PRIME focus
MAS SOCIETY JOURNAL
mas macarthur astronomical society

july2020
volume 20 quarter 03

contents

The Crab Nebula: Observations Through Time - NASA

This composite of the Crab Nebula was made with data from the Chandra X-Ray Observatory (blue and white), Hubble Space Telescope (purple), and Spitzer Space Telescope (pink).

top of each page:
return to menu

from the editor

Hello, and welcome back to our re-booted PRIMEfocus. M.A.S. presents to you our July 2020 edition - volume 20, edition 4 - quarter 3. In this edition, we continue to enjoy contributions from several new contributors. For their time and effort, we thank them sincerely.

To those of you who are connected to M.A.S. via our website, FaceBook group, Twitter or elsewhere, welcome to our society and please feel free to join in. For the first time, this magazine will now be made available to all who'd like a copy each month, not just our financial member base.

Again I'd like to sincerely thank our new contributors. For this edition, we have professional astronomer Dr. Emil Lenc and Jackie from the One Giant Leap Australia Foundation back again - thank you both.

I must mention a change to the production of PRIMEfocus from this point forward. Given new time constraints due to the Covid crisis, and a re-location to Tasmania, I regretfully have to change the frequency at which this publication is produced. From here on in, PRIMEfocus will become a quarterly.

Hopefully, this will allow each edition to grow significantly in size, and bring you FAR more astronomy/space goodness in each issue. It will allow our ccurrent contributors, and (hopefully) new ones to spend the time to increase their input. Quarterly editions will fall in week one of the following months each year: January (Q1), April (Q2), July (Q3) and October (Q4).

We'll see you all for the next edition, V20Q4, in October.

Clear Skies!
Chris Malikoff

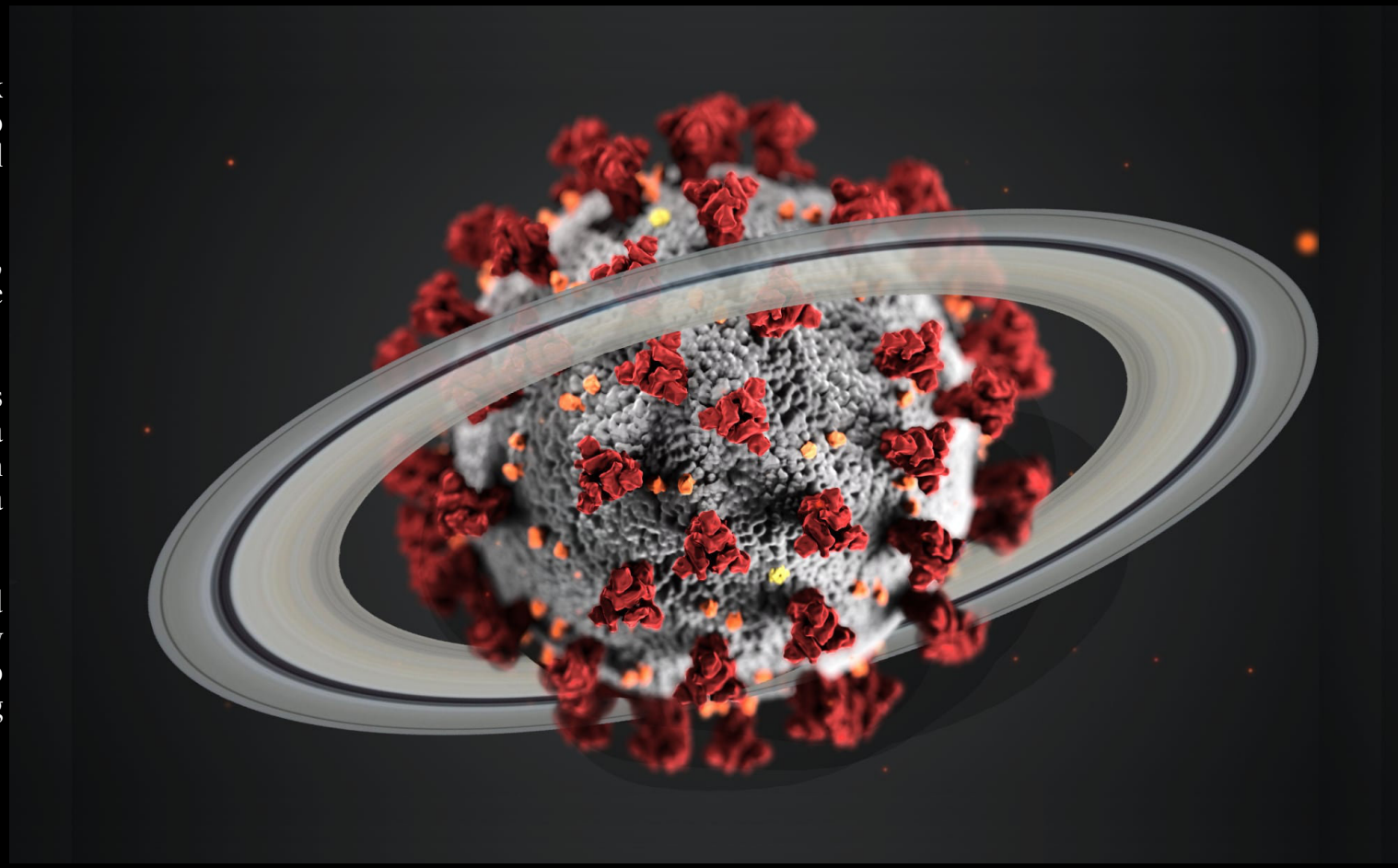

Image: "Jupiter's Corona" composite Chris Malikoff (MAS)
A composite image made up of data from various NASA images.

president's report

JOHN ROMBI

Dear members & associates, welcome to our July edition of Prime Focus. I hope that you are all surviving this Covid-19 world, and are keeping healthy!

Whilst many pastimes have been curtailed, fortunately astronomy can still be enjoyed by surfing the net.

The information is endless, and will certainly help you to "enjoy" the imposed isolation. The Macathur Astronomical Society is on Facebook, Twitter and our own website, www.macastro.org.au.

Don't forget to step outside and to take in the beautiful universe around us. No extra instruments are needed, just your eyes. Speaking of instruments, a good pair of binoculars will help you unravel some of the wonders, and of course a telescope will take you deeper into the universe.

Over the next couple of weeks you will be able to observe five of the main planets in our night sky from dusk until dawn. Any of the usual planetarium programs, either on your phone, laptop etc, will be able to guide you to them.

MAS Observing

With the lifting of restrictions in June, we made many trips to our two observing sites at the Forest and Stargard.

Two sessions were held at Stargard, with a total of twenty members attending and, for once, clear skies greeted us after a cloudy beginning. Macdob2 (6") made its "First Light" appearance and it did not disappoint.

The Forest (with its darker skies) is our best site, but I fear that the very cold weather has kept our numbers down this winter, along with our friend covid. Unless restrictions are reimposed, I would encourage you to attend either or both sessions, you will not be disappointed. And of course there will be plenty of help on hand, if needed.

Zoom Forums

These will continue for the foreseeable future, and I'm glad of the positive response from the members. I would like to thank all our speakers for agreeing to present their research to us, in this way.

Contributing Editors

I hope you have been enjoying the articles from our experts. Don't forget, if you have any questions regarding the information, please don't hesitate to contact the contributor. Their contact details are available at the bottom of the article.

Join Us

If you would like to know more about astronomy and the M.A.S., please don't hesitate to contact me via email. Until next month, keep your feet on the ground, but keep reaching for the stars.

Cheers, John.

John Rombi
President, MAS
presidentmas55@gmail.com
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what's on?

macarthur astronomical society

New Moon Weekends (Fri-Sat)

Belanglo Forest

Members Private Observing Nights

~~Jan 24th-25th cancelled (bushfires).~~

~~Feb 21st-22nd cancelled (weather).~~

~~March 20th-21st went ahead.~~

~~April 24th-25th cancelled (public health).~~

~~May 22nd-23rd cancelled (public health).~~

~~June 19th-20th - 10 members, no visitors.~~

~~July 17th-18th Cancelled (cabin hygiene)~~

August 21st-22nd: Int. House cancelled

September 18th-19th

October 16th -17th

November 13th -14th

December 11th -12th

Third Quarter Moon Saturdays

Stargard

Members Private Observing

~~Jan 18th cancelled (bushfires).~~

~~Feb 15th cancelled (weather).~~

~~March 14th pp to 20th (weather).~~

~~March 20th unscheduled - went ahead.~~

~~April 18th cancelled~~

~~May 16th cancelled (public health).~~

~~June 13th - 10 members, no visitors.~~

~~July 11th~~

August 15th

September 12th

October 10th

November 7th

December 5th & 12th

First Quarter Moon Saturdays

Public Nights

~~January 4th: unallocated~~

~~February 1st: unallocated~~

~~March 7th: unallocated~~

~~April 4th: unallocated~~

~~May 2nd: Domes cancelled (public health).~~

~~May 30th: Domes cancelled (public health).~~

~~June 27th: Domes cancelled (public health).~~

~~July 25th: Domes cancelled (public health).~~

~~Aug 29th: Domes cancelled (public health).~~

~~Sept 26th: Domes cancelled (public health).~~

October 24th : unallocated

November 21st : unallocated

December 19th : unallocated

Third Mondays of the Month

Macarthur Astronomy Forum

~~January 20th~~

~~February 17th~~

~~March 16th cancelled (public health).~~

~~April 20th online~~

~~May 18th online~~

~~June 15th Online~~

~~July 20th~~

August 17th

September 21st

October 19th

November 16th

December 7th (First Monday)

STOP PRESS:

John Rombi
presidentmas55@gmail.com

From Saturday June 13th, the NSW government has (further) relaxed the rules on the number of people that may gather together. It is now 20 people.

This means that Stargard will now host 20, with all the usual social distancing rules.

If you would like to attend, and have not already notified me, please contact me asap. Unless I have your request to attend, you will not be allowed on the field. I will check with International House, concerning The Forest cabin for the following weekend. Until I have a clearance from them, the numbers will be limited to the current number of 10.

If you have any questions, please don't hesitate to contact me.

the armchair radio astronomer

Dr. EMIL LENC

Radio telescopes may seem nothing like their optical cousins but they share more similarities than meets the eye. Sure, they have no eyepiece but that is also true for many optical observatories where electronic sensors take their place. Also, there is quite a bit of wizardry and black magic that goes on between the many radio telescope mirrors and the forming of an image (otherwise known as interferometry and synthesis imaging for those dabbling in the dark arts) but this is also true for multi-mirror optical telescopes such as the VLT. The more important aspects of each type of telescope, however, remain similar e.g. the larger the telescope, the better your sensitivity and the better your resolution.

There are also observing similarities: both need to be pointed at the source of interest, they need to track if observing for a while, and for increased sensitivity long exposures are needed. These similarities became altogether apparent while inspecting data from the Rapid ASKAP Continuum Survey (RACS) and the ASKAP Survey for Variables and Slow Transients (VAST). Both surveys take 12-15 minute exposures of sky regions, each of which is 12 moon-widths in extent.

While inspecting the data I inadvertently came across a number of Solar System favourites and it got me thinking about how many more I could find. Quite a few it turned out but only after I resorted to using several amateur planetary astronomer "tricks of the trade".

Just like in the optical, Jupiter and Saturn were the easy ones to find. They are bright and did not move much over the course of a RACS/VAST observation but they did move over months when those fields were re-observed. Oddly enough, while Saturn loses its rings in radio, Jupiter gains a one i.e. the image is dominated by the radiation belt on either side of the planet.

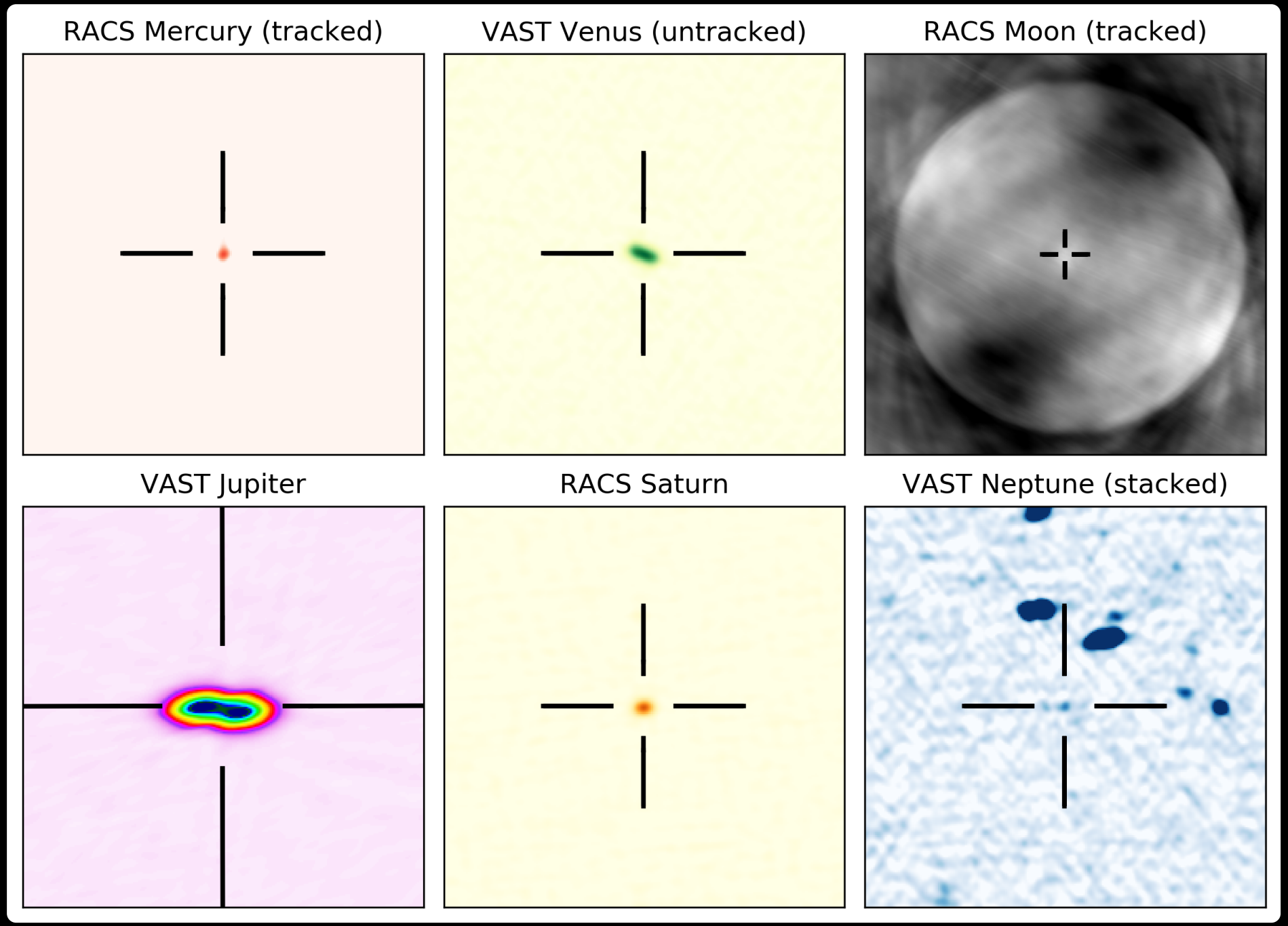
The word "planet" is derived from an ancient Greek word meaning "wanderers" and some planets are surprisingly fast wanderers. Venus, which is quite bright in radio, moved enough in its orbit over a 12 minute VAST observation to appear slightly blurred. This is because the telescope was tracking the sky and not the planet itself. Mercury, being both faster and somewhat dimmer, was blurred out of existence in the RACS image when I first looked. Fortunately, when we record radio data we can create shorter snapshots - much like the frames from a video camera.

When I tracked for the orbit of Mercury and stacked the individual frames together the planet appeared quite clearly. The moon, also a fast mover, is big and bright so I had to track it over 15 minutes to avoid a blurred mess. The moon is in its first quarter so you may well ask why do we see a full disk? The radio observation "sees" heat several metres below the regolith, this remains relatively constant regardless of the lunar phase.

Neptune was the next challenge, while it doesn't move very fast (being an outer planet), it is too weak to see in any individual VAST observation. Fortunately, VAST observed in Neptune's direction 13 times over the past year. By accounting for its movement and stacking the images together I could just pick out Neptune as a faint source.

Those with keen eyes will note that Mars and Uranus are missing. Sadly, while these were briefly observed by RACS/VAST they were too weak to be seen in radio. Hopefully, as we accumulate more data, I'll be able to add these to the Solar System family album in future.

the armchair radio astronomer



one giant leap

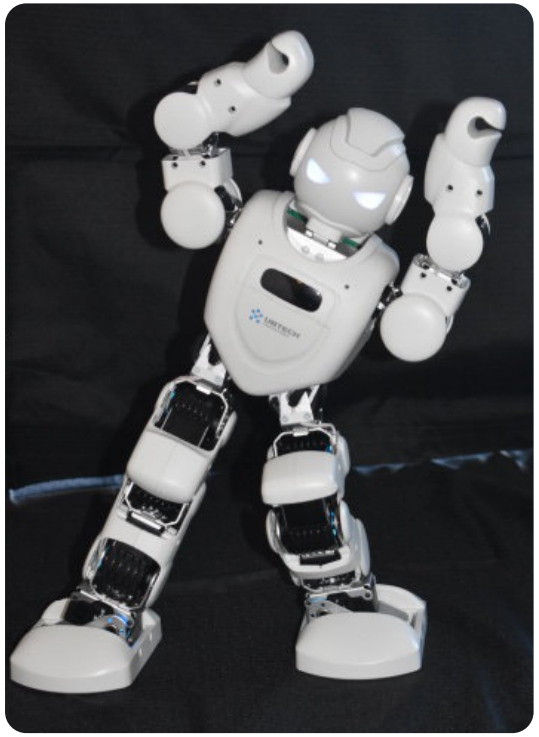
ONE GIANT LEAP
AUSTRALIA FOUNDATION

Article written by Lachlan Waring and Dominic Christie, who are Year 8 students and One Giant Leap Australia Foundation Student Ambassadors.

"Exploration and discovery, the driving forces in the advancement of mankind."

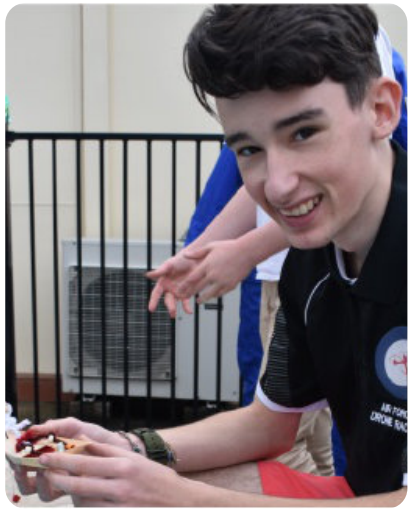
In the first week of the winter holidays, a group of One Giant Leap Australia Foundation student ambassadors came together at the Headquarters in Western Sydney. Called 'The Gathering', it was a week of experiments, collaboration, robotics, astronomy and aviation/ aerospace. During daylight hours, the ambassadors were encourage to be innovative and creative. They were given the opportunity to explore the capability of the brand new UBTECH robot 'Alpha 1'.

As robotics is one of the major focus areas for the Australian Space Agency, also in education and skills development, it was only fitting that remote operation of land, water and air based machines were a focal point. One Giant Leap Australia Foundation is the national coordinator of the Kibo Robot Programming Challenge and is collaborating with JAXA and NASA on this competition. There are more than 15 teams in the inaugural round. You can find out more here: https://kiboaustralia.com.au/



After nightfall, the students braved the freezing cold to observe the night sky. In particular, the splendid full Moon, Saturn and its rings and Jupiter and its moons. Using a telescope to scan the sky, the student ambassadors were looking for interesting astronomical features. It was perfect! The Moon (plenty of great photos), Saturn (the rings were visible) and Jupiter with 3 of the 79 moons could be seen as well as the bands. The Jewel Box Cluster, which, although small, looked stunning through the telescope in the night sky.

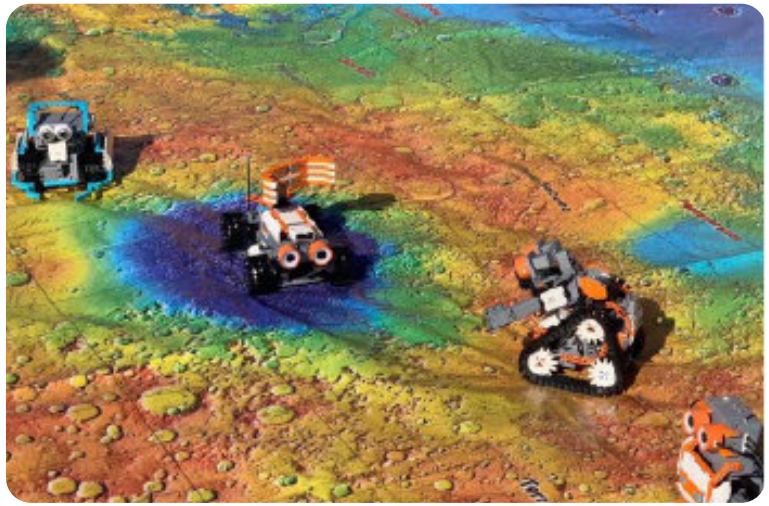
one giant leap



One Giant Leap Australia Foundation recently purchased Australia's first Giant Moon and Mars maps. These unique maps illustrate the surface of Mars and the Moon including locations, landing sites, heights, depths and more. They will provide a vital and significant contribution to the learning of students all around Australia. Arriving with the maps were two interactive globes of the Moon and Mars. These models are extremely precise and appropriately scaled in their details.

Through the use of augmented reality and other recently developed technology, you are able to connect to an application on your device. This application uses your camera to label the surface of the models and create an interactive and innovative learning experience for the user.

One Giant leap Australia Foundation is preparing Australian students for the jobs of the future. The Student Ambassadors cannot wait to help do the same for others.



Read more about the Student Ambassadors:

https://onegiantleapaustralia.com/student-ambassador-program/

...or visit our Facebook page at:

tony's law

uncommon cometary comments

TONY LAW

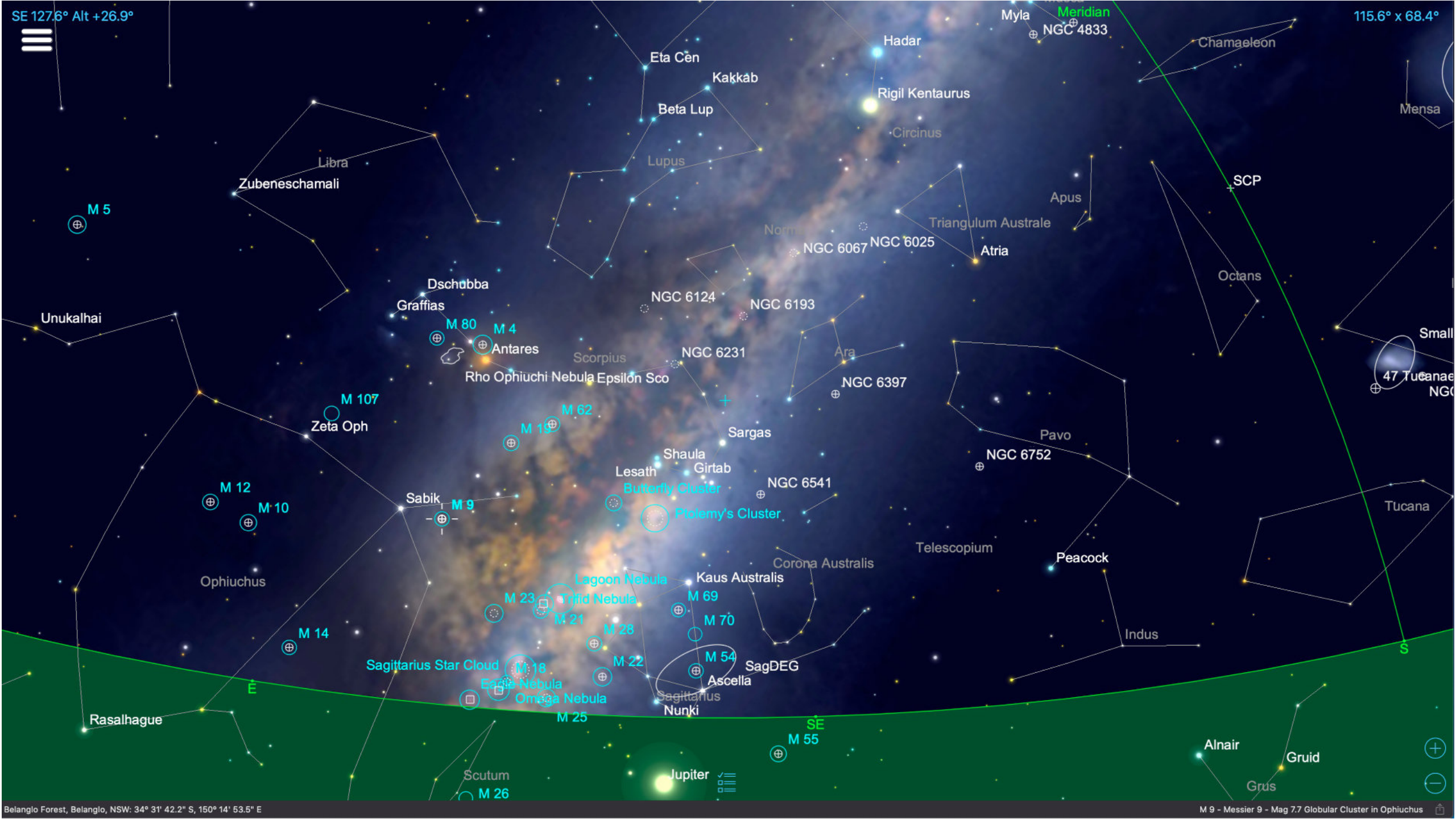
July and August are my favourite months for observing the Milky Way and in particular the Constellations of Scorpius (Scorpion), Ophiuchus and Sagittarius (Teapot). Those members (financial) that have not joined us at 'The Forest' for a night or a weekend are missing out on great skies. Remember your annual membership fee allows you a free weekend at The Cabin (currently worth $35.00). Since the tree felling that went on late last year we have a much greater field of view in all directions. You may well encounter some local wildlife as you carry out your observations! Check out our Facebook posts to keep up to date with what is going on or direct to our website.

Whether you are imaging widefield night-scapes with camera only, or through your telescope we have much darker skies than Stargard but still have some skyglow to the East, filters help tremendously.

Map of the Constellations and Messiers (SkySafari) for mid-August is at end of the article. You can see from this that the area swarms with Messier Objects, over 25 in this section. The Messier objects are a set of 110 astronomical objects catalogued by the French astronomer Charles Messier in his “Catalogue des Nébuleuses et des Amas d'Étoiles”, published in 1771. Because Messier was only interested in finding comets, he created a list of non-comet objects that frustrated his hunt for them!

Some of the well-known are M4 (near Antares) M7 (Open Cluster), M8 (Lagoon Nebula), M16 (Eagle Nebula), M17 (Swam Nebula) , M20 (Trifid). The images show you what you can see through processing multiple images! Dave Manning's image of Rho Ophiuchus (includes Antares and M4 at the bottom) is a 3 panel Mosaic. The others have been taken by me over the last couple of years

Wishing us all Clear Skies! Tony


SE 127.6° Alt +26.9°
115.6° x 68.4°
Meridian
Myla
NGC 4833
Chamaeleon
Hadar
Eta Cen
Kakkab
Rigil Kentaurus
Beta Lup
Mensa
Circinus
Lupus
Libra
Zubeneschamali
SCP
Apus
M 5
Triangulum Australe
Atria
NGC 6067
NGC 6025
Octans
Dschubba
Graffias
NGC 6124
NGC 6193
Unukalhai
M 80
M 4
Antares
Small
Scorpius
NGC 6231
Ara
Rho Ophiuchi Nebula
Epsilon Sco
NGC 6397
47 Tucanae
M 107
M 62
Zeta Oph
M 19
Sargas
Pavo
Shaula
NGC 6752
Lesath
Girtab
M 12
NGC 6541
Butterfly Cluster
Sabik
M 9
M 10
Ptolemy's Cluster
Tucana
Telescopium
Corona Australis
Peacock
Ophiuchus
Lagoon Nebula
Kaus Australis
M 23
Trifid Nebula
M 69
M 21
M 70
M 28
M 14
Indus
Sagittarius Star Cloud
M 18
M 22
M 54
SagDEG
Eagle Nebula
Ascella
E
S
Omega Nebula
Sagittarius
Nunki
Rasalhague
M 25
SE
M 55
Alnair
Gruid
Scutum
Jupiter
M 26
Grus
Belanglo Forest, Belanglo, NSW: 34° 31' 42.2" S, 150° 14' 53.5" E
M 9 - Messier 9 - Mag 7.7 Globular Cluster in Ophiuchus

cosmic focus

the universe, and all that...

ROGER POWELL

Identifying Photographic Objects

Astro-imaging has revolutionised amateur astronomy over the last couple of decades. It's now commonplace to see images which are equal or better than images taken by larger professional telescopes pre-digital photography.

With low-noise CMOS and CCD cameras, amateurs are picking out fainter objects than are found in most sky atlases, making identification difficult.

It's nice to independently confirm details of the target; and it's enriching to identify any unexpected objects in the image.

Tools

These are some of the tools I use:

I submit all images to nova.astrometry.net (1). Within minutes I obtain a copy of my image, annotated with the identities of stars and certain deep sky objects. Useful stats are supplied, including the field of view and image orientation.

Sky Safari Pro (2) is an app for tablets and phones, surpassed by none, identifying over 100 million stars, 3 million galaxies down to 18th magnitude and every comet and asteroid ever discovered. It can do much more; but it's the reliable object data base and display which are invaluable, at home and out in the field.

The Simbad online data base (3) is a library of deep sky objects maintained by Strasbourg Astronomical Data Centre. It's updated by professional astronomers and is useful for teasing out more information about specific objects.

Another online tool which has come in handy has been Google Sky (4). It's great for identifying sky coordinates of unknown objects.

M83

Examples

Example 1: I recently posted a 2½ hour exposure of galaxy M83 on my website. It showed a pair of tiny smudges appearing next to M83. (see red marks on image). "What do I think they are?" enquired one subscriber, an experienced amateur astronomer.

Using the above tools, I established the names of the mystery objects, both galaxies: ESO 444-85 and [R84] A1-342. I was astonished to learn that these 16th and 17th magnitude galaxies on my image are a boggling 665 million light-years away, (redshift 0.012 - receding at 4.6% light speed).

As an amateur, I never expected to capture galaxies that are two thirds of a billion light years away. The light was emitted when the first fossils that might represent animals were forming on Earth!

Example 2: I wanted to identify a fairly bright star close to globular cluster C105. I went to Google Sky for the coordinates and found the star – no longer bright but very faint. A variable star!

I was able to identify it as RZ Muscae, a star which pulses between 13th and 16th magnitudes every 47 weeks.

Astronomy is exciting but can be even more rewarding when you research and document what you capture!

Reference Links

(1) http://nova.astrometry.net/upload
(2) https://skysafariastronomy.com/
(3) http://simbad.u-strasbg.fr/simbad/
(4) https://www.google.com.au/sky/

Questions?

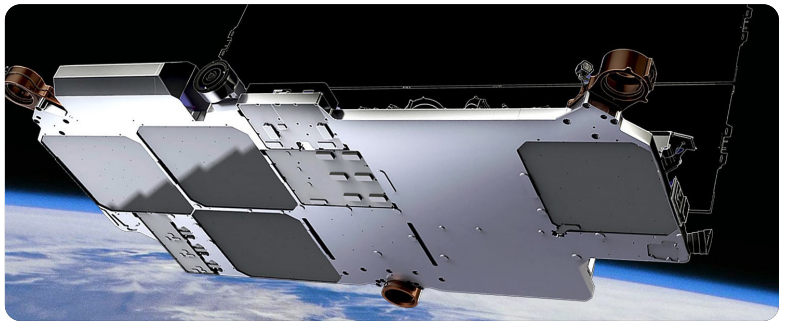
Thanks for reading. If you have any comments or questions, you can find me at:

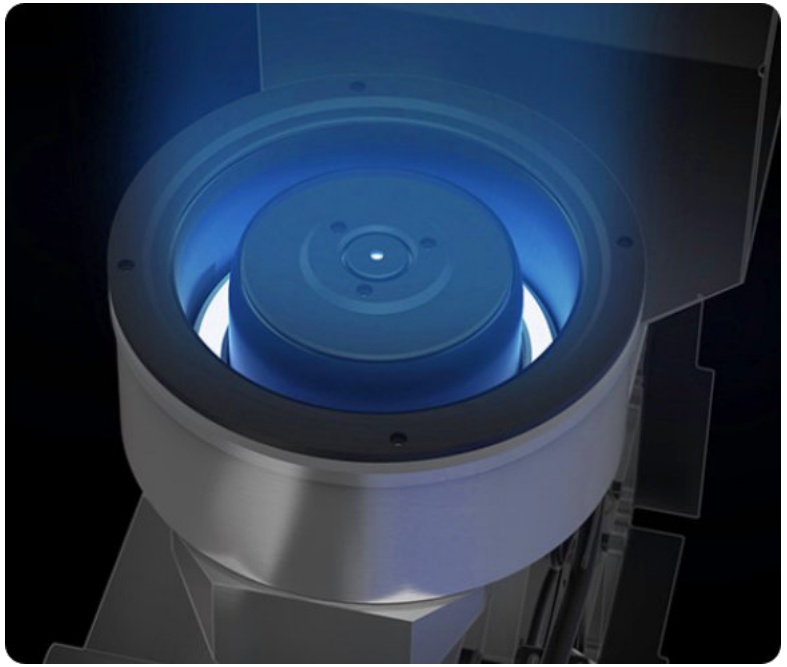
roger@macastro.org.au
cosmicfocus.wordpress.com

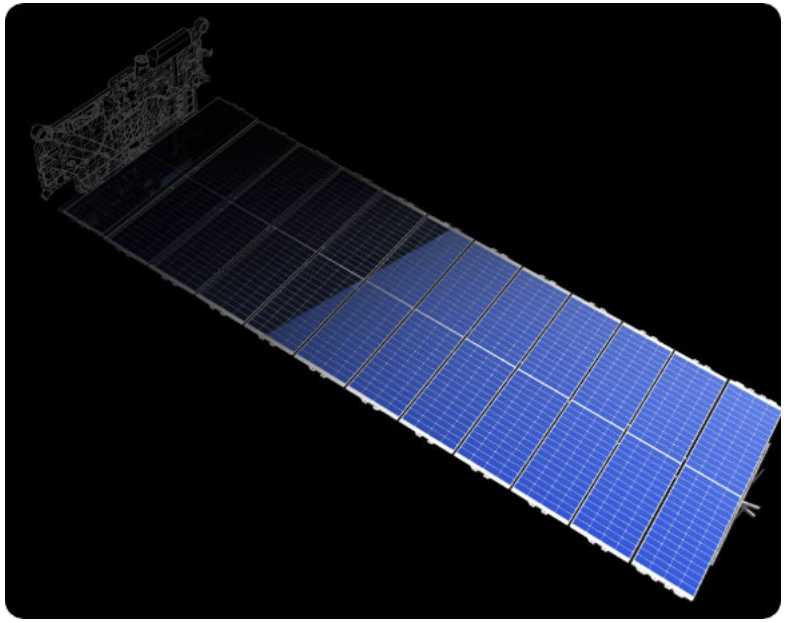
M83 Image: Copyright ©R.Powell

Article: SpaceX - “Starlink”

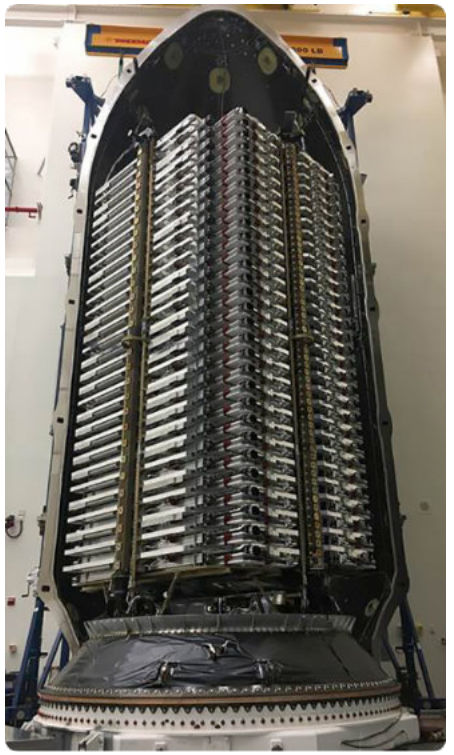
As I compile this article, Starlink9 launch is on hold for a couple of days. Following a static fire test, further checks on the Falon9 launch vehicle are being carried out. Once reaching their planned orbits, at a height of 550km, this series of 57 satellites will increase the total number of satellites to approx. 450.







The Aim: High Speed Internet Access Worldwide



With performance that far-surpasses that of traditional satellite internet, and a global network unbounded by ground infrastructure limitations, Starlink will deliver high speed broadband internet to locations where access has been unreliable expensive, or completely unavailable.

The Hardware

Four powerful Phased-Array Antennas on each satellite, a krypton ion engine (the first of its kind), single solar array, a star tracker (custom built in-house navigation sensors for attitude stability) and autonomous collision avoidance system to protect from space debris. Each Satellite weighs about 260kg, a compact, flat-panel design to minimise volume and allow for a dense stack to take advantage of the launch capabilities of the Falcon 9.

Keeping Space Clean

Starlink is on the leading edge of on-orbit debris mitigation, meeting or exceeding all regulatory and industry standards. At end of life, the satellites will utilise their on-board

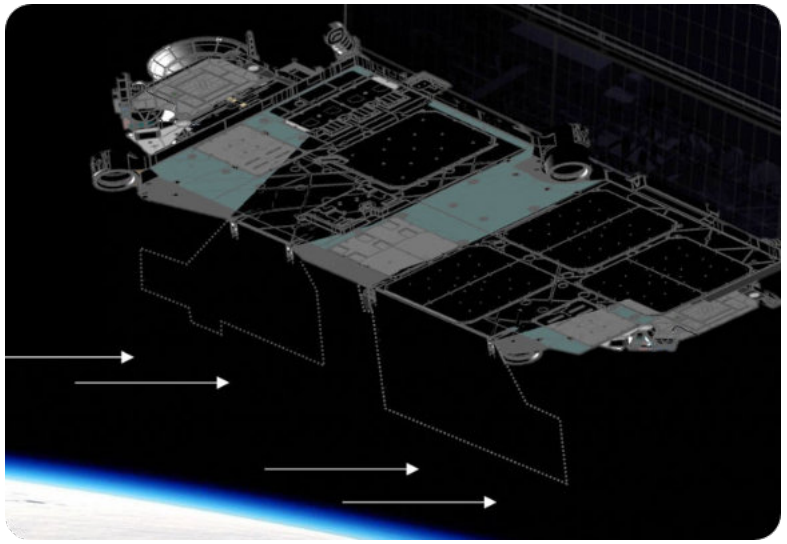
propulsion system to de-orbit over the course of a few months. In the unlikely event the propulsion system becomes inoperable, the satellites will burn up in Earth's atmosphere within 1-5 years, significantly less than the hundreds or thousands of years required at higher altitudes.

Astronomy Downside

From the start astronomers have complained about the light emanating from the current satellites, the Starlink mega-constellation will consist of at least 12,000 satellites!

SpaceX is showing that it's taking astronomers' concerns seriously. Its first attempt to darken the Starlink satellites, dubbed "DarkSat," launched in January. While the company had announced it would put a dark coating on parts of this test case in order to reduce its brightness. The brightest parts of the satellites are the white phased array antennas on the bottom, the white parabolic antennas on the sides, and the white backing of the solar array. For DarkSat, engineers had darkened the phase array and parabolic antennas. Surprisingly, the solar panels don't present as much of a problem. They do glint in the sunlight, but for the vast majority of the time that glint is facing a direction other than down.

Ultimately, studies showed that the paint job did not do enough to reduce the satellite's brightness, and it caused thermal problems to boot.



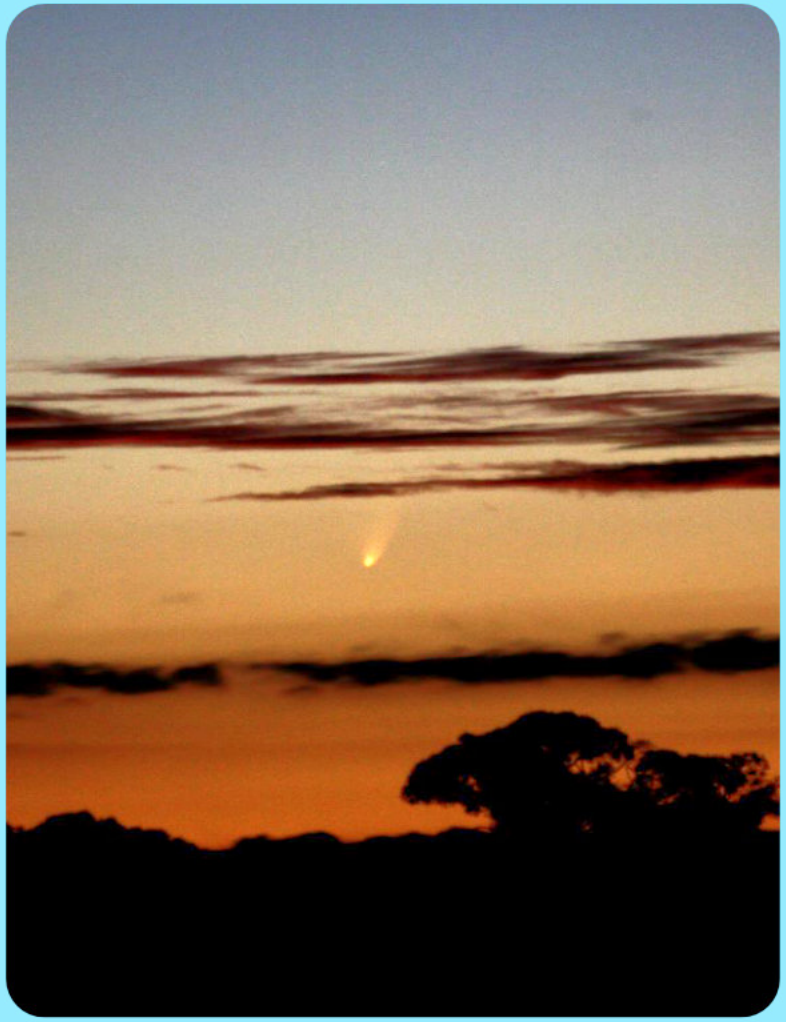
SpaceX hopes to do better with its plan for a Sun visor (Visorsat). The visor provides the benefit of black paint by blocking sunlight from all of the white parts of the main body, as well as the antennas, while avoiding the thermal balance problems. The first VisorSat was launched in May, and is on all satellites onboard the Starlink9 mission.

SpaceX has also said that, in addition to providing orbital elements to help astronomers (and others) track its satellites, it's also now providing predictive data ahead of launch. "While it will not be possible to create satellites that are invisible to the most advanced optical equipment on Earth," the document reads, "by reducing the brightness of the satellites, we can make the existing strategies for dealing with similar issues, such as frame-stacking, dramatically more effective."

We will wait and see!

Compiled from SpaceX data and comments from various magazines and websites - Tony Law

A Guide to Visual Comet Observing



A guide to the methods of observing and reporting your visual Comet observations.

Measuring a Comet

There is a way to monitor a Comet's behaviour by studying its light curve. To produce a light curve we must measure it's brightness but to do this we need to follow a few simple steps:

1) Determine angular size of the Coma
2) Determine the Coma's "Degree of Condensation"
3) Determine the "Total (visual) magnitude" by carefully selecting one of three 'extra-focal' methods and interpolate the magnitude using suitable comparison stars from a prepared chart.

Visually a comet will appear as a diffuse round blob of light increasing in intensity to a peak brightening of the coma centre. The integrated brightness of a Comet is referred to as the 'm1' or 'Total (Visual) Magnitude'. This is how we monitor the overall activity status of the comet and we can help identify changes in the morphology of a comet during its apparition, and continue the data legacy for returning comets.

Instrumentation

Use an aperture and magnification of the lowest power possible which allows a comfortable view of the comet, using telescopes, binoculars or naked eye depending on the brightness and diffuseness of the Comet. Use eyepieces of good quality with the least amount of optical elements (i.e.: Plössl, Orthoscopic) Magnifications which are too high will produce fainter magnitude estimates (due to Instrument / Eye effects), approximately x5 magnification per inch of aperture is a good starting point.

Aperture (mm)	Limiting Magnitude
50	8.0
80	9.5
150	11.0
200	12.0
300	13.5
400	14.5

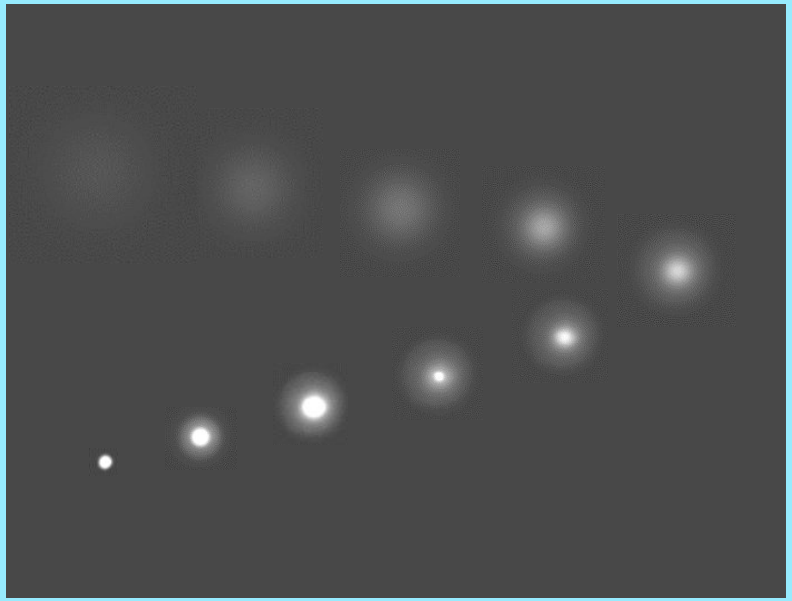
Table courtesy M. McKenna www.nightkskyhunter.com (approximation only)

Coma Size

The easiest way is to compare the coma to spacing of a pair of stars on your chart and use your software measuring tool or scale to determine the diameter. Make sure you are measuring across the coma which is perpendicular to the radius vector (or tail) and not including any part of the tail if possible.

"Degree of Condensation"

The "Degree of Condensation" (DC) relates to the brightness profile across the coma. A DC of 0 is a totally diffuse and featureless coma, if there is a definite brightening to centre a DC of 3 is given. If there is a stellar pseudo-nucleus visible, no matter how faint, a DC of 6 is given. DC's of 6 and higher define a central condensation that is stellar but with varying amounts of outer coma visible, a DC of 9 is a disc-like or stellar coma.



Magnitudes depend on the surface brightness and size of the comet, a comet which appears to be bright may be spread out over such a large area making it appear very dim. Coma size and D.C. play an important role in magnitude determination.

Magnitude Estimation Methods

These methods are like a 'sliding scale' of a single extra-focal method. The eye as a detector requires a minimum contrast gradient above the background sky level for a comet to be noticed. It is essential that magnifications and the amount of defocusing be kept minimal to maximise the visibility of the coma and consistency of the magnitude measurements.

"In – Out" or VSS method (S)

(Vsekhsvyatskij – Steavenson -Sidgwick)

For DC of 0 to 3:

- Memorise brightness & size of the "In-focus" coma
- Defocus stars to diameter of the "In-focus" comet
- Interpolate magnitudes with comparison stars of varying brightness

"Out-Out" or VBM method (B)

(Van Biesbroeck – Bobrovnikoff – Meisel)

For DC of 7 to 9:

- Compare brightness of "Out-of-focus" comet to "Out-of-focus" stars using the same amount of defocusing
- Interpolate magnitude
- Suitable for highly condensed comets with small comae, direct comparisons can be made in the same Field of View.

*For faint and highly condensed comets with a DC of 9, it is possible to compare the in-focus coma to that of an in-focus star, the method carries the ICQ code (I)

"Modified-Out" or "Morris" method (M)

For DC of 3 to 7

- Defocus comet until brightness gradient across coma diameter is smooth
- Memorise diameter and brightness of defocused coma
- Compare with stars defocused to same diameter of out-of-focus comet
- Interpolate magnitude

Some Tips to Remember

Always use 'Averted Vision' when observing Comets

Use lowest power/instrument combination possible which clearly renders the Comet visible in a comfortable manner for the observer

Avoid bright background stars or crowded fields where possible

Try to avoid Moonlit nights unless absolutely necessary

Try to avoid artificial light pollution where possible

*Comet designations (i.e.: C/2012 F6 Lemmon) are prefixed with a C/ for long period comets (>30 & >200 yr.) or a P/ for periodic comets awaiting return (<30 yr.); a "P" designation is given after the number for comets that have been seen on at least 2 returns, the number denotes the order of designation (i.e.: 29P =29th comet determined to be periodic). The C/ or P/ is followed by the year of discovery, then the half-month which is given a letter (I is not used) and number the order of discovery in that half-month followed by the discoverer or survey (i.e.: C/2012 F6 Lemmon =Long period comet, discovered in 2012, in second half of March and is the sixth comet discovered in that half-month period).

Comparison Stars & Charts

To obtain reliable magnitudes you will need to rely on good star catalogue data. Tycho-2 stars are recommended up to mag 10.5, for stars between 10.5 to 16th mag recommended sources include APASS, TASS-4, ASAS-3, Henden etc. See link below for more info.

NEVER use quoted magnitudes for galactic or extragalactic objects

- Try to use 3 or more comparison stars
- Use comparison stars with a similar spectral type as our Sun and keep the colour index between 0.0 and 1.0.
- At altitudes of 20° or less select comparison stars at same altitude as the comet (otherwise atmospheric extinction corrections need to be applied)
- Do not use catalogues which only have stars brighter than the comet

Use recommended catalogue sources:

http://www.icq.eps.harvard.edu/ICQRec.html

Only use 'V' - filtered data for online catalogue sources. Apply 'Atmospheric Extinction' corrections when required:

http://www.icq.eps.harvard.edu/ICQExtinct.html

Report Your Observation

Reporting your observation will require you to at least note the following:

Comet designation and name;
Date and time of observation in UT YYYY/MM/DD.DD (Decimal days);
Your estimated m1 value;
Coma diameter (specify arc-mins or Deg);
DC value (0 to 9);
Aperture (in cm);

Instrument / Optical configuration and star catalogue source, See ICQ codes here:

http://www.icq.eps.harvard.edu/ICQKeys.html

Magnification used;
Focal ratio;
Observer name and location (Name/City/Country). Method used (S,B,M or I);

Star catalogue source code:

http://www.icq.eps.harvard.edu/ICQRec.html

You can also give a description including any details of a visible tail. Tail measurements should include length specified in Degrees or Arc-Minutes, and position angle as measured from North through East.

Send your observations to:

International Comet Quarterly:
icqcsc@eps.harvard.edu
COBS*: www.cobs.si
CometBase*: http://195.209.248.207/
*These databases have online forms for you to fill in or you can submit your observation in ICQ 80 column single line format. See the link below for information on the 80 column format:

http://www.icq.eps.harvard.edu/ICQFormat.html

*For observers new to COBS or CometBase you will need to sign up to the relevant sites. You will be then provided with an observer code which you will use for your observations in the 80 column format.

back to basics

NOEL "richard stargard' SHARPE

The Stargard Files

The society is very fortunate to have two great observing fields to be enjoyed by our financial members. Namely, the first is our dark sky site at "The Forest". It's a log cabin on a couple of acres situated in the Belanglo forest. The cabin belongs to Sydney University's International House group. Then, we have what we call "Stargard", a general-purpose field at The Oaks, about 15 minutes west of Camden. Stargard is an unusual name with quite a story behind it. To keep things in context, there's a timeline as to why we call it Stargard, and this will be revealed in later articles.

In this article I am writing about the journeys of the M.A.S. in their search for the ideal observing field - more akin to the search for the Holy Grail. When the society was in its infancy it became apparent that we needed three main objectives to be accomplished. A place to meet, a place to observe the night sky and someone who knew what there were doing to talk to us at our meetings.

We would be doing things a bit tough if we couldn't get these things up and running, but we had a bugger of a time finding a regular observing site. With this in mind, I donned King Arthur's armour and it became my quest to find us the Holy Grail - our own observing field. It would be one with 'a shrubbery' (Google it, any non-Monty Python philistines - Ed) or maybe two, and 'a path for a two-level effect' (again - Ed). It does sound simple BUT, in reality, it would be easier to 'cut down a tree with herring', again my apologies to our intrepid Monty Python fans.

So, I remember one of our early members had a property at Wilton and she was kind enough to let us use a level area adjacent to her house. We held the society's inaugural Star Night there, and it was on Friday 22nd March, 1996. It was a kind gesture, and we subsequently enjoyed many nights there. We could drive in close and set up, and even had the odd camp-out. Our president Phil called it "Camp Constellation"! However, using someone's backyard wasn't ideal, and several garden gnomes made the ultimate sacrifice. Many great memories were made there, but unfortunately our generous member moved away and we were again on the lookout for greener pastures.

We did manage to observe a couple of times at properties in Oakdale, and even grabbed some amazing views through a cracking 25-inch reflector at Yanderra. We enjoyed the a few collaborations observing-wise with the Wollongong Amateur Astronomical Club and, of course, some Macquarie University's nights. I remember once we thought we found a place, but the well-meaning owner of the property was quoted as saying "You guys can't bring your cars in here". It was a long haul with the gear to set up that night. We needed a regular gig.

An opportunity did come up to observe with another astronomical society, on an old abandoned airstrip at Bargo. We were very grateful, and met there many times, and the night sky was crisp and dark. Sometimes, when the local pub closed, we would see some visitors exhibiting their fine motor skills in hotted up cars by providing us with donuts (yum) and then they would keep us warm by lighting bonfires. Ah... the good old days.

Soon it was time to continue the quest for the Holy Grail of observing sites. We desperately needed a place to call home - one that was safe, secure and private, easily accessible, permission to use, no direct light intrusion, manageable sky glow, not too far away, not prone to fog, protected from farmyard animals, extended horizons and good mobile phone reception. See "easier to cut down that tree with that herring", but we were not finished yet!

More next time...

Richard Stargard

the domes

ROGER POWELL

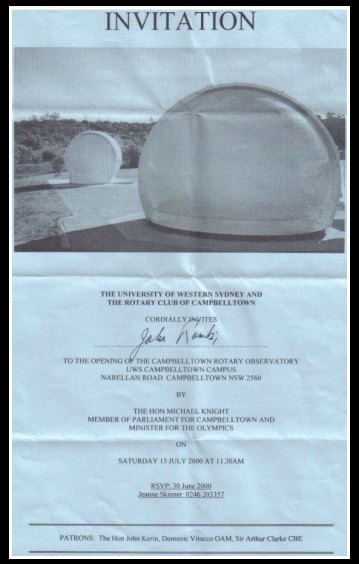
Twenty Years of The Domes

We cannot hold any of our popular public nights at The Domes this year - for health reasons - but we haven't forgotten its twentieth birthday - it's this month!

Campbelltown Rotary Observatory was opened on 15th July 2000 by local MP and Minister for the Olympics, Michael Knight. One of the invitees in attendance was our current President, John Rombi.

The Observatory - owned by Western Sydney University - is located in the appropriately named Milky Way, Macarthur Heights, just behind the University.

It was founded by its Director, Dr Ragbir Bhathal and was constructed with considerable support from Campbelltown Rotary and other organisations.



INVITATION

THE UNIVERSITY OF WESTERN SYDNEY AND
THE ROTARY CLUB OF CAMPBELLTOWN

CORDIALLY INVITES

TO THE OPENING OF THE CAMPBELLTOWN ROTARY OBSERVATORY
UWS CAMPBELLTOWN CAMPUS
NARELLAN ROAD CAMPBELLTOWN NSW 2560

BY

THE HON MICHAEL KNIGHT
MEMBER OF PARLIAMENT FOR CAMPBELLTOWN AND
MINISTER FOR THE OLYMPICS

ON

SATURDAY 15 JULY 2000 AT 11.30AM

RSVP: 30 June 2000
Jeanne Skinner 0246 203357

PATRONS: The Hon John Kerin, Domenic Vitocco OAM, Sir Arthur Clarke CBE

Hopefully, MAS may get back to holding some public nights at The Domes again next year!

my first telescope

STEWART GRAINGER

My first telescope is not a "was", but rather an "is still", a Pentax 40mm refractor and this is the story of how I came about to own it.

Growing up in the sixties, I was in awe of the space program. The Gemini program was so exciting to see especially with the coloured images of space craft rendezvousing in orbit, even today when I see those images I'm reminded of how I felt back then. I knew the in's and out's of each flight, and had a model of the Gemini craft.

So, my chosen career paths were going to be:

1: Astronaut

2: Geologist

3: Scientist (of some sort...)

Clearly, none of these came to pass.

So, with a solid interest in manned spaceflight and the upcoming Moon flights I thought it only fitting that I should have a look at what was out there (Star Trek also has a lot to answer for, I also had a model of the USS Enterprise) and for Christmas of 1967, when asked what I wanted the reply was...

... a TELESCOPE!!!!.

Also on my wish list was a chemistry set, but my mother had seen too many TV shows where the child had blown up their chemistry set so that was out...not that you could have blown anything with what those sets contained and besides, the worst thing that ever happened was singed eyebrows and a soot covered face on the hapless child.

Now, I have to state here that I had no idea how much these things cost, but probably weren't cheap. I mean, I was 10 years old, so there's my mother, recently widowed and me asking for something expensive.

It's at this point, dear reader, that I have to take a break from the main story to give you all a bit of a back-story that is entirely relevant.

I grew up in the Sydney suburb of Hurstville where my father was a photographer and had a photographic business. Ten years prior to my request for a telescope he had quite an innovative same-day film developing processing which, as you can see, was not the norm for mid 50's, well...anywhere.

This same-day process involved my mother leaving the house in the morning then catching a series of connecting buses from our home to Kingsgrove, then to Bexley, Rockdale and back to Hurstville. This was to pick up undeveloped film dropped off at a number of chemist shops by the morning commuters for my father to process through the day.

In the afternoon the same trip was made so those same commuters could pick up their newly developed photos on the way home from work. One of those chemist shops was run by Mr Bruce Geddes of Geddes Pharmacy in Kingsgrove.

Meanwhile, back in the 60's...

Unbeknownst to me, my dear Mum was out shopping one day, and saw in the window of Geddes Pharmacy... a telescope.

Upon going inside, a conversation apparently took place between Mum and Mr Geddes (this is assumption on my part based on what I was told later) with the end result Mr Geddes giving the telescope to Mum because of the previous business dealings with my dad, and knowing of Mum's

current situation... and it had been in the window for quite a while with nobody wishing to buy it.

When I was told about what Mr Geddes had

my first telescope

done you would think that I would have gone to his shop to thank him but no, I was totally oblivious to such things. Now, I cannot thank him enough for his kindness and generosity. Thank you, Mr Geddes.

And so it came to pass that on Christmas Day 1967. I became the owner of the aforementioned telescope.

As you all know, Christmas Day in Australia is in the middle of summer, so the days are long... and when you have a brand-new telescope and you want it to be night it only made the day longer.

But, when nightfall finally arrived I promptly set up a small table on our verandah, placed the telescope on top, looked through the eyepiece at the first bright object I could see which happened to be a star of some sort and not knowing what to expect (well, I expected to see a planet or something) and I saw a planet!

It was massive! It filled the entire eyepiece!

But it was a bit blurry, so I moved the focuser slowly in, the planet became clearer and a bit smaller until I could see in perfect clarity... that same star but slightly larger that naked eye.

Well... wasn't I disappointed?

However, my spirit was damped only slightly because when I looked at the Moon I was awestruck. Seeing the mountain ranges and craters was just astounding.

My favourite thing to look at on the Moon (and still is) is the terminator line. Looking at the shadows cast, the jagged edges made me feel like I was up there. I couldn't say how many hours I spent looking though that eyepiece.

Eventually, curiosity took hold and I wondered how this thing worked. So, I pulled it apart - the tube ends, the focuser, all the internals of the focuser, the lot.

Today I'm not even sure the focuser lenses were ever reassembled in the correct order but it still worked.

With the end of the Apollo missions my interest began to wane. I had started work by the mid 70's and other interests took hold - like cars and girls, but I still kept the telescope.

It moved wherever I did, even if I didn't use it.

By the early 90's I had moved to Bradbury. I was married and had children by this time but the telescope was still in my possession.

I'd look up at the night sky and think I should do something about finding out about all this.

I had discovered a column in a local paper that pointed out various star gazing moments which I took advantage of. My interest in astronomy was starting to reignite!!

I took out my old telescope and discovered I could easily see Jupiter and some of its moons and Saturn. I was impressed that my old Pentax had more bang than I ever gave it credit for.

I've since graduated to a 10" Dob as well as a 100mm refractor (which will be getting paid forward) and, since joining Macastro 15 years ago, I'm very grateful to all the help I've received from the other members.

The Pentax is mostly a display item now. I still have the original box too, which is slowly deteriorating and I do bring it out on occasion, like for the world record-breaking observing session a few years ago.

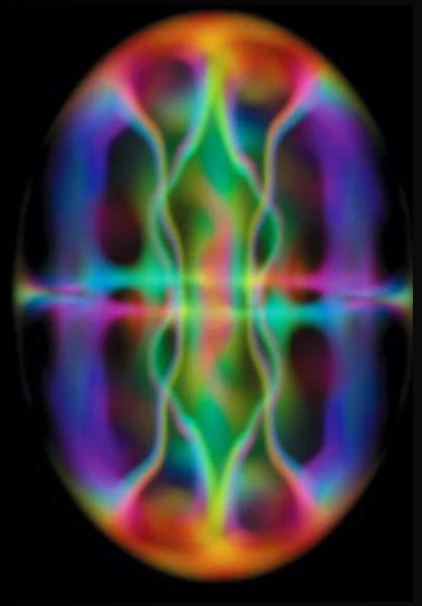
This story was supposed to be about my first telescope and it is but I cannot let this moment go without highlighting two people that stand out for getting me started in astronomy and getting me back into it.

One I have already mentioned is Bruce Geddes. The other is the man who wrote that newspaper column which re-kindled my interest in astronomy.... someone I'll always be thankful for.

That man is **Bob Bee**.

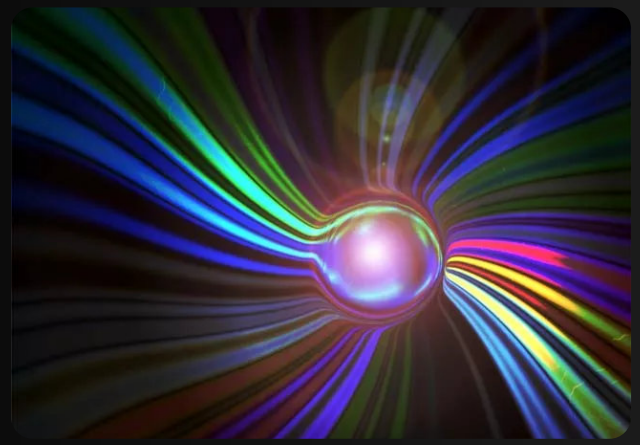
the fifth state

TONY LAW



This information garnered from various papers and articles - Tony Law

The Fifth State of Matter (Bose-Einstein Condensates) - Theory & Discovery.



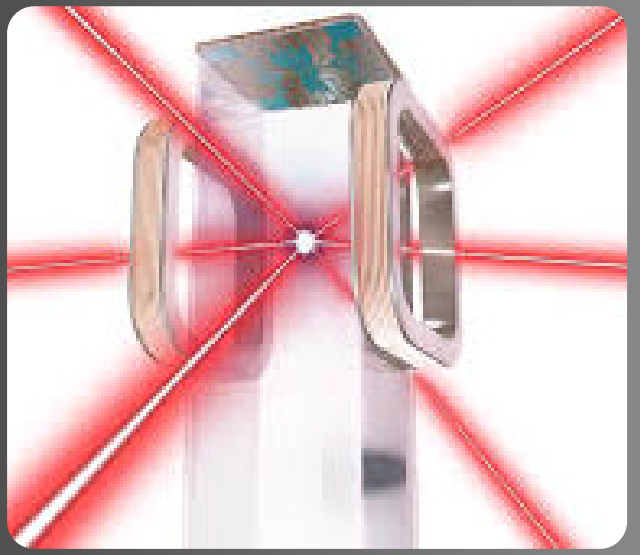
(Image - An illustration of a "super-photon" (BEC) © Jan Klaers, University of Bonn)

Bose-Einstein condensates were first predicted theoretically by Satyendra Nath Bose (1894-1974), an Indian physicist who also discovered the subatomic particle named for him, the boson. Bose was working on statistical problems in quantum mechanics, and sent his ideas to Albert Einstein. Einstein thought them important enough to get them published. As importantly, Einstein saw that Bose's mathematics — later known as Bose-Einstein statistics — could be applied to atoms as well as light.

What the two found was that ordinarily, atoms have to have certain energies — in fact one of the fundamentals of quantum mechanics is that the energy of an atom or other subatomic particle can't be arbitrary. This is why electrons, for example, have discrete "orbitals" that they have to occupy, and why they give off photons of specific wavelengths when they drop from one orbital, or energy level, to another. But cool the atoms to within billionths of a degree of absolute zero and some atoms begin to fall into the same energy level, becoming indistinguishable. That's why the atoms in a Bose-Einstein condensate behave like "super atoms." When one tries to measure where they are, instead of seeing discrete atoms one sees more of a fuzzy ball.

Other states of matter (solid, liquid, gas, plasma) all follow the Pauli Exclusion Principle, named for physicist Wolfgang Pauli. Pauli (1900-1958) was an Austrian-born Swiss and American theoretical physicist and one of the pioneers of quantum physics.It says that fermions — the kinds of particles that make up matter — can't be in identical quantum states. This is why when two electrons are in the same orbital, their spins have to be opposite so they add up to zero. That in turn is one reason why chemistry works the way it does and one reason atoms can't occupy the same space at the same time. Bose-Einstein condensates (BEC's) break that rule.

Though the theory said such states of matter should exist, it wasn't until 1995 that Eric A. Cornell and Carl E. Wieman, both of the Joint Institute for Lab Astrophysics (JILA) in Boulder, Colorado, and Wolfgang Ketterle, of the Massachusetts Institute of Technology, managed to make one, for which they earned the 2001 Nobel Prize in Physics.



To make a BEC, you start with a cloud of diffuse gas. Many experiments start with atoms of rubidium (Rb). Then you cool it with lasers, using the beams to take energy away from the atoms. (See Image BEC 2 above) After that, to cool them further, scientists use evaporative cooling. "With a BEC, you start from a disordered state, where kinetic energy is greater than potential energy," said Xuedong Hu, a professor of physics at the University at Buffalo. "You cool it down, but it doesn't form a lattice like a solid." Instead, the atoms fall into the same quantum states, and can't be distinguished from one another. At that point the atoms start obeying what are called Bose-Einstein statistics, which are usually applied to particles you can't tell apart, such as photons.

Enter the ISS!

the fifth state

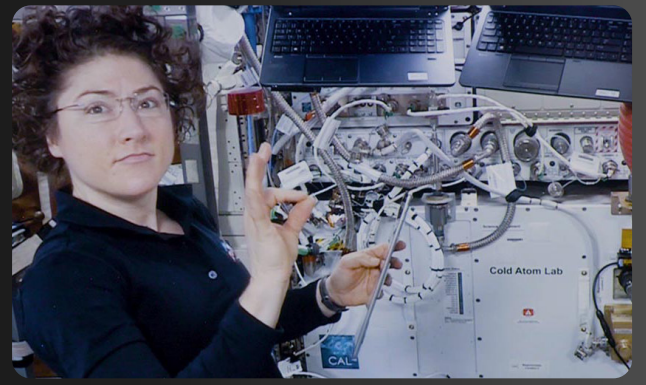
TONY LAW

^ ^ ^ (Image: The Cold Atom Lab instrument sitting on a desk!)

(Image: Kristina Koch on board ISS) > > >
Credit: NASA/JPL-Caltech/Tyler Winn

The Cold Atom Laboratory (CAL) was launched to the ISS in 2018 to investigate Bose-Einstein condensate (BEC) in microgravity. NASA sent the Cold Atom Laboratory (CAL), shown in the figure, to the International Space Station in 2018. Remotely operating CAL from NASA's Jet Propulsion Laboratory, David Aveline and colleagues have now produced rubidium Bose Einstein condensates in orbit. Their measurements show the equipment's successful operation and demonstrate the benefits of microgravity.

Remotely operating CAL from NASA's Jet Propulsion Laboratory, David Aveline and colleagues have now produced rubidium Bose–Einstein condensates in orbit. Without Earth's gravity, the cloud of Rb atoms reached such a low temperature that once it was released, it persisted in the instrument's observation region for more than a second. For comparison, when CAL was tested before launch, the cloud lasted only about 40 ms. The researchers also observed an unexpected difference: The cloud contained nearly three times as many Rb atoms as it did when CAL was tested before launch, and nearly half of those atoms were in a state that barely responds to magnetic fields. On Earth, gravity would have



pulled those particles out of the trap during cooling. But in space, the trap held them in a weak orbit around the denser condensate.

The newly confined atoms' insensitivity to magnetic fields may make them well suited for high-precision spectroscopy, one of the areas of research CAL is meant to advance. The researchers also predict that those atoms will have a uniquely flat density profile when confined in a three-dimensional trap, which would make them useful for studying phases of quantum matter under homogeneous conditions. The experiments expand the scope of the research community's plans for CAL. New trap geometries permitted by microgravity, such as bubble shells, are already being investigated, as are advanced cooling techniques for precision atom interferometry. Other planned experiments include studying quantum gas mixtures and probing yet-untested density and temperature regimes. (D. C. Aveline et al., Nature 582, 193, 2020.)

"This is pretty remarkable because this gives you a macroscopic-sized quantum mechanical object," says Maike Lachmann at Leibniz University Hannover in Germany. BECs have been produced in a variety of experiments on Earth since 1995, but these are hindered by gravity, which collapses the clouds in a split second. The microgravity environment of the ISS keeps them stable for multiple seconds, allowing them to be studied in more detail. In the near future, the researchers hope to use the experiment to watch atoms collide on a quantum level. They also want to probe ripples in space-time called gravitational waves by monitoring disturbances in the movement of the atoms.

Looking further ahead, the experiment could also tackle ideas like Einstein's equivalence principle, which says that all masses in a given gravitational field accelerate in the same way. Tests in microgravity could reveal whether there are any violations of the principle. "It's usually unwise to bet against Einstein," says Thompson. "But it's always important to test these things."

Article - A Cosmic Mystery: ESO Telescope Captures the Disappearance of a Massive Star

Using the European Southern Observatory's Very Large Telescope (VLT), astronomers have discovered the absence of an unstable massive star in a dwarf galaxy. Scientists think this could indicate that the star became less bright and partially obscured by dust. An alternative explanation is that the star collapsed into a black hole without producing a supernova. "If true," says team leader and PhD student Andrew Allan of Trinity College Dublin, Ireland, "this would be the first direct detection of such a monster star ending its life in this manner."

Between 2001 and 2011, various teams of astronomers studied the mysterious massive star, located in the Kinman Dwarf galaxy, and their observations indicated it was in a late stage of its evolution. Allan and his collaborators in Ireland, Chile and the US wanted to find out more about how very massive stars end their lives, and the object in the Kinman Dwarf seemed like the perfect target. But when they pointed ESO's VLT to the distant galaxy in 2019, they could no longer find the telltale signatures of the star. "Instead, we were surprised to find out that the star had disappeared!" says Allan, who led a study of the star published today in Monthly Notices of the Royal Astronomical Society.

Located some 75 million light-years away in the constellation of Aquarius, the Kinman Dwarf galaxy is too far away for astronomers to see its individual stars, but they can detect the signatures of some of them. From 2001 to 2011, the light from the galaxy consistently showed evidence that it hosted a 'luminous blue variable' star some 2.5 million times brighter than the Sun. Stars of this type are unstable, showing occasional dramatic shifts in their spectra and brightness. Even with those shifts, luminous blue variables leave specific traces scientists can identify, but they were absent from the data the team collected in 2019, leaving them to wonder what had happened to the star. "It would be highly unusual for such a massive star to disappear without producing a bright supernova explosion," says Allan.

The group first turned the ESPRESSO instrument toward the star in August 2019, using the VLT's four 8-metre telescopes simultaneously. But they were unable to find the signs that previously pointed to the presence of the luminous star. A few months later, the group tried the X-shooter instrument, also on ESO's VLT, and again found no traces of the star.

"We may have detected one of the most massive stars of the local Universe going gently into the night," says team-member Jose Groh, also of Trinity College Dublin. "Our discovery would not have been made without using the powerful ESO 8-metre telescopes, their unique instrumentation, and the prompt access to those capabilities following the recent agreement of Ireland to join ESO." Ireland became an ESO member state in September 2018.

The team then turned to older data collected using X-shooter and the UVES instrument on ESO's VLT, located in the Chilean Atacama Desert, and telescopes elsewhere."The ESO Science Archive Facility enabled us to find and use data of the same object obtained in 2002 and 2009," says Andrea Mehner, a staff astronomer at ESO in Chile who participated in the study. "The comparison of the 2002 high-resolution UVES spectra with our observations obtained in 2019 with ESO's newest high-resolution spectrograph ESPRESSO was especially revealing, from both an astronomical and an instrumentation point of view."

The old data indicated that the star in the Kinman Dwarf could have been undergoing a strong outburst period that likely ended sometime after 2011. Luminous blue variable stars such as this one are prone to experiencing giant outbursts over the course of their life, causing the stars' rate of mass loss to spike and their luminosity to increase dramatically.

Based on their observations and models, the astronomers have suggested two explanations for the star's disappearance and lack of a supernova, related to this possible outburst. The outburst may have resulted in the luminous blue variable being transformed into a less luminous star, which could also be partly hidden by dust. Alternatively, the team says the star may have collapsed into a black hole, without producing a supernova explosion. This would be a rare event: our current understanding of how massive stars die points to most of them ending their lives in a supernova.

Future studies are needed to confirm what fate befell this star. Planned to begin operations in 2025, ESO's Extremely Large Telescope (ELT) will be capable of resolving stars in distant galaxies such as the Kinman Dwarf, helping to solve cosmic mysteries such as this one.

Source: ESO https://www.eso.org/public/news/eso2010/

astrophotography

Greg Bradford

Eta Carinae

astrophotography

Dave Manning

Centaurus A, cropped.

astrophotography

Mohammed Ali

MAS away missions

Chris Malikoff

VLT - Paranal
Atacama Desert
Chile

Astronauts and Mission Control at Spacefest VII

Front Row LtoR; Vance D Brand, Alan Bean, Fred Haise, Walt Cunningham, Rusty Schweikart, Dave Scott, Charlie Duke, Dee O'Hara, Michael Collins, Al Worden, Jim McDivitt, Jim Lovell, Dick Gordon, Gene Cernan

Middle Row LtoR: Chuck Dietrich, Rick Armstrong, Gerry Griffin, Sy Libergot, Jerry Ross, Don Thomas, Nicole Passonno Stott, Eileen Collins, Rhea Seddon, 'Dutch' von Ehrenfried, Glynn Lunney

Rear: Paul Weitz, 'Hoot' Gibson, Jack Lousma, Charlie Walker, Tony Law

European
Southern
Observatory

www.eso.org

The exceptional global conditions due to the Covid-19 pandemic have deeply affected science operations at ESO observatories, causing an unprecedented backlog of observations for high-priority programmes, including Large Programmes. ESO is studying a variety of measures to complete those programmes at the earliest possible time once operations are resumed, which may require the exceptional suspension of the Call for Proposals for Period 107 (April-October 2021). While the decision is not firm yet, researchers preparing or planning to submit proposals for Period 107 should take into account that such suspension is a real possibility.

The ongoing Covid-19 pandemic is having a strong impact on the ESO observatories, where science operations have been suspended since late March 2020. Unfortunately, this will lead to the loss of most if not all of the observing time allocated in Period 105 (April-September 2020). At the moment, ESO has planned a safe, progressive ramp-up of operations as soon as conditions allow, aiming to reduce the impact on those high-priority scheduled programmes whose targets will be still observable before the end of the period. It is already clear, however, that at best only a small fraction of the time committed will be available. Furthermore, at the present time it is not possible to guarantee that full science operations will have been resumed by the beginning of Period 106 (October 2020-March 2021).

The major loss of observing time caused by the pandemic has a particularly strong effect on observing time committed to high-priority programmes, creating a backlog of unprecedented volume. Given the visibility window of targets that could not be observed in Period 105, most of the backlog can be alleviated only at the expense of the time available in Period 107. Moreover, any backlog absorbed during Period 106 will be at the expense of the time that would normally have been available to newly approved programmes in that Period. This will add considerably to the pressure on the observing time in Period 107. In addition, delayed technical activities at the observatory, including the installation and upgrade of new instrumentation, will have to be re-scheduled in the coming months in time slots that would have been normally allocated to scientific observations.

ESO is conducting an exhaustive analysis of the situation considering the backlog, the time allocation in Period 106, the time required by technical activities at the Observatory, and an emerging, obvious conclusion is that the time available for new programmes in Period 107 will be at most a small fraction of the total science time available during the semester. While ESO is still working to estimate, as accurately as currently possible, the total amount of science time expected to be available in Period 107, the scenario to not issue a normal Call for Proposals for Period 107 is being seriously considered. This would be an unprecedented step in the history of ESO. It is clear that such a step cannot be taken without a careful assessment of its scientific impact on the ESO community. In particular this will require a plan to offer alternative submission channels, which ESO will develop in consultation with its governing bodies, with the ultimate goal of safeguarding access to the observing facilities for the execution of high-priority observations.

At the time of writing, all these aspects are being studied in depth and a decision will be made as soon as possible. In the meantime, researchers who are preparing or planning the submission of proposals in response to the next Call should be aware of the real possibility of suspension. ESO will inform its community promptly of further developments and decisions.

Feedback should be preferentially channeled through the members of the Users Committee: http://www.eso.org/public/about-eso/committees/uc/uc2020.html