royal Dublin Society (RDS; I am a member of the RDS myself today) in which he claimed that his Aplanatic lens design could eliminate or even over correct spherical aberrations. He is said to have been disappointed some years later when Dallmeyer (who had been working with Ross in London) obtained a patent for the Rapid Rectilinear lens which, some say, carried elements of Grubb's aplanat design.

I would now like to take a step back in time and introduce the Parsons Family. William Parsons was born on 17th June 1800 in Yorkshire , the son of an Irish peer. The family seat was in Birr (formerly called Parsonstown) County Offaly. Parsons obtained a first-class degree in mathematics in Oxford in 1822 and inherited an earldom (3rd Earl of Rosse) when his father died in 1841. He set about building the largest (focal length 52 feet and aperture 6 feet) astronomical telescope in the world, nicknamed the 'Leviathan of Parsonstown' , in the 1840s. The previous largest telescope in the world had been the one at Markree in County Sligo, Ireland which had an equatorial mount built by Thomas Grubb.

Rosse did a lot of the work at Birr and the creation (casting grinding and polishing) of the speculum mirror was done there. He had some difficulty with creating solid mounts for the thee-ton mirror and this is where Thomas Grubb stepped in and helped with some creative levered support solutions for a mirror of this size. I visited Birr to see the telescope a few years ago and, even today, it is a most impressive instrument

It has its own 'building' (walls 23 feet apart, 40 feet high and 71 feet long) which does not move, but the telescope was capable of some altitude and azimuth movement via a 'universal joint'.

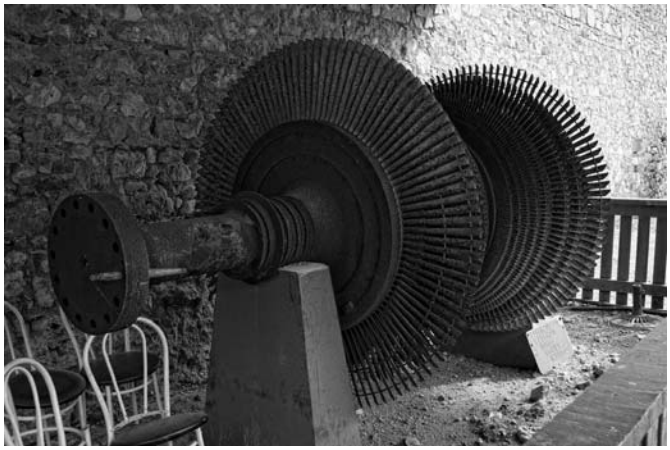
In 1845 Rosse was able to sketch a picture showing the correct structure of the 'Whirlpool Galaxy' and this is comparable to a photo of the same galaxy taken by the Hubble Space Telescope

Rosse was the first astronomer to establish the spiral nature of galaxies. He was also able to see other features clearly for the first time. For example, he was the person who gave the 'Crab Nebula' its name as he was able to see its features more clearly than any other astronomer at that time. For the remaining part of the 19th century, the Birr telescope remained the largest telescope in the world, although further evolution in telescope design rendered it somewhat outdated.

The Earl's wife Mary, Countess of Rosse, was a very active photographer. She joined the Dublin Photographic Society which had been founded in 1854 by Thomas Grubb and others. She was the second female member after Miss M Grubb, who is presumed to be Thomas Grubb's daughter. Mary Rosse was soon winning prizes for her photography and in 1859 she won the Society's Minerva Medal . Her photo laboratory is preserved in Birr Castle and remains as it was in her time. It is thus a treasure trove of Victorian photographic equipment and techniques.

William and Mary Parsons had thirteen children but only four of them survived into adulthood. Their youngest child was Charles Algernon Parsons(later Sir Charles), born in 1854, who went on to become the inventor of the steam turbine. His ship design, the Turbinia, which was built in 1894, was at that time the fastest ship in the world by a large margin. The ship famously turned up at the Spithead Review in 1897 where it easily outran existing Royal Navy ships.

The original is now on display in a museum in Newcastle. In the yard at Birr Castle on the day that I visited I saw the following remains of an old steam turbine.



Parsons set up the Parsons Marine Turbine Company in 1893. This was later absorbed into C.A. Parsons which became a leading manufacturer of steam turbines, particularly for the power generation industry. Many nuclear power stations today have Parsons steam turbines. The company was located at Heaton in Newcastle-upon-Tyne and underwent a number of structural changes after the death of Sir Charles in 1931. It is, currently, a division of the Siemens group.

It is now time to go back to the Grubb family. The youngest son of Thomas Grubb was Howard Grubb (later Sir Howard), born in Leinster Square, Rathmines, Dublin in 1844. During the 1860s Thomas began to hand over control to Howard who had been training to become a civil engineer. Under Howard, the Grubb Telescope Company made great strides. Grubb telescopes and mounts were installed in Dunsink and Armagh observatories and in the Royal Observatory in Greenwich. The company also manufactured telescopes for observatories much further away. One of the most famous was the great Melbourne telescope

This telescope was not without its teething problems. Eventually, those problems were resolved and the telescope gave many years of service, during which time it was modified several times, including the installation of CCDs in the 1990s on Grubb's original equatorial mount. It was damaged in a bush fire in 2003, but there is an ongoing project to restore it.

When the Melbourne telescope was ordered, the Grubbs moved to a larger premises in what is now Observatory Lane in Rathmines in Dublin

Most people passing through Observatory Lane today on their way to the Leinster Cricket and Sports Club or to their houses or apartments, or just to park, probably have no idea that this was once the site of the foremost large telescope factory in the world, whose products can still be found all over the globe.

Thomas Grubb died in 1878 and Howard continued to develop the company after his death. By the time of the First World War the Grubb Company had become a supplier of periscopes to the Royal Navy and also made telescopic gunsights. Perhaps as a result of the 1916 Easter Rising and also, possibly, because of fear of a German invasion of Ireland, the company moved to St Albans in England in 1918.

After the war, the demand for some of the Grubb products declined and by the mid 1920s the company was in serious difficulties. At this point Sir Charles Parsons stepped in with funding to form the company of Sir Howard Grubb and Parsons Limited. Its headquarters were moved from St Albans to Newcastle where it continued to provide first-class optical items for observatories all over the world until 1985, long after both Sir Howard and Sir Charles had died.

The impact of the creations and endeavours of these two illustrious families continues long after their time and even though neither company still exists, their achievements will not be forgotten.

As part of the commemoration of those achievements, the Irish Academy of Engineering presents a Parsons Medal with a portrait of Sir Charles Parsons on the medal to those achieving excellence in the development of engineering.

In 2017 my younger brother, Professor Tony Fagan of University College Dublin, was a recipient of the medal. He is seen in the centre of the above picture receiving the medal from the current Earl of Rosse, Brendan Parsons, who is on the left. The current Earl is a half brother of the late Earl of Snowdon who was a renowned photographer and the husband of Princess Margaret.

Through this medal award, the Parsons name lives on as a mark of engineering excellence in Ireland.

This article started from my acquisition of an historical lens made in Dublin in 1855, but it has taken me through an amazing series of inventions and creations by two families whose paths crossed on many occasions, leading to the development of science and technology and the world in which we live today.

All photos in this article are © William Fagan

Further reading

- A Lens Collector's Vademecum, Dr Alex Neill Wright, from www.antiquecameras.net/lensvademecum.html
- Photography in Ireland, The Nineteenth Century, Edward Chandler, Edmund Bourke Publisher
- Impressions of an Irish Countess, The Photography of Mary Countess of Rosse 1813-1885, David H. Davison, The Birr Scientific Heritage Foundation
- Victorian Telescope Makers, The Lives and Letters of Thomas and Howard Grubb, Ian S. Glass, Institute of Physics Publishing , Bristol and Philadelphia
- William Parsons, 3rd Earl of Rosse, Astronomy and the castle in nineteenth-century Ireland, Edited by Charles Mollan, Manchester
- Two Fathers and Two Sons by G.E. Manville, General Manager of Sir Howard Grubb, Parsons & Co Ltd, available for download from archive.org/details/TwoFathersTwoSons

A star with a sting in its "tale"

by Michael McCreary

This really is a star with a sting in its "tale". Mira "the Wonderful" or "Astonishing" has many names such as omicron (o) Ceti. It is the brightest and most famous of the long-period pulsating veritable stars and the standard object of it's type. But it has greater secrets to unfold.

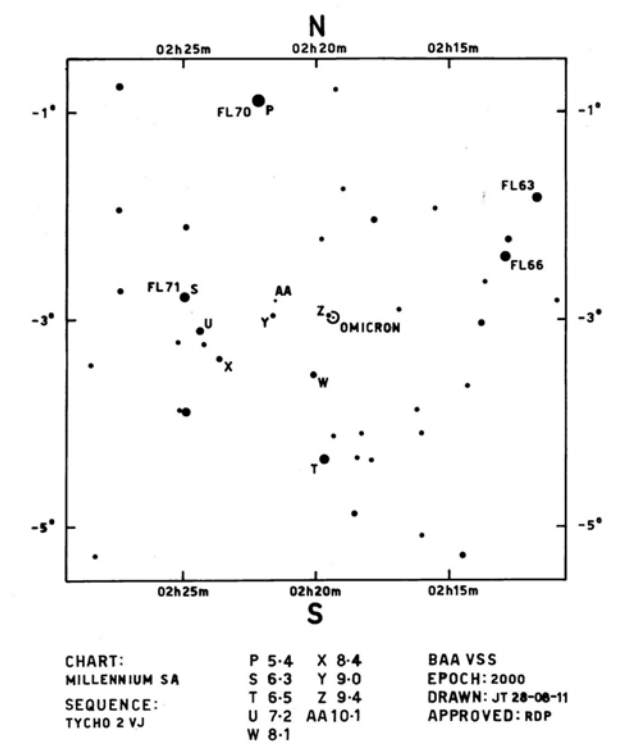
It was thought to have been discovered by a German amateur astronomer in 1596 who at the time thought it to be a nova, a "comet" or even the planet Mercury. David Fabricius was a pastor who, along with his son Johannes, is also credited with discovering sunspots. Not a lot more of Fabricius senior is known except for his unusual death which occurred at Osteel in Germany after denouncing a local goose thief from the pulpit. The accused man struck him on the head with a shovel and killed him in 1617. His son Johannes died in 1615 aged only 29.

David Fabricius rediscovered the star in 1603 and it became clear a new kind of object had been found in the sky. Evidence that the "star" was known in ancient China, Babylon or Greece astronomy is only circumstantial. There is talk of a "guest star" seen in the constellation of Cetus.

Johann Bayer added it to his Uranometria star catalogue and in 1638 the astronomer Hevelius gave omicron the name Mira "the Wonderful".

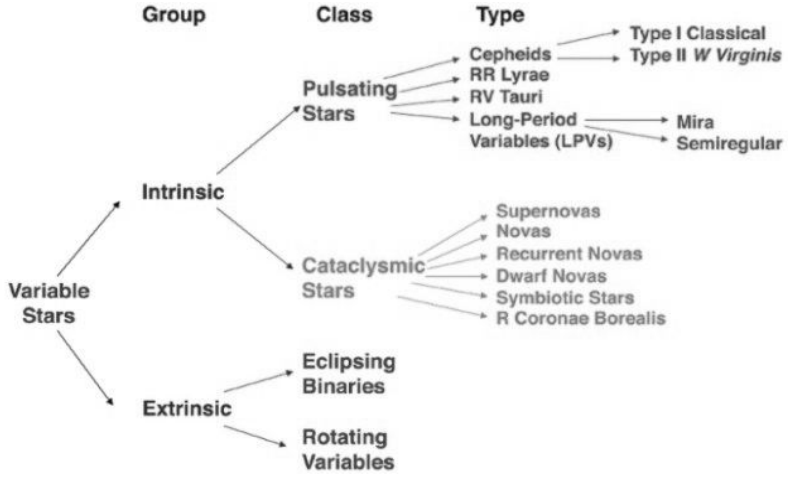
Mira is a Long Period Variable (LPV) red giant star in the constellation of Cetus and is estimated to be about 300 ly away, approximately six billion years old, and with a surface temperature of around 3000 K. It's diameter is 700 times that of the Sun but with a mass of only 1.18 times that of our sun.

All the physical characteristics of Mira seem to change regularly in the course of each cycle, suggesting that we are observing a periodic pulsation of the star, or at least the outer layers. It has being suggested that it's orb swells and contracts by about 20 percent.



BAA finder chart with comparison star magnitudes. More charts and details of how to observe variable stars are at the AAVSO web site www.aavso.org

Another twist in the story of Mira is it has a companion, Mira B, also known as VZ Ceti and is separated by about 100 AU from the primary. It was suspected as early as 1918 and was visually confirmed in 1923 by Robert Grant Aitken. Mira B orbits around the A star in approximately 400 years and has a surrounding disk of material. It was confirmed to be a white dwarf star in 2010 which is robbing material from Mira A.



Miras are just one branch in a whole range of variable star types

Ultra-violet studies of Mira by NASA's Galaxy *Evolution Explorer* (*GALEX*) space telescope have revealed that it sheds a trail of material from the outer envelope, leaving a "tail" 13 light-years in length that has formed over tens of thousands of year. Mira is travelling at 465,000 km/h through space creating a hot bow-wave in interstellar space. As all this is best seen in ultra-violet light I am really looking forward to images from the *James Webb Space Telescope* after its expected launch in 2020.

Check out the article and links at www.aavso.org/vsots_mira2

Sky notes for April to June 2018

by James O'Connor

Universal Time (same as G.M.T.) is used throughout

THE SUN continues its steady northward movement until the day of the summer solstice (June 21), after which it begins to move southwards again. Its north pole is tilted 6.6° away from Earth on April 1, reaches a zero point on June 6 and is tilted 2.8° towards Earth by June 30. The N end of the axis of rotation is sloped 26° towards the west on April 1, reducing to 3° by June 30. Aphelion (Earth furthest from the sun) is on July 6.

The Moon

Last Quarter	Apr. 8 07 18	May 8d 02h 09m	Jun. 6 18 32
New	Apr. 16 01 57	May 15 11 48	Jun. 13 19 43
First Quarter	Apr. 22 21 46	May 22 03 49	Jun. 20 10 51
Full	Apr. 30 00 58	May 29 14 20	Jun. 28 04 53

Perigee is on Apr 8 at 05h, May 6 at 0h, June 2 at 16h and June 30 at 02h .

Apogee is on Apr 20 at 14h, May 17 at 21h and June 14 at 23h .

Libration maxima: Apr 2.66 (8.2° in P.A. 235°), Apr. 15.96 (8.2° in P.A 18°), Apr 29.8 (8.0° in P.A. 234°), May 13.11 (8.9° in P.A 23°), May 26.62 (8.4° in P.A 240°), June 9.7 (9.7° in P.A. 26°), June 22.59 (9.4° in P.A. 246°) and July 7.5 (10.2° in P.A. 28°)

Lunar Occultations (at Dublin)

Date and Time	Star	Mag.	Phase	C.A.°	Moon illum. %
Apr. 20d 19h 56.4m	ZC 940 – 68 Ori	5.8	D	58N	+27
Jun. 24 23 20.5	ZC 2247 - η Lib	5.4	D	80N	+90
Jun. 28 22 38.6	ZC 2779 - o Sgr	3.8	R	65S	-99

Cusp Angle (CA) is the angle of the event around the limb of the Moon measured from the nearest cusp. Negative values (-) indicate a bright limb event. The cusps are usually N (north) or S (south) but can be E (east) or W (west) near Full Moon.

Meteors

Conditions are favourable this year for observation of the **Lyrid meteor** shower for which maximum is predicted on April 22. The predicted ZHR of 10 has been substantially exceeded on some occasions.

Variable stars

Minima of **Algol (**β Persei**)** are predicted for April 12d 0.3h, April 14d 21.1h, May 3d 22.8h, May 6d 19.6h, May 24d 0.5h, May 26d 21.4h and June 15d 23.1h .

The following Mira-type stars are approaching maximum: **X Cam** (July at mag. 8.1); **T Cas** (June/July at mag. 7.9), **SS Her** (May at mag. 9.2); **X Oph** (Apr. at mag. 6.8) and **R Ser** (June/July at mag. 6.9). The predictions, especially as regards maximum magnitude, are subject to considerable uncertainty.

The Planets

Mercury: Mercury spends the months of April and May in the morning sky but rising only a short time before the sun. Following superior conjunction on June 6, it enters the evening sky reaching greatest elongation E (26°) on July 12. It sets about 80 minutes after the sun during the second half of June but the long-lingering twilights of summer will hamper observation.

Venus dominates the western evening sky throughout the period, shining at a brilliant magnitude -4 and setting up to three hours after the sun. Its apparent angular diameter increases slowly from 10" to 15" of arc as it reduces its distance from Earth and the illuminated proportion of its disc simultaneously reduces from 94% to 70%.

Mars is on its way through the constellation Sagittarius towards what at first sight might seem a very favourable opposition on July 27 in Capricornus, when it will have an apparent angular diameter of almost 25 seconds of arc. Unfortunately, it will then be located far south of the Equator and consequently very low in the sky for observers in these northern latitudes. These unfavourable circumstances persist for the entire period under review and, indeed, for some months afterwards.

Due to its decreasing distance from Earth, the planet's apparent angular diameter increases from 8" on April 1 to 21" on June 30. There in a corresponding increase in brightness from +0.4 to -1.8. It exhibits a gibbous phase throughout with the proportion of the disc illuminated gradually increasing from 88% to 95%. The south pole of the planet is tilted earthwards by values varying between 7° and 15°. The south polar cap should, therefore, be a prominent object in the telescopic view .

Jupiter comes to opposition on May 9 in Libra and remains a prominent object in the evening sky for the remainder of the period. The planet's apparent angular diameter (Equatorial) will be 45" at opposition, reducing somewhat to 41" by the end of the period. Its stellar magnitude at opposition is -2.5.

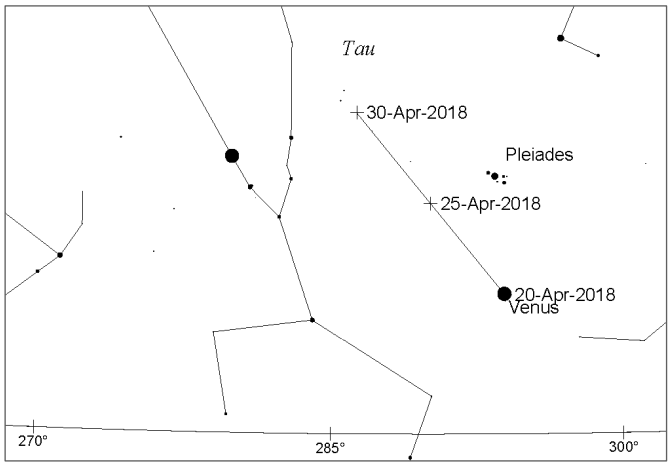
When to view —>	**Apr**	**May**	**Jun**
Mercury	not visible	not visible	evening (last week)
Venus	evening	evening	evening
Mars	morning	morning from early am	from midnight
Jupiter	from late evening	all night	until the early hours
Saturn	morning	from midnight	all night

Saturn, shining at magnitude zero, comes to opposition on June 27 in Sagittarius. The northern face of the rings are (at 26°) currently tilted earthwards close to their maximum possible extent, allowing the outer "A" ring to be visible all around the planet.

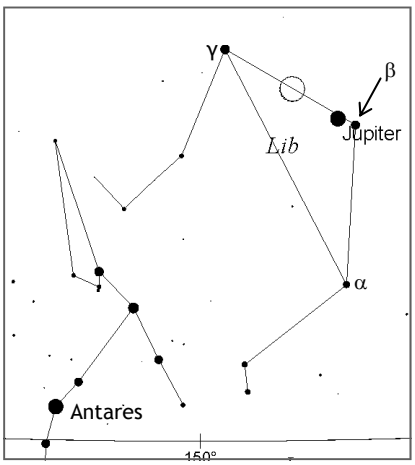
Several of Saturn's satellites may be seen in a small telescope. The largest, Titan, is, at magnitude 8.3, the easiest to see. Rhea (mag. 9.7), Tethys (mag. 10.2), Dione (mag. 10.4), Enceladus (mag. 11.7) and Mimas (mag. 12.9) are progressively more difficult. Another satellite, Iapetus, is very much an oddball. It orbits far from the planet in a period of 79 days and is ten times brighter at western elongation than at eastern. Such a favourable western elongation occurs on June 12, when it will shine at about magnitude 10 .

Uranus, magnitude 6, in Aries, enters the morning sky after conjunction with the sun on April 18 but remains too close to the sun for satisfactory observation for the rest of the period.

Neptune, magnitude 8, in Aquarius, is also in the morning sky in a somewhat similar situation to Uranus but emerges from the solar glare sooner. Throughout the month of June it will be almost stationary about a degree west and a little south of 4.4 magnitude 90 ψ Aquarii.



PM: Venus passes near the Pleiades in late April



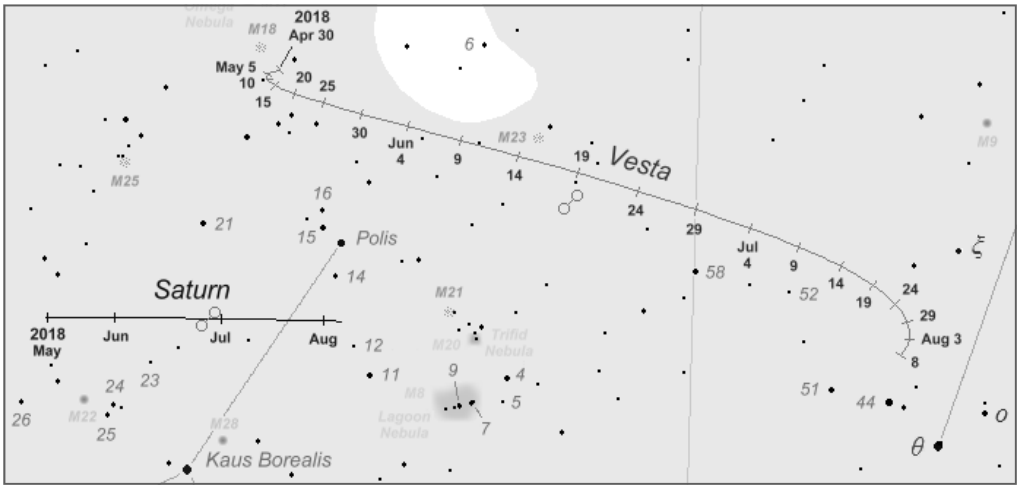
PM: almost Full moon is near Jupiter on May 27th

Jupiter satellite phenomena

Apr 3/4	Shadow transit of II begins 22:27, ends 00:43
Apr 8	Eclipse disappearance of I at 22:00
Apr 9	Shadow transit of I begins 19:21, ends 21:31
Apr 11	Eclipse disappearance of III at 19:24; reappearance at 21:10
Apr 15	Eclipse disappearance of I at 23:54
Apr 16	Shadow transit of I begins 21:15, ends 23:25
Apr 18	Eclipse disappearance of III at 23:21
Apr 19	Eclipse disappearance of II at 22:45
Apr 23/24	Shadow transit of I begins 23:08, ends 01:18; shadow transit of I begins 23:30, ends 01:37
Apr 24	Eclipse disappearance of I at 20:16
Apr 28	Shadow transit of II begins 19:28, ends 21:43; transit of II begins 20:00, ends 22:09
May 1	Eclipse disappearance of I at 22:10
May 2	Shadow transit of I begins 19:31, ends 21:41; transit of I begins 19:40, ends 21:49
May 5/6	Shadow transit of II begins 22:03, ends 00:19; transit of II begins 22:15, ends 00:24
May 6	Shadow transit of III begins 21:09, ends 22:53; transit of III begins 21:39, ends 22:49
May 9	Transit of I begins 21:24, ends 23:32; shadow transit of I begins 21:25, ends 23:35
May 10	Eclipse reappearance of I at 20:42
May 14	Eclipse reappearance of II at 22:04
May 16/17	Transit of I begins 23:08, ends 01:16; shadow transit of I begins 23:19, ends 00:29
May 17	Eclipse reappearance of I at 22:37
May 24	Eclipse reappearance of III at 20:59
May 25	Shadow transit of II begins 19:42, ends 21:51
May 30	Shadow transit of II begins 19:08, ends 21:24
Jun 1	Shadow transit of I begins 21:36, ends 23:45
Jun 2	Eclipse reappearance of I at 20:54
Jun 6/7	Shadow transit of II begins 21:44, ends 00:00
Jun 8/9	Shadow transit of I begins 23:30, ends 01:40
Jun 9	Eclipse reappearance of I at 22:49
Jun 15	Eclipse reappearance of I at 21:41
Jun 17	Shadow transit of I begins 19:53, ends 22:02
Jun 18	Shadow transit of III begins 21:00, ends 22:45
Jun 24	Shadow transit of I begins 21:48, ends 23:57
Jun 25	Eclipse reappearance of I at 21:08

On June 19th the bright asteroid (4) Vesta is at opposition in Sagittarius when it will appear as a magnitude 5.3 “star”. This is the brightest the asteroid has been since 1989.

The chart on the right by Martin J. Powell will allow you find the area where Vesta lies while charting software/apps will plot more detailed positions for the object.



Peering into the Big Bang

by David Taylor

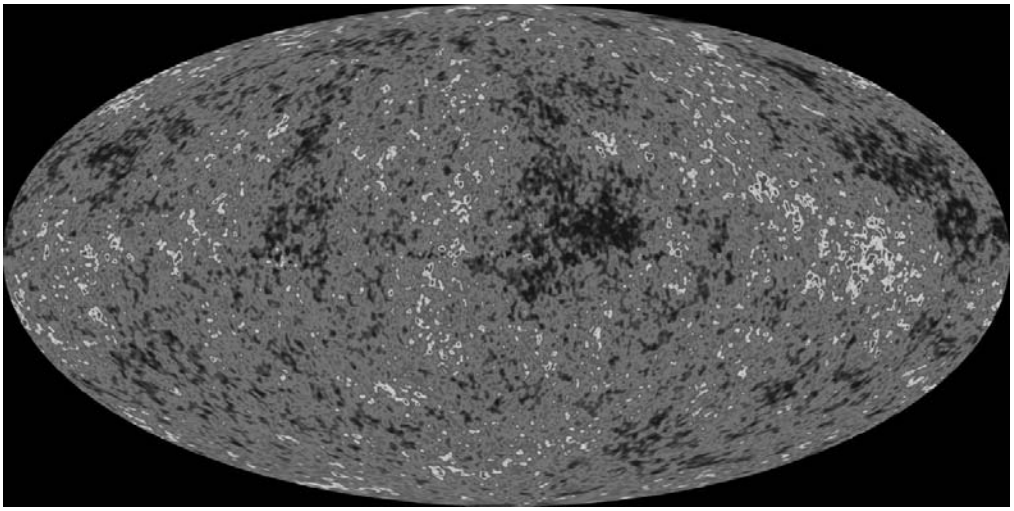
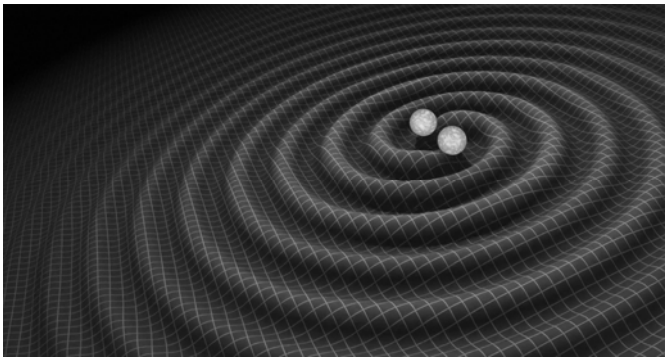


Image credit: Wikipedia

THE COSMIC MICROWAVE BACKGROUND RADIATION (CMB) is the farthest we can see into the past. The image from WMAP above, shows the relative differences in temperature of the universe about 380,000 years after the Big Bang. At this point, the universe was a soup of plasma too hot for atoms to form. Electrons whizzed around nuclei knocking photons in all directions; it was a mess. There is an issue here in terms of observations. Namely that the CMB forms a wall which effectively destroys any information about what happened before this from getting through. Regardless of our technological progress, we simply cannot gain any meaningful data beyond this barrier via light (electromagnetic radiation or EM). A possible solution may be looming over the horizon, and I believe that we are entering into a new age of astronomy. The answer may lie with one of our most newly harnessed tools; gravitational waves (GW).

Ripples in space-time

Let's take a step back for a moment. What are GWs? They are ripples in space-time caused when massive objects, such as black holes and neutron stars, interact. In February of 2016 the Laser Interferometer Gravitational-Wave Observatory (LIGO) announced the first observations of GWs. Namely, in a cataclysmic event 1.3 billion years ago where two black holes, 29 and 36 times the mass of the sun, merged in a fraction of a second. As an aside, this was yet another confirmation of Einstein's general theory of relativity, published a hundred years prior. Since this first observation, several more have been discovered in relatively quick succession. At the time of writing, there have been six GW observations, including a binary neutron star merger. It has been postulated that discoveries like this will be commonplace in the near future and is reminiscent of the discovery of exoplanets that began in the early 1990s. The rate of discoveries grew exponentially from then and now we know of more than 3,500 exoplanets.



Artist's impression of gravitational waves generated by binary neutron stars. Credits: R. Hurt/Caltech-JPL

New way of "seeing" the Universe

EM gives us many different paths for discovery. Take for example the multi-wavelength view overleaf of the Andromeda galaxy, a near-twin of our own Milky Way and a member of the Local Group. Each frequency tells a different story, uncovering different phenomena in each part of the spectrum. For example, when viewed in visible light, the rings appear to be spiral arms, however in ultra-violet and infrared they closely resemble a ring-like structure. This has been used to suggest that Andromeda was involved in a direct collision with its neighbour M32 more than 200 million years ago. Another example is that when viewed in ultra-violet, clusters of stars can be seen along the arms and in the centre, particularly the hottest, bluest, and youngest stars.

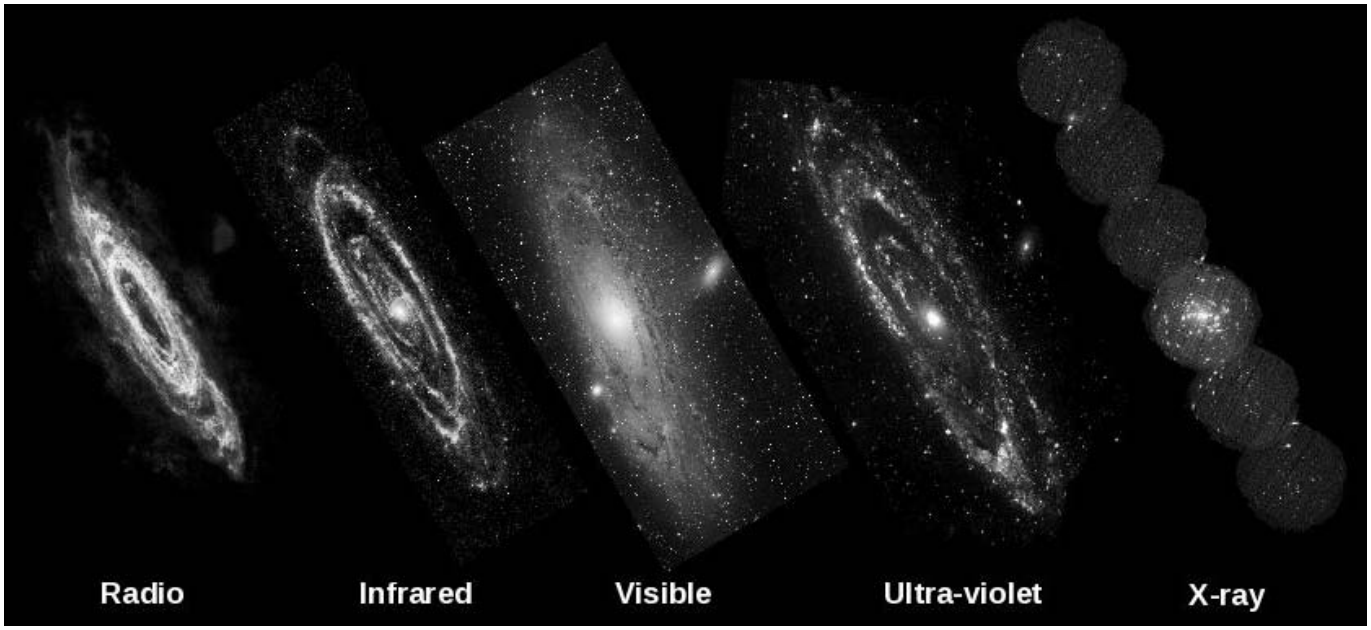


Image credit: Multiwavelength images of M31, via the Planck mission team; ESA / NASA.

While viewed in infrared, the cooler gas shows where the next generation of stars will form.

So what's so different about GWs? GWs are a completely different kind of phenomenon, providing a unique way of observing the universe. While EMs are the oscillation of electric and magnetic fields, GWs are the oscillation of spacetime itself! They are the literal expansion and contraction of spacetime. The use of this new method may allow us to observe right through the barrier of the CMB and uncover more mysteries of our universe.

Where does that leave us?

Our problem is that we cannot "see" past the CMB with EM. As we learn more and refine our understanding of GWs what then may we find through the wall of the CMB? Will we measure the first ripples of the Big Bang itself, the roar of the hypothesised inflationary period, or will we measure something else entirely? This is truly a new and exciting chapter in astronomy.

JWST delayed to 2020

Once it deploys, the James Webb Space Telescope (JWST) will be the most powerful and technically complex space telescope ever deployed. Using its powerful suite of infrared-optimized instruments, this telescope will be able to study the earliest stars and galaxies in the Universe, extra-solar planets around nearby stars, and the planets, moons and asteroids of our Solar System.

Unfortunately, due to its complexity and the need for more testing, the launch of the JWST has been subject to multiple delays. And as of recently, NASA announced that the launch JWST has been delayed yet again. According to a statement issued by the agency, the launch window for the JWST is now targeted for sometime around May 2020. The decision came after an independent assessment by the project's Standing Review Board (SRB) of the remaining tasks, all of which are part of the final stage of integration and testing before the JWST launches.

The final phase consists of some of the most challenging work, where the 6.5-meter telescope and science payload element are being joined with the spacecraft element to complete the observatory. In addition, the science team also needs to ensure that the observatory can be folded up to fit inside the Ariane 5 rocket that will launch it into space. They also need to ensure that it will unfold again once it reaches space, deploying its sunshield, mirrors and primary mirror. Already, the JWST has completed an extensive range of tests to ensure that it will reach its orbit roughly 1.6 million km from Earth. While delays can be discouraging, they also increase the likelihood of mission success.

The next step in testing will take several months, and will consist of the spacecraft element undergoing tests to simulate the vibrational, acoustic and thermal environments it will experience during its launch and operations. Once complete, the project engineers will integrate and test the fully assembled observatory and verify that all its components work together properly.

Observer's Corner

compiled by Aubrey Glazier (aubreyglazier@eircom.net)

Now that 2018 has truly arrived, many of us have probably noticed that our Earth's nearest neighbour has climbed much higher in our evening skies than it did at the tail end of last year. We have had some clear evenings since early January and the Moon is often the first celestial object we point our scopes at – whether they are reflectors, refractors or SCT's, before we go on to the more exotic.

Some of us have Antonin Rukl's Atlas of the Moon. Other publications are Atlas of the Lunar Terminator, Kaguya Lunar Atlas, Sky & Telescope Field Map of the Moon and Wood & Collins' 21st Century Atlas of the Moon.

In the past some of us have observed a 1 day old Moon. But to observe some craters we tend to wait until days 2 to 4 when the Moon is a waxing crescent. Some of us even get excited at seeing a Full Moon, which I personally love the sight of. I also find fascinating as to what its name is. Each Full Moon actually does have a name – Harvest, Wolf, Lenten, Fruit… Lunar observers get very fond of some features such as Rupes Recta, Copernicus, Vallis Schroteri, Theophilus or the Montes Apenninus. I could add many more. We can increase our magnifications beyond 200X if required. But most of the time 50 to 100X is perfectly sufficient. Lunar eclipses and occultations of stars and planets also provide excitement from time to time.

I wish you all clear skies, Aubrey.

From Kevin Berwick

Over the years, I have tried to buy the perfect travel telescope for use on holidays in southern Europe, where the skies are clearer than at home here in Ireland. Recently, I decided to buy a small Maksutov Cassegrain telescope. The idea was to use the little 'Mak' as a 'grab and go' telescope for casual observing of the Moon and bright deep sky objects. In addition, I could use it for travel. These little Maks are very cheap and rugged, so I could use it on holidays without fear of damage. After searching online for a while I found a decent, used, Celestron C90 for sale for £100 and bought it. It is interesting to note that in the picture above, the eyepiece is considerably more expensive than the telescope.

The C90 is a Maksutov Cassegrain scope of 90 mm aperture. It has a tube length of about 40 cm and a weight of 2.3 kg. The telescope has a Celestron Lifetime No Fault Warranty, indicative of the ruggedness of the design. It is worth noting that this Optical Tube Assembly (OTA) is made by Synta and marketed under various brand names such as Skywatcher, Orion (US) and other brands. Also, the C90 is usually marketed as a spotting scope, however, it can be successfully used for astronomical use.

The only upgrade I performed was that I decided to replace the, essentially useless, finder with a Sky-Watcher zero power reflex sight I bought on Amazon UK, a direct replacement for the supplied finder.

I decided to mount the telescope on a Universal Astronomics MicroStar Deluxe mount on a TeleVue Telepod tripod. It is a nice match for the C90, particularly for grab and go applications. In addition, this mount is light and therefore suitable for travel. In fact, any camera tripod would work with this telescope. The telescope, on tripod, can easily be picked up with one hand and carried downstairs from my bedroom into the back garden. When in the garden, the telescope can easily be moved to view between trees where necessary. In short, it is a very usable telescope.

A few problems with the scope are worth mentioning. First, the meniscus lens can dew over after even a short observing session under damp Irish skies. Cool down is supposed to be a problem with the Maksutov design, however I didn't really see much of a problem with this small Mak. It may be a problem with a larger telescope of this design. In general, I use the telescope half an hour after leaving it out in the garden, with no cool down problems, at least to my eyes.

A few nights after I bought the C90, I had a look at several couple of deep sky objects on a cold, clear, moonless night in January from my back garden on Dublin's south coast. I thought it would be nice to have the option of at least viewing the brighter deep sky objects when I travel abroad to dark sky sites, as it would extend the telescope's utility considerably.

First light were the Pleiades. My view was with a 32mm TeleVue Plossl, giving a magnification of 39X with the C90. The view filled the eyepiece, but I was unable to get the whole cluster into the field. Stars were tiny hard balls of light. Of course, the first thing you notice is that the field of view is somewhat smaller than what I'm used to in my refractors. In addition, because of the high magnification resulting from the long focal length of the telescope, the sky background is a little darker than I am used to. So, using typical eyepieces, you don't get the full impact of this large open cluster since you can only look at a portion of the cluster at any one time.

The view was softer than what I have seen using my refractors with a similar aperture. As I said earlier, I did check collimation and it looked fine. Perhaps the optics are a little rough, or perhaps the reduction of the effective aperture and contrast by the central obstruction was responsible for this effect.

Impressed with the performance of the telescope, I decided to document my deep sky experiences with the C90, sketching at least some of them to give readers an idea of what to expect when viewing the deep sky from the suburbs with this diminutive telescope. It would be of help to beginners and even seasoned observers might be surprised as to what is possible with a small telescope.

How many objects? Ninety. The aperture of the telescope is in millimetres. Ninety with the C90.

I strongly urge anyone reading this to get themselves a small telescope for quick looks and to keep it accessible. Your number of nights observing will increase enormously. One last point, there seems to be a trend online to style larger and larger telescopes 'grab and go'. I have seen people write that telescopes such as their 10-inch Dobsonian or 5-inch apo is 'grab and go'. Perhaps the crossover between astronomy and pumping iron is bigger than I imagine. For me, 'grab and go' means an easy lift, with one hand, of telescope, mount, tripod and eyepiece bag. Perhaps an 80mm refractor, a 4 or 5-inch reflector or Maksutov, no more. Give it a try. The price of these telescopes is low triple figures, especially if second-hand. I guarantee it will become you most used telescope in no time.

Anyhow, on with the observations.

No. 1: M27 The Dumbbell nebula

Caught this object one Autumn evening in October as it was beginning to set. It is really a Summer object, so it is nice to catch it this time of year. You can use the constellation Cygnus to easily find this object, even though it is in Vulpecula. The Dumbbell is easy to find, big and bright, at magnitude 7.3, so it is an ideal target for the little Mak. A planetary nebula, it is worth at least trying to use any narrowband filters you might have to improve the view. Through the 32mm Plossl, at 39X, the Dumbbell's rectangular shape is obvious, as is the narrowing at the centre. You can convince yourself that the nebula is 'greenish', although I suspect that this is spurious.

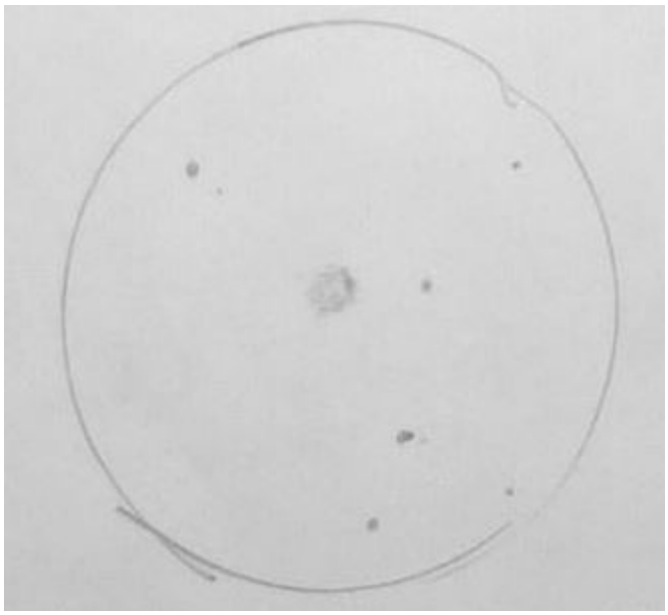
No. 2: M2 Globular in Aquarius

I caught this little globular in late November from my back garden in Dublin with the little C90. Use the line from alpha to theta Pegasi as pointers to find this object. They point almost directly at M2. It's a featureless puffball in the Mak and fainter than M15. I thought I detected hints of a stellar nucleus but cannot be sure. The field in the 20mm Plossl was very dark, there are a few faint field stars visible at 63 X. Make sure you compare M2 to nearby M15.

No. 3: M3 Canes Venatici

This globular is relatively easy to find using theta and epsilon Pegasi as pointer stars. This globular shines at magnitude 6.3, compared to the 6.6 magnitude M15. It is noticeably brighter than M2, more so than I expected it to be given the relatively small magnitude difference.

I saw hints of a stellar core, the edge of the globular certainly expands as you view it: - a combination of dark adaptation and averted vision.



Sketch of M3 in the C-90 by Kevin Berwick

No. 4: M45 the Pleiades

Galileo chose to make this object the first one he looked at with his newly acquired telescope, so naturally the first object I looked at when I bought the C90 was the Pleiades, M45. My view was with a 32mm TeleVue Plossl, giving a magnification of 39X with the C90. No doubt, the view I got was far better than the

one that Galileo had with his primitive telescope. The view filled the eyepiece, and I was unable to get the whole cluster into the field. Stars were tiny hard balls of light. However, it must be said that a magnification this low would be very forgiving of optics, a far higher magnification would be required to do an exacting star test. Collimation appeared good, a relief after buying used.

I have viewed the Pleiades many times with my wide field apochromatic refractor. The field of view in the C90 is somewhat smaller than what I'm used to in the 4-inch refractor. In addition, because of the high magnification resulting from the long focal length of the telescope, the sky background is a little darker. So, using typical eyepieces, you don't get the full impact of this large open cluster since you can only look on a portion of the cluster at any one time. Overall, the view in the C90 is less pleasing than in the TV 101. However, it must be remembered that this telescope is less than 1/10th of the price of the refractor, so it isn't a fair comparison.

No. 5 M42 the Orion Nebula

M42, the Orion nebula, was the first nebula I saw with my first telescope, a 60 mm refractor. Of course, it was during the long Northern hemisphere winter and I always associate Orion with sparkling frosty nights. I sometimes wonder how many hours I have spent in my lifetime, staring at this showpiece nebula. It is one of those objects you could look at all night. I almost always take a quick look at it if it is on show as the visibility of the mottling of the nebula is very dependent on sky conditions.

While not the only nebula in Orion, M42 is the Daddy of them all. Looked fantastic in the C90 with the 32mm Plossl at 39X, partially because it was a cold clear winter's night. In addition, the transparency was excellent since there had been recent rain and stormy weather. The fish's mouth, Trapezium and the characteristic 'seagull' shape were all very obvious. I didn't even attempt to sketch what I saw, such was the level of detail.

As always with the little Mak, I got a lovely high contrast view, with black space framing the nebula beautifully. The stars were tiny pinpoints at this low magnification.

More next time everyone. Thanks for reading!

From James O'Connor

The Sun: The only recent event of note was the sunspot group that crossed the disc during the first half of February. I first saw it as a small spot near the eastern limb on Feb 6 and followed it as it developed and then reduced again to a single small spot visible near the western limb on Feb 15. In between, it was quite impressive for a sunspot-minimum object. At its greatest development (Feb 9-11), it comprised a reasonably large leading spot with following spots of various sizes. The umbra of the leading spot was cut in two by a bridge of photospheric material.

The Moon: The Good seeing on the night of Feb 20 induced me to have a look at the moon. It was the first night as far as I can remember that I saw the crater Theophilus illuminated while its companions Cyrillus and Catharina were still in darkness. The interior of Theophilus was in darkness except for two of its central peaks, one much more prominent than the other. I also observed Posidonius (situated in the eastern part of Mare Serenitatis). Its floor showed a great amount of detail. The most prominent features were the prominent crater in its centre and small ruined craters in the eastern part of its floor. (30 cm refl. x70, x170).

Close conjunction of Jupiter and Mars, 2018 Jan. 7d: I had a good view of this close conjunction which took place at 7h. The separation was only 0.3' of arc. It was impressive not only because of the close approach but also because of the big difference in colour. The planets differed in brightness by a factor of 20 but if I hadn't prior knowledge of this fact I would have guessed something more like 10 or 12.

Minima of RW Tauri: I observed four minima of this eclipsing variable, the variable with the largest known difference (a factor of 25) between normal and minimum. The eclipse lasts for some nine hours (with a flat "total" phase lasting about 80 minutes. Naturally, I "came in" on the eclipse at different stages on each of the four occasions. Details follow:

- *2017 Dec. 11*: The object was at magnitude 8.2 (close to normal) when I commenced observing at 18: 05. It faded to 11.5 by 21: 00. By 22:30, when cloud put an end to observations, it had passed through its flat minimum and had recovered to mag. 9.4.
- *2017 Dec. 22*: At full magnitude (8.0) at 19h, it had declined to 10.5 by 22: 00, when cloud interfered.
- *2018 Jan. 5*: It was passing through its flat minimum (magnitude 11.5) when observations commenced at 19: 00. It had recovered to 8.3 by 22: 10, when cloud interfered.
- *2018 Feb. 21*: At magnitude 10.0 and fading when observations began at 19:50. It reached minimum at 20: 25. Cloud put an end to observations shortly after this point. (30 cm refl. x70)

Colour in the Orion Nebula (M42): Unlike the situation in colour photos, the excited gases forming the Orion Nebula look a plain white or maybe slightly bluish to the eye. I read in a recent *Sky and Telescope* article that it was possible to see colour in it if one went against the normal wisdom of such things and looked while the eye was not dark-adapted. I decided to give the idea a try on the night of 2018 Feb. 17. Well, the ploy worked – sort of. When using the method on the central (Huygenian) region of the nebula, I could see the fringes of the area distinctly amber and not white. The colour faded back to white as my eye regained its dark adaptation.

From John O'Neill

Sunspot counts

During the period December 2017 – February 2018, the maximum sunspot index I observed was on 13 February (W=17) and I observed no spots on the Sun on the following dates: 3, 4 December; 26 January; 17, 24 and 27 February. Counts were conducted on 9 days during this period and reported to the AAVSO Solar Section. I used 70 mm and 85 mm refractors, both equipped with Thousand Oaks Type 2+ solar filters.

Jupiter and Mars

2018 January 9-10 at 16:08 UT. Mars and Jupiter had separated to 1.5 degrees from their recent close conjunction. Mars was magnitude +1.4, Jupiter -1.9 and the +5.2 magnitude star nu Librae was between them. Two of Jupiter satellites were surprisingly prominent in the 10x30 image stabilized binoculars.

Afterwards, I checked the configuration of the Jovian moons. It appears, at the low power of the binoculars, Io and Europa were combined (just 6" apart) to form one visible body. Even more remarkable, the same thing applied to Ganymede and Callisto (29" apart). Both of these separations were too small to resolve at the low binocular power. The combined magnitudes were 5.5 and 5.4 respectively.

From Liam Smyth

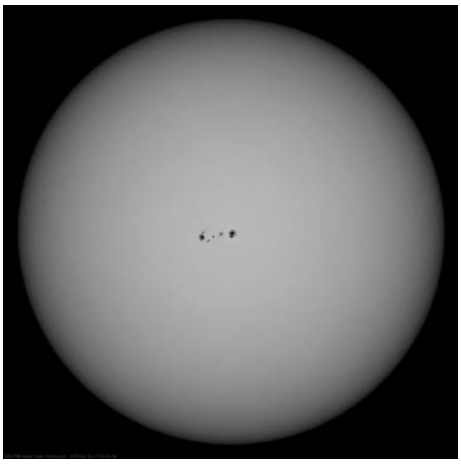
An observation of Antares

9th February 2018: At about 0645 UT in the morning as the sky was just beginning to lighten the waning crescent moon shone brightly in the southern sky while Jupiter gleamed some way to the right of it and the eye caught Spica further on. Then just three degrees below the moon I caught sight of Mars and a further five degrees lower the red planet was clearly outshone on this occasion by its eponymous rival Antares. This was puzzling. Guide 8 indicated a trifling difference in magnitude between the planet and the star. The lower altitude of the latter should surely in that case have made it fainter as both were quite low in the sky anyway. Is it likely that even to the naked eye the difference between a point source and an extended object on this scale would result in a contrast effect to make the star look the more intense in lustre? Hardly.

I had never really thought of Antares as a variable star, in a city environment the usual issue being to see it at all, but as a red giant it should be immediately suspect. I presume that is the explanation of what I found puzzling. It seems Antares can reach magnitude 0.6 so it could be noticeably brighter than Mars much of the time.

From Barry Pickup

I managed to find this image on the NASA SDO website. It is now solar minima in the 11 year cycle. It has been a long time since a similar group was visible.



A superb wide-angle view by Derek Buckley of M81 (centre) with the elongated star-burst galaxy M82 to its lower left