Shoalhaven Astronomers Inc.
www.shoalhavenastronomers.asn.au

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Issue 3

Astro Flyer

MARCH 2022

Club News

From The President

Meetings

While attendance is a personal decision that takes account of your specific circumstances, as an association we are ensuring we all have the opportunity to meet if we so wish. Consequently we will continue to run face to face meetings at our usual venue. I am looking forward to seeing you all in person again so see you there!

Our next meeting is the 18 Mar 22 at 7:00pm for a start at 7:30pm. This will be a ***face to face*** meeting.

As always. we are always looking for people to step up and present something – if it's of interest to you it's a good bet it will be of interest to your fellow association members so don't hesitate – volunteer!

Observatory (see over next page)

Contents

MOON PHASES

New Moon	First Quarter	Full Moon	Last Quarter
Apr 1	Apr 9	start→Mar 18	Mar 25

Viewing Nights

VIEWING NIGHTS SUSPENDED UNTIL FURTHER NOTICE

Club viewing nights are selected to provide viewers with the best possible conditions for good viewing. They are held on specific Saturdays at different locations around Nowra.

More Club Information Including viewing site Directions Page 14

Cont...2

Observatory

The funding deed has been executed and we are awaiting transfer of funds. Negotiations with the University and progress towards Development Approval for construction are also progressing in parallel. Next step is to talk to the council and walk through our development application.

Do any of you have a good relationship with a licenced electrician who might be willing to do some pro bono work for us? The work would consist of:

- vetting our electrical design for safety and code compliance – it's a dead simple design so this task wouldn't be more than an hour or two of work.
- Wiring a simple switchboard and half a dozen Double General Power Outlets (DGPO). All necessary parts and supplies would be provided by us. Labour to physically mount conduits, outlets and the switchboard would also be provided by us so the labour content would be inspecting our work and doing the critical electrical connections. Should all be over in half a day…
- Providing an appropriate Certificate of Compliance so council will be happy.

In return we can offer:

- Free membership for as long as they want!
- Beer on the day! - after the work is complete of course…

This work would be done once the observatory structure is complete so likely to be July timeframe at the earliest.

Keep on watching! Mark Town

OUT THERE BY BOB TURNBULL
OBSERVATION OFFICER

MARCH-APRIL

Hi there all you hopeful members !!
What a difficult period for viewing but let us hope some luck will be possible if these constant and damaging rains easers off !

PLANETS
If we sneak out and look up to the Eastern sky around 5 am all five naked eye planets can be viewed. This early view time gets later as we continue into April as the Sun rises slightly more as the year progresses, so feast on this for starters

MERCURY
Starts 2.5 degrees above SATURN with a crescent Moon. So if you continue with this easterly rising in consecutive weeks a collect of proceeding planets will meet our eyes!
Follow the illustrations on page 39 until the other planets will show.
By the end of March the remaining planets will rise, including JUPITER

VENUS & NEPTUNE
These planets will be closest together during April 28th.

METEOR SHOWERS
See the Lyrids in April from the 16th to the 25th and maximum rates during the pre dawn hours from the 22nd to the 23rd.
The waning gibbous Moon may be an issue.

NOW FOR SOMETHING COMPLETELY DIFFERENT !!

Where do some stars disappear ???
THE MYSTERY OF THE MISSING STARS

Zoom in on the excellent article on page 42 !
THIS explains this mystery and upsets the publishers of sky maps (but their are plenty of objects left to see!)

IT WILL SURPRISE YOU AT THE 290,000 irregularities of 10 million objects!!

Good viewing
Bob Turnbull

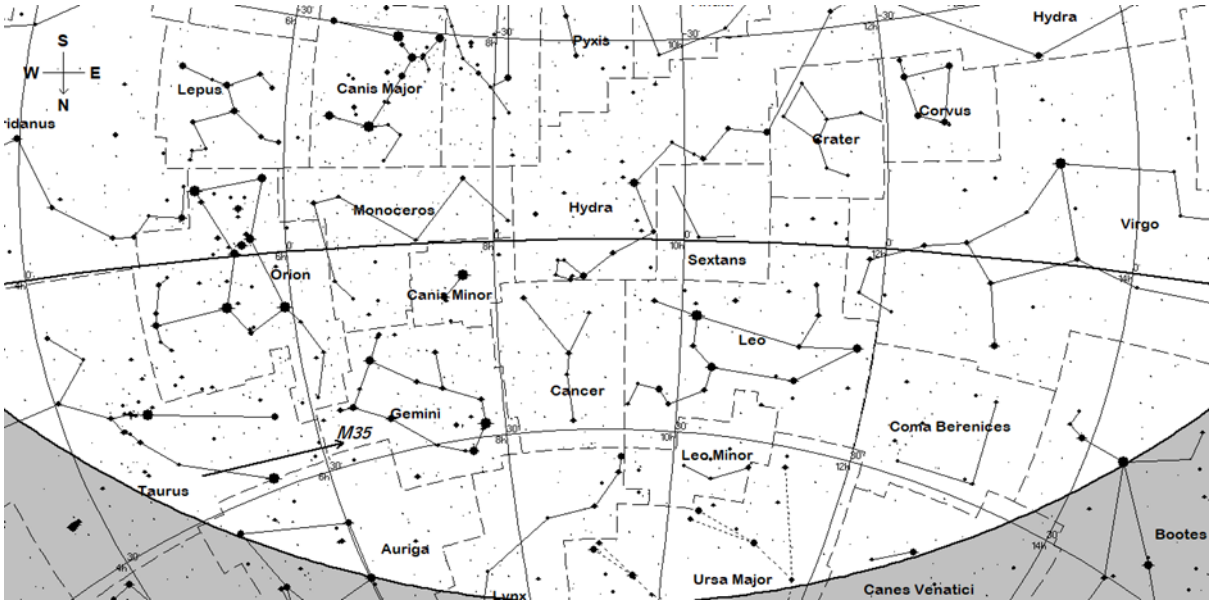
Charles Messier (1730-1817)

Messier of the Month

M 35 – Open Cluster in Gemini

Because the constellation Gemini is in the northern part of our sky and such objects only make brief appearances in our night sky, they tend to be neglected by southern viewers which is a shame because like our object for this month it not only is bright and easy to find but the open cluster contains two other noteworthy objects in the field, namely the oc NGC 2158 and the beautiful double star

M35. NGC2168. Shining at about mag. 5 this open cluster is the size of a full moon and is an easy binocular or small telescope object. It is about 3,000 ly away and it appears as chains of stars at the eyepiece at the feet of Gemini. One star chain runs through the centre of the cluster and the northern part is box-shaped. The much smaller and dimmer oc2158 lies about 26' SW in a low power field and is only 5' in diameter at magnitude 8.6, but lies a whopping 16,500 ly away and is estimated at about 10 times older than M35. The final treat in this field is the double star OΩ134. The double is at the end of a northern running chain. The primary stands out as a 7th magnitude orange star while the 9.1 companion star is a wide 31' distant, which make this gem an easy object in small telescopes. A worthwhile field to study under dark skies.



Astro Events from Frank Gross

Methuselah: The oldest star in the universe

By David Crookes published 1 day ago

How can a star be older than the universe?

The oldest star in the universe is HD140283 — or Methuselah as it's commonly known. This Digitized Sky Survey image shows Methuselah star, located 190.1 light-years away. Astronomers refined the star's age to about 14.3 billion years (which is older than the universe), plus or minus 800 million years. Image released March 7, 2013. (Image credit: Digitized Sky Survey (DSS), STScI/AURA, Palomar/Caltech, and UKSTU/AAO)

In 2000, scientists looked to date what they thought was the oldest star in the universe. They made observations via the European Space Agency's (ESA) Hipparcos satellite and estimated that HD140283 — or Methuselah as it's commonly known — was a staggering 16 billion years old.

Such a figure was rather baffling. After all, the age of the universe — determined from observations of the cosmic microwave background — is 13.8 billion years old, so how can a star be older than the universe?
"It was a serious discrepancy," says astronomer Howard Bond of Pennsylvania State University. So with that in mind, Bond and his colleagues set out to discover the truth and test the accuracy of the figure. Their conclusions were just as mind-blowing.

Astronomers began observing Methuselah — named in reference to a biblical patriarch who is said to have died aged 969, making him the longest-lived of all the figures in the Bible — more than 100 years ago. The curious star is located some 190 light-years away from Earth in the constellation Libra and it rapidly journeys across the sky at 800,000 mph (1.3 million kilometers per hour).

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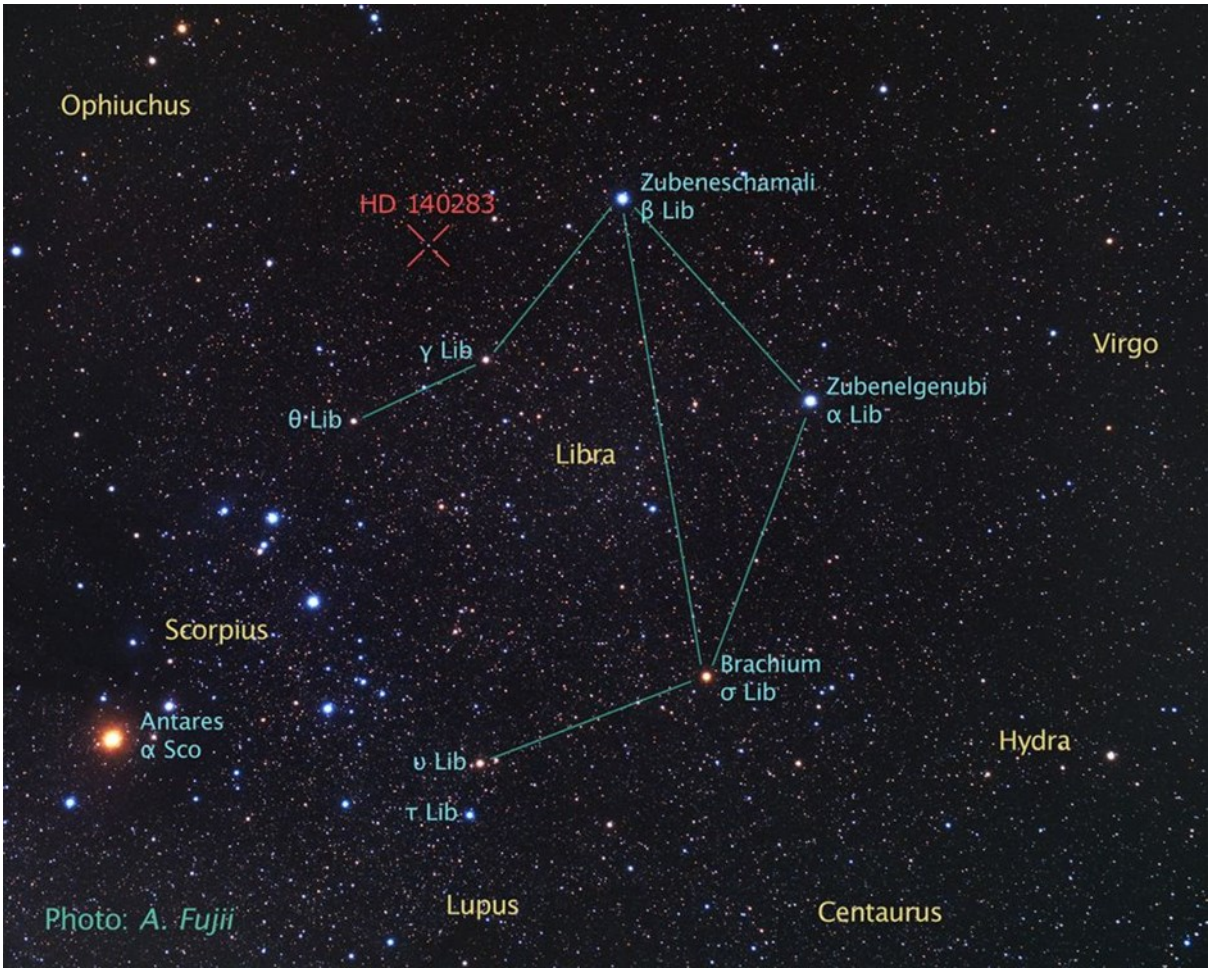
Fast Facts

– Methuselah covers the width of the moon in the night sky every 1,500 years.
– You can't see Methuselah with the naked eye. It can only be seen using a telescope
– It contains just 1/250th of the iron content of our sun

It was clear that the star was old. The metal-poor subgiant is predominantly made of hydrogen and helium and contains very little iron. Such composition meant the star must have come into being when helium and hydrogen dominated the universe and before iron became commonplace (the heavier elements only appeared when massive stars created them in their cores)

But could Methuselah really be more than two billion years older than its environment? Surely that is just not possible. Either the star was older than the universe or the universe was not as "young" as scientists thought it to be. Or maybe the dating was simply all wrong. What was it to be?



This is a backyard view of the sky surrounding the ancient Methuselah star, cataloged as HD 140283. Image released March 7, 2013. (Image credit: A. Fujii and Z. Levay (STScI))

A mystery of this magnitude could not be ignored so Bond and his colleagues attempted to unearth the truth by pouring over 11 sets of observations that had been recorded between 2003 and 2011.

Cont...3

These observations had been made by the Fine Guidance Sensors of the Hubble Space Telescope, which noted the positions, distances and energy output of stars. In acquiring parallax, spectroscopy and photometry measurements, the scientists could determine a better sense of age.

"One of the uncertainties with the age of HD 140283 was the precise distance of the star," Bond said. "It was important to get this right because we can better determine its luminosity and, from that, its age — the brighter the intrinsic luminosity, the younger the star.

"We were looking for the parallax effect, which meant we were viewing the star six months apart to look for the shift in its position due to the orbital motion of the Earth, which tells us the distance."
Bond adds that there were also uncertainties in the theoretical modeling of the stars, such as the exact rates of nuclear reactions in the core and the importance of elements diffusing downwards in the outer layers. So they worked on the idea that leftover helium diffuses deeper into the core, leaving less hydrogen to burn via nuclear fusion. With fuel used faster, the age is lowered.

"Another factor that was important was, of all things, the amount of oxygen in the star," Bond said. HD 140283 had a higher than predicted oxygen-to-iron ratio and, since oxygen was not abundant in the universe for a few million years, it pointed again to a lower age for the star.

As a result of all of this work, Bond and his collaborators estimated HD 140283's age to be 14.46 billion years. It was a significant reduction on the 16 billion previously claimed but it was still more than the age of the universe itself.
In that sense, it didn't clear up the mystery and, on the face of it, simply ensured Methuselah remained a curiosity. But the scientists posed a residual uncertainty of 800 million years, which Bond said made the star's age compatible with the age of the universe. It was a major breakthrough.

"Like all measured estimates, it is subject to both random and systematic error," said physicist Robert Matthews of Aston University in Birmingham, UK, who was not involved in the study. "The overlap in the error bars gives some indication of the probability of a clash with cosmological age determinations"
"In other words, the best-supported age of the star conflicts with that for the derived age of the universe [as determined by the cosmic microwave background], and the conflict can only be resolved by pushing the error bars to their extreme limits."

Further refinements saw the age of HD 140283 fall a bit more. A 2014 follow-up study, for instance, updated the star's age to 14.27 billion years. "Again, if one includes all sources of uncertainty — both in the observational measurements and the theoretical modeling — the error is about 700 or 800 million years, so there is no conflict because 13.8 billion years lies within the star's error bar," Bond said.

What's more, in May 2021, another group of astronomers revised the best estimates for the age and mass of Methuselah and, having modeled how stars change over time, they found its age to be 12 billion years. It still makes HD 140283 extremely old (the sun, by comparison, is only a kid at 4.6 billion years old) but it puts the age of the star well and truly within the age of the universe. Or does it?

On the one hand, Bond says the efforts to date Methuselah is "an amazing scientific achievement which provides very strong evidence for the Big Bang picture of the universe". By showing similarities between the age of the universe and that of this old nearby star, he says the problem with the age of the oldest stars is far less severe than it was in the 1990s when the stellar ages were approaching 18 billion years or, in one case, 20 billion years. "With the uncertainties of the determinations, the ages are now agreeing," Bond said.

Yet, on the other hand, Matthews believes the problem has not yet been resolved. Astronomers at an international conference of top cosmologists at the Kavli Institute for Theoretical Physics in Santa Barbara, California, in July 2019 were puzzled over studies that suggested different ages for the universe. They were looking at measurements of galaxies that are relatively nearby which suggest the universe is younger by hundreds of millions of years compared to the age determined by the cosmic microwave background.

Far from being 13.8 billion years old, as estimated by the European Planck space telescope's detailed measurements of cosmic radiation in 2013, the universe may be as young as 11.4 billion years. If that is, indeed, the case, then Methuselah is one again older than the universe. The plot, indeed, thickens, but how accurate are these re-estimates proving to be?

Cont...4

One of those behind the studies to date the universe is Nobel laureate Adam Riess of the Space Telescope Science Institute in Baltimore, Maryland.
The conclusions are based on the idea of an expanding universe, as shown in 1929 by Edwin Hubble. This is fundamental to the Big Bang — the understanding that there was once a state of hot denseness that exploded out, stretching space. It indicates a starting point that should be measurable, but fresh findings are suggesting that the expansion rate is around 10% higher than the one suggested by Planck.

Indeed, the Planck team determined that the expansion rate was 67.4 km per second per megaparsec, but more recent measurements taken of the expansion rate of the universe point to values of 73 or 74.
That means there is a difference between the measurement of how fast the universe is expanding today and the predictions of how fast it should be expanding based on the physics of the early universe, Riess said. It's leading to a reassessment of accepted theories while also showing there is still much to learn about dark matter and dark energy, which are thought to be behind this conundrum.

A higher value for the Hubble Constant indicates a shorter age for the universe. A constant of 67.74 km per second per megaparsec would lead to an age of 13.8 billion years, whereas one of 73, or even as high as 77 as some studies have shown, would indicate a universe age no greater than 12.7 billion years.
It's a mismatch that suggests, as stated, that HD 140283 could still be older than the universe. It has also since been superseded by a 2019 study published in the journal Science that proposed a Hubble Constant of 82.4 — suggesting that the universe's age is only 11.4 billion years. Astronomers are hoping the James Webb Space Telescope could shed light on this particular mystery.

Matthews believes the answers lie in greater cosmological refinement. "I suspect that the observational cosmologists have missed something that creates this paradox, rather than the stellar astrophysicists," he said, pointing to the measurements of the stars being perhaps more accurate.

"That's not because the cosmologists are in any way sloppier, but because the age determination of the universe is subject to more and arguably trickier observational and theoretical uncertainties than that of stars."
But what could be making the universe potentially appear younger than this particular star?

"There are two options, and the history of science suggests that in such cases the reality is a mix of both," Matthews said. "In this case that would be sources of observational error that haven't been fully understood, plus some gaps in the theory of the dynamics of the universe, such as the strength of dark energy, which has been the prime driver of the cosmic expansion for many billions of years now."

He suggests the possibility that the current "age paradox" reflects time variation in dark energy, and thus a change in the rate of acceleration — a possibility theorists have found might be compatible with ideas about the fundamental nature of gravity, such as the so-called causal set theory. New research into gravitational waves could help to resolve the paradox, Matthews said.

To do this, scientists would look at the ripples in the fabric of space and time created by pairs of dead stars, rather than relying on the cosmic microwave background or the monitoring of nearby objects such as Cepheid variables and supernovae to measure the Hubble Constant — the former resulting in the speed of 67 km per second per megaparsec and the latter in 73.
Trouble is, measuring gravitational waves is no easy task, given they were only directly detected for the first time in 2015. But according to Stephen Feeney, an astrophysicist at the Flatiron Institute in New York, a breakthrough could be made over the next decade. The idea is to collect data from collisions between pairs of neutron stars using the visible light these events emit to figure out the speed they are moving relative to Earth. It also entails analyzing the resulting gravitational waves for an idea of distance — both of which can combine to give a measurement of the Hubble Constant that should be the most accurate yet.

The mystery of the age of HD 140283 is leading to something bigger and more scientifically complex, altering the understanding of how the universe works.

"The most likely explanations for the paradox are some overlooked observational effect and/or something big missing from our understanding of the dynamics of the cosmic expansion," Matthews said. Precisely what that "something" is, is sure to keep astronomers challenged for some time.

Cont...5

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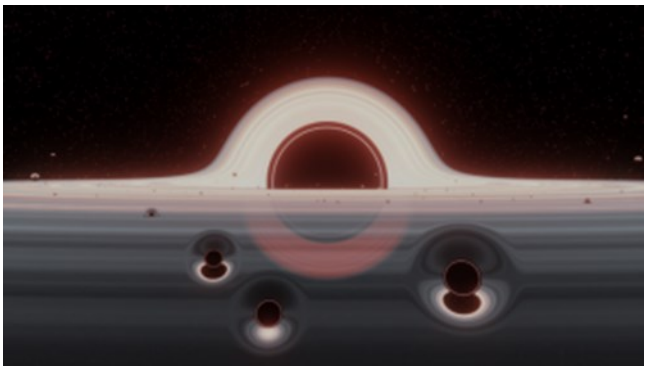
Around a monster black hole, smaller black holes collide in strange ways

By Meghan Bartels published 1 day ago

In this celestial "billiards" game, chaos reigns.



An artist's depiction of stellar black holes in the disk of a supermassive black hole. (Image credit: J. Samsing/Niels Bohr Institute)

Take three black holes and throw them into the disk surrounding a supermassive black hole and things get really weird, really fast.

That's the conclusion of new research digging into a particularly strange gravitational wave event that scientists observed in May 2019 and are still trying to understand. Gravitational waves are the ripples in space-time caused by, among other dramatic events, the mergers of black holes. But this particular observation didn't match other collisions scientists have caught: it resulted in a black hole in the mid-size range that scientists can barely see, much less explain, and some force was stretching the typically circular dance as the behemoths approached each other.

"The gravitational wave event GW190521 is the most surprising discovery to date. The black holes' masses and spins were already surprising, but even more surprising was that they appeared not to have a circular orbit leading up to the merger," Imre Bartos, a physicist at the University of Florida and co-author on the new research, said in a statement. (Astronomers name gravitational wave signals with the date they were observed, so GW190521 marks a gravitational wave detected on May 21, 2019.)

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PLAY SOUND

In the earliest analysis of the strange signal, scientists had already suspected that the merger occurred in a pocket of space rich with black holes. Astronomers know of two types of black holes. One, dubbed stellar black holes, form from dying stars and contain perhaps a dozen times the mass of our sun. Supermassive black holes, in contrast, hide at the center of some galaxies (including our Milky Way) and can contain millions of times the mass of their puny counterparts.

The result of the May 2019 merger appeared to be an intermediate black hole, a size category that ranges from perhaps 100 to 1,000 times the mass of our sun. Scientists had never yet managed to study and could not explain how such an object might form. In response to the detection, astronomers suggested that one of the colliding black holes was itself the result of a collision, pushing the final product into the mysterious intermediate range at 142 times the mass of the sun.

Cont...6

To get two sequential collisions, the astronomers first analyzing GW190521 proposed that the event occurred near what scientists call an active galactic nucleus — a particularly dynamic supermassive black hole anchoring a galaxy, where smaller black holes might proliferate.

The new research supports that suggestion, approaching the situation from a different angle.
These scientists wanted to understand how it was that the two black holes weren't actually circling each other as they collided — instead, their orbits were eccentric or elliptical, more ovals than circles. That, too, was strange: Astronomers thought that the massive gravitational forces involved when two black holes are colliding should have forced these two onto circular paths.

So physicists behind the new research set about modeling black hole collisions. And while their calculations suggested that three black holes at random were unlikely to result in an eccentric collision, something changed when they considered the environment of an active galactic nucleus.

This type of feature also hosts a disk of matter surrounding the supermassive black hole, like a much more massive model of the solar system. Where the solar system has planets, an active galactic nucleus has stellar black holes scattered throughout the disk in what the new research identifies as essentially a two-dimensional system.

Under those conditions, the probability of an eccentric merger in the models shot up — as much as 100 times, co-author Johan Samsing, an astrophysicist at the Niels Bohr Institute in Denmark, said in the statement. At that rate, perhaps half of mergers in the disks of active galactic nuclei would be eccentric rather than circular, making the exceptional observation of May 2019 much less surprising.

"In these environments, the typical velocity and density of black holes is so high that smaller black holes bounce around as in a giant game of billiards and wide circular binaries cannot exist," co-author Bence Kocsis, an astrophysicist at the University of Oxford in the United Kingdom said in the statement.

The researchers noted that the probability of eccentric mergers in their model varies with characteristics of the disk surrounding the supermassive black hole. Next up, they said, is spotting ever more black hole collisions to analyse.

Gems of the 'Southern Canon' by Harry Roberts

Jewel Box NGC4755

While probably the best known star cluster of the southern sky, the "Jewel Box" NGC4755, DUN301, was first recorded by Jamie Dunlop in his epoch making Catalogue, read before the *Royal Astronomical Society*, 1827, earning him their Gold Medal!

The Herschel Family (German Immigrants) were little-known musicians in 1781, when William discovers planet Uranus and instant fame! King George III, also German, and an amateur astronomer, makes him "Royal Astronomer at Windsor". They often spoke; the Herschels' were 'very well' at court!
James Dunlop, a Scottish technician, many felt to be a rather taciturn, 'low-bred' Scot, but one who had 'bagged' most of the astronomical wonders of the southern sky! He had even made a detailed sketch of the LMC, SMC, as well as the Jewel Box cluster and much more.

History. Dunlop was of a working class family, with an early interest in building lathes, lenses and reflectors. *"The ingenuity he displayed attracted the attention of his employers who discerned in him the dawning of a distinguished scientist"* (Service, J. 1890.)

Dunlop had been appointed by Brisbane to maintain the instruments he would establish at "Parramatta Observatory", NSW, and to assist Rumker (chief astronomer) in observing. Their task was to map southern stars – not to record "deep sky objects". The latter will become Dunlop's passion. However, Governor Brisbane soon clashes with Rumker, who 'quits', to live at "Stargard", near Picton. As both were professional 'warriors' this is hardly surprising!

Dunlop completes the star catalogue – and is then free to begin a 'private catalogue' of southern clusters and nebulae: The Dunlop Catalogue.

Over just seven months he locates, describes and at times sketches 629 southern objects as well as 253 double stars during full Moons! *Remarkable!* The catalogue was addressed to Brisbane (his patron) and after etching, was read to the Royal Astronomical Society by John Herschel. Dunlop is then awarded The RAS 'Gold Medal' by (Pres.) J. Herschel!

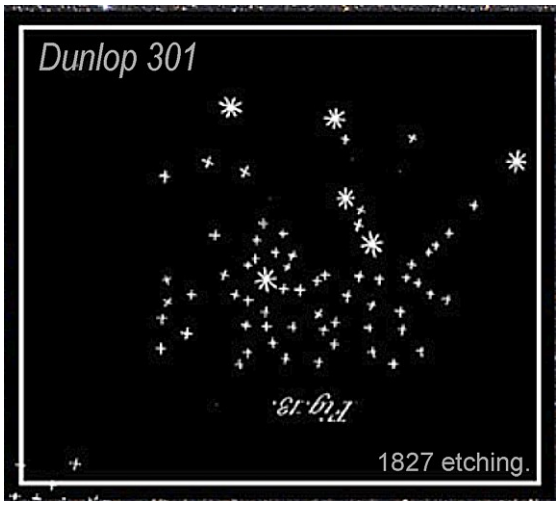
Dunlop now has *'primacy of discovery'* for most of the Southern Canonical objects!

In the 1840's, on return from his 4 yr stint at the Cape of Good Hope, John Herschel would "arrange" a campaign to discredit Dunlop's work! He now has positions and sketches made with specialised scopes at a 'proper' observatory, and wants to see the Dunlop Catalogue discredited! Anticipating this, I think, Dunlop had returned to live and work in NSW, back at Brisbane's Parramatta Observatory by 1831, on the then good salary of 300 Pounds a year!

Gems of the 'Southern Canon' by Harry Roberts

Cont...2

How good a draughtsman was 'Jamie' Dunlop? Pretty good it seems. Many etchings accompanied his 1826 paper and, when compared with 20C. B&W photos, are seen to be fairly accurate, as is his D301 sketch.



Dunlop's Telescope was a 9inch speculum reflector in his backyard about 1km from Brisbane's Observatory. At times he used it rather like a 19thC transit 'scope, with a brass quadrant to give altitude angles and ropes to control the scope's pointing. He had seven months to 'do' the entire southern sky! He recorded 629 objects, and sketched a few dozen, later made into etchings by the London publishers.
All objects were recorded as they briefly crossed his narrow FOV. He could not follow them in azimuth!

D301 in our eyepiece? He notes: "D301: 12h44m,SPD -30°35'.(Kappa Cru of Bode) is five stars of the 7th magnitude, forming a triangular figure, and a star of 9th mag between the second and the third, with a multitude of very small stars on the south side, Fig 13, is a very correct representation".

The rich star colours seen in modern scopes are not mentioned. His 9inch speculum is said to equal a modern 6 to 7inch reflector. Yet colours are seen in a 3inch 'mak'? His image is rotated to match the FOV in the 10inch.

Jewel Box sits within the 'Coalsack' dark nebula, as mapped by Dunlop and likely the most impressive compact star cluster in the whole Night Sky.

Clear Skies! *(Laughing!)*

Gems of the ‘Southern Canon’ by Harry Roberts

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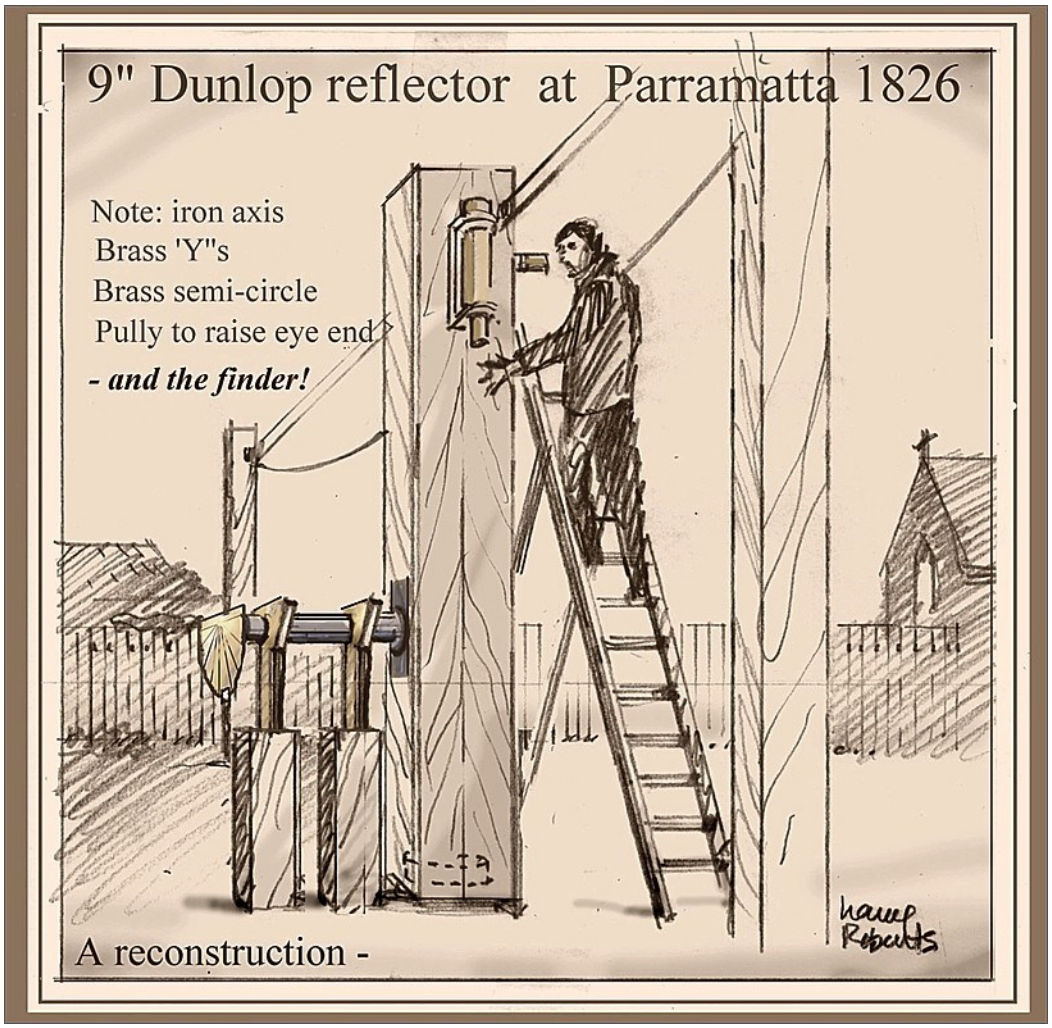

More Club News continued from page 1

Club/Social Viewing Nights

Club/Social Viewing Nights are on Saturday evenings "just" Before Sunset. Viewing nights are for members and invited guests. The contingency plan for poor weather on the proposed viewing night is to meet the next night (a Sunday night) .

Woncur Road, South Nowra (Head South down The Princes Highway, turn right at BTU Road, Woncur Road is the street first on the left).

University Viewing site. On the way to the university on George Evans Road go straight ahead through the second turning circle to the new viewing site.

Bring your scopes and or binoculars and a small folding chair, a decision on the day planned, depending on viewing conditions, by the club president and his deputy.

Email information if details are changed, to all, or contact Frank for changes.

Solar viewing BBQ lunches (BYO) may be held and these will be advised ahead of these events. Special events such as Comets, eclipses etc. may also warrant members night viewings.

The AGM was held at the July 2019 monthly meeting. Elected officials for 2019- 2021

The 2021 AGM has been postponed due to Covid.

President: Mark Town
Vice President: John Gould
Secretary/Treasurer: Frank Gross
Public Officer; Frank Gross
Observation Officer: Robert Turnbull
Editor: Kaye Johnston
Librarian: Chris O'Hanlon

The Committee: Robert Turnbull, Rudolf Henssen, Robert Spruyt, Chris O'Hanlon, John Gould, Ernest Royston, Anthony Peters

Check out the Astro Flyer on the web site: www.shoalhavenastronomers.asn.au

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The deadline for Articles for the Astro Flyer is The First Friday of the Month.

Editor Kaye Johnston

Club Video Projector Rental

The Video Projector is available for club members for a small rental fee. If a club member would like to project a football game, cricket game onto a wall for a party this is the way to go. You will get up to a 100 inch diagonal picture on a light coloured wall with the Epson video projector. The projector has an inbuilt speaker but you can add your own speaker units if necessary. The unit s very easy to use and instruction would be given before the borrowing (2 days) occurs. The rental price is set at present at $15 for two days.