



Reflections

Journal of the Northern Sydney Astronomical Society Inc.

September 2019

President's Message

Australia gets its first Dark Sky Reserve. It is pleasing to see the interest in protecting the dark skies of Australia is growing and that the number of parks getting recognised around the world is increasing.

Recently, an area around Swan Reach, 100km north-east of Adelaide, was recognised by the International Dark Sky Association as Australia's first Dark Sky Reserve.

Being close to Adelaide, it is accessible to a large population with the purposeful inclusion of many local communities who live in the area.

The River Murray Dark Sky Reserve (RMDSR) (<https://www.rivermurraydarkskyreserve.org/>) is a large area of 3200 km² that contains a number of parks and conservations areas that were first set aside as nature reserves in the 1970s.

These have been brought together and now form part of the RMDSR which enjoys the additional status as being Australia's first dark sky reserve.

It took two years of work by many organisations including councils, LandCare, astronomy and tourism associations and federal government bodies to put together the submission that ran to 470 pages. This included over 70 letters of support from a diverse range of people, including the Chief Scientist of SA, the Premier and Leader of the Opposition, Prof. Brian Schmidt (Nobel Prize winner) and Prof. Fred Watson.

More importantly support also came from local shop owners, tour operators, progress associations, sports clubs, wildlife researchers, local farmers and school children.

It is interesting to note that the RMDSR, and the planned Urban Night Sky Park (UNSP) in Palm Beach are reasonably close to major capital cities.

Another dark sky reserve in Germany, Westhavelland Nature Park, was designated in 2014 and is only 70km from Berlin. It shows that dark skies can

be achieved reasonably close to large populations with the correct community support, governmental consideration and planning.

In support of the planned application for the Urban Night Sky Park at Palm Beach, Greg McCall reconnoitred the area to select a location to gather night sky measurements on an ongoing basis.

Phil Angille, our representative on the working committee with Northern Beaches Council, has built a light-measuring meter that is currently undergoing calibration and hence we hope to begin data collection in the coming months.

In Australia, the Australasian Dark Sky Alliance (ADSA) was formed to create an Australian focus for this community interest and to enable on the ground support. I encourage you to get involved as the recent applications show, community support and councils are a core component of the change that needs to take place to protect our night sky.

Writing or talking to your local council will help spread the message. There are many resources available on the Internet if you wish to research or understand this some more.

Use the links below as I have found them very informative, or google "health effects from Light Pollution".

- <https://www.globeatnight.org/light-pollution.php>
- <https://www.darksky.org/our-work/lighting/lighting-for-citizens/lighting-basics/>
- http://www.adelaideobservatory.org/darkskysa/goodbad_lighting.html

- <https://www.earthlawcenter.org/blog-entries/2019/7/dark-sky-reserve-networks-usher-in-earth-law>

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If you really wish to understand it in more detail then the following guides are quite extensive and very informative. Put aside an hour or two!

- https://www.darksky.org/wp-content/uploads/2015/06/MLO_FINAL_June2011.pdf

- <https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/285916/Dark-Sky-Assessment-Guide.pdf>

On behalf of the Society, I wish you and your families well over the holiday period.

David Stevenson
President



Monthly Showcase

August saw the introduction of a new format for our monthly competition titled “Monthly Showcase”.

For those who may have missed them, here are the new rules:

The purpose of the Monthly Showcase is to encourage people to look up and or be involved with the sky / space environment and any submission can be considered where the activity involved the act of looking up or being outside observing the night sky.

People are encouraged to select and submit objects (photos, drawings, stories, articles, anything!) of their own choosing that suits their telescope and/or their interests.

Objects can include deep sky, planetary, solar, wide angle day or night sky, comets, satellites, meteor showers or other objects greater than 10km up.

All submissions have to be the authors’ own work, and where collaboration in data collection has happened then this is to be clearly articulated.

All submissions require supporting material describing:

- *Date, times and location that the data was collected and,*

- *The telescope and associated imaging equipment, and*
- *Any software used to process the image, or*
- *If a drawing or other medium then the telescope that was used to observe the object.*

Optional additional information could include:

- *Number and length of exposures,*
- *Focal length and aperture,*
- *Filters used,*
- *Information of interest about the capture or processing process, or*
- *Hints learned, or things that the person might need to learn/research/ fix.*

The data collected does not need to be collected in that month and can involve data collected over previous months and seasons.

Where multiple images are submitted then they are to be considered as a single entry and not as multiple entries.

The processing must be done by the author and the author alone.

All submissions are due in by the end of the month and are presented at the following month General Meeting where all submissions are shown on screen and talked to by the author.

Voting is to be done by a show of hands at the meeting and the criteria is determined by the person attached to the hand.

Consideration should be given to overall “value” of the image or drawing taking into account the uniqueness, the experimentation at play, authors experience and value of the equipment.

Where a tie happens then both parties are declared winners.

For reasons of practicality, articles and stories will be judged separately and beforehand by the committee.

Where any submission is considered to contravene these rules then the Monthly Showcase coordinator can refer it to the Astrophotography Lead and the Observing Officer who can make any decision that they feel is necessary to keep the Monthly Showcase in the best interests of all society members.

The Monthly Showcase coordinator will distribute a forward calendar of potential objects that might assist people selecting an object. These objects are to assist people only and are not considered as required for entry submissions.

August Showcase

This month winner is Kym Haines with a picture of the Trifid Nebula, catalogued as Messier 20 and NGC 6514.

The runner up is yours truly with a picture of Saturn and the Moon minutes before the occultation of the former by the later.

Finally, John Sandoval sent us a link to a fantastic star trail video. You’ll find it at:

<https://drive.google.com/file/d/1XDEYNPDwUMJ91na8amt95ybJHmU9-mO2/view?usp=drivesdk>

And, unfortunately, we did not receive any article for this month.

Target	Trifid Nebula
Telescope	Ritchey Chretien 14” f/8 2850mm
Camera	FLI PL09000 (mono with filter wheel)
Mount	Paramount MX+
Field of view	44’ x 44’ - cropped slightly
Exposures	15 x 10min + 14 x 15min of luminance 8 x 15min of red 8 x 15min of green 8 x 15min of blue
Software	PixInsight, GIMP
Location	Suburban Sydney
Date	Exposures from several nights; completed on 27 Jun 2019

Kym Haines



- Afocal photo taken from my backyard on August 12th, 2019
- TAL 200K Klevtsov-Cassegrain scope with a 40mm Super Plössl eyepiece
- Handheld Samsung Galaxy on automatic
- Image slightly sharpened and cropped in Photoshop.

Notice Saturn in the left down corner and how small it appears compared to the Moon.

Jean-Luc Gaubicher



Date 09 May2019

Time 11pm - 1am

Location Yulara, Northern Territory

Video consists of 45x 2-minute exposures of the Milky Way. I used Registax to stack the individual photos progressively for each of the video frames.

By 'progressively,' I mean:

Frame 01 of the video consists of 2-minute photo 1.

Frame 02 of the video consists of 2-minute photos 1+2 stacked.

Frame 03 of the video consists of 2-minute photos 1+2+3 stacked.

and so on...

Frame 45 of the video consists of all 2-minute photos stacked. So from the first photo to the last (45 exposures stacked), the star trails gets longer and longer.

Then I used Media Composer (video editing software) to create a video sequence out of all the frames.

Equipment:

- Nikon Z7 mirrorless interchangeable lens camera
- Nikon 17-35mm f/2.8 lens
- Hahnel intervalometer
- Manfroto tripod

John Sandoval

September Showcase

Surprise, surprise, this month winner is Kym Haines again!
His entry is a picture of the God’s hand, a nebula situated in Puppis. This object is apparently quite difficult to image and therefore not a popular target for astrophotographers; personally it’s the first time I’ve heard of it.
The runner up is Ryan Coutts who has chosen a more popular target but has achieved a very commendable result none the less.
Once more, we did not receive any article but Kym’s comprehensive comments easily make up for that.

Telescope	Ritchey Chretien 14” f/8 2850mm
Camera	FLI PL09000 (mono with filter wheel)
Mount	Paramount MX+
Field of view	4’ x 44’ - cropped slightly
Exposures	20 x 30min of hydrogen alpha 4 x 30min of red 4 x 30min of green 4 x 30min of blue
Location	Suburban Sydney
Date	Exposures from several nights; Completed on 25 May 19
Processing software	PixInsight, GIMP

CG4 is quite faint, so I wasn’t sure how I was going to approach it. First I tried with Ha (hydrogen alpha) and got a good result; so I thought it would be amenable to LRGB but the luminance was poor.
Instead I substituted Ha for L and produced HaRGB which retains all the detail of the Ha but has the side effect of purple colour cast.

From wikipedia: CG4 ... is a star-forming region located in the Puppis constellation, about 1,300 light-years (400 pc) from Earth.
It is one of several objects referred to as “cometary globules”, because their shapes are similar to that of a comet.
It has a dense head formed of gas and dust, which is around 1.5 ly in diameter, and an elongated faint tail around 8 ly in length.
Kym Haines



Taken using a 8” SCT
22 x 180sec exposures.
From Turramurra using a light pollution filter and
shot on a Canon 6D.
Ryan Coutts



HVSP

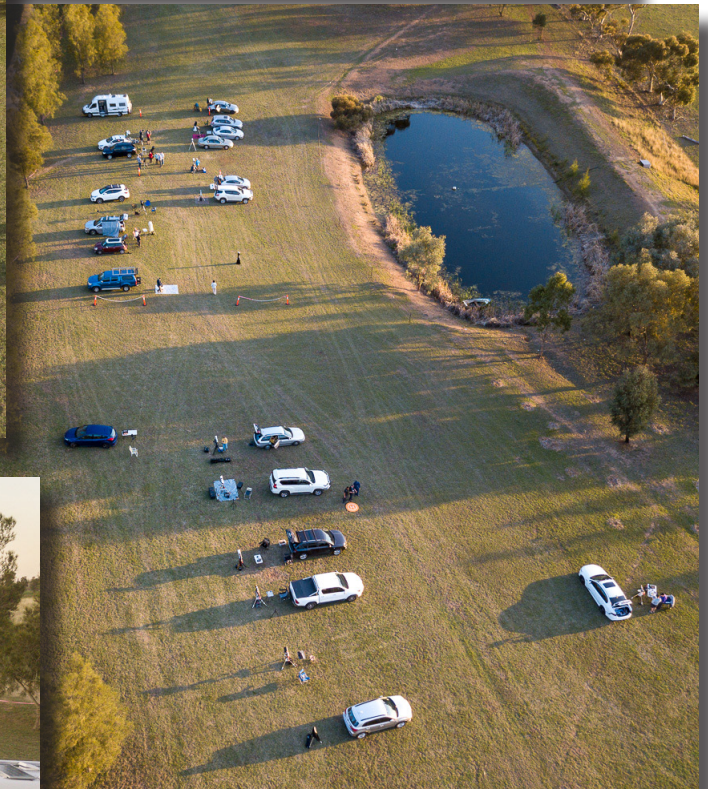
According to what I've heard, the inaugural Hunter Valley Star Party was a real success, all participants thoroughly enjoying themselves.

Shame, nobody sent us a report but here are a few photos of the impressive field of scopes taken by Greg McCall who, cheek in tongue, wrote:

"Some quick edits from the better photos on the SD card in my drone:

Too bad the objects in the photos are not more than 10km away, or I could have entered them in this month's showcase. Although in some photos, I can see something in the sky at more than 10km!"

Greg McCall



How to extract Energy from a Black Hole

Black holes are the largest stockpiles of pure energy in the universe.

If you come too close, they'll devour you and add your energy to their hoard; and the energy is lost to us forever.

Or is it?

It turns out there's a way to get back a part of this energy to power us until the very death of everything or... of constructing the largest bomb in the universe!

But how?

Didn't we learn that everything, even light, is trapped forever in black holes?

This is true.

Except for the fact that most black holes are spinning!

When really massive stars die, their cores collapse under their own gravity into black holes.

This means something very big becomes infinitely tiny. The tiniest anything can be in this universe.

But stars are rotating and a fundamental property of our universe is that things that are spinning don't want to stop spinning; it's called the conservation of angular momentum: a big thing that spins and becomes smaller spins faster.

So, as the core of a star collapses, its angular momentum makes it spin faster and faster until it collapses into a black hole.

And then, the black hole keeps on spinning, inconceivably fast, some of them spin millions of times a second.

Just like non-spinning black holes, spinning black holes have an event horizon and a singularity at their core where all of their mass is concentrated.

The singularity is usually described as a infinitely small point with no surface area. But points can't rotate, ergo a rotating singularity can't be a point!

Instead it is a RINGularity.

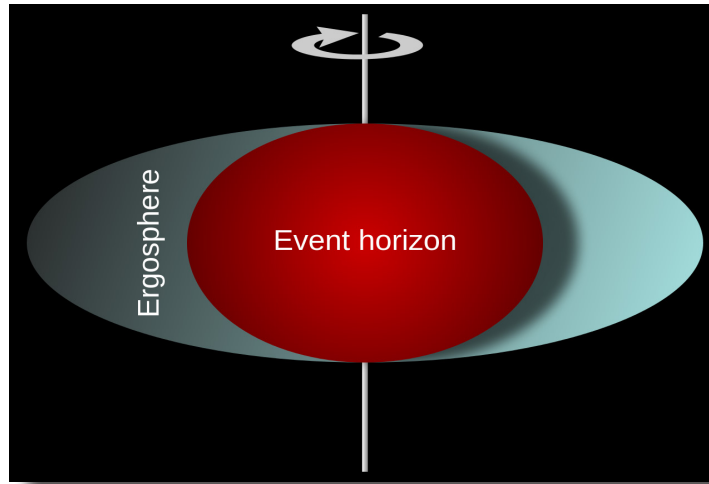
A ringularity is a ring with a thickness of zero, and therefore no volume, spinning extremely fast and containing all the mass of the black hole.

It is spinning so fast that it literally drags space with it.

This creates a new weird region of space-time that envelops the black hole, including its event horizon: the ergosphere.

If space and time are completely broken inside the event horizon, you can say that they are only "half broken" inside the ergosphere and it is possible to enter it and then leave it again.

You can imagine it like this: falling into a non-spinning black hole is like sliding down a hole, Alice in Wonderland style.



Ergosphere of a spinning black hole

But being inside the ergosphere of a spinning black hole is like spiralling down a whirlpool, Charybdis style.

So how would we extract energy from a black hole?

Here comes the Penrose process, as theorized by Roger Penrose.

When something enters the ergosphere, it is dragged along and accelerated by the rotating space and therefore gains energy.

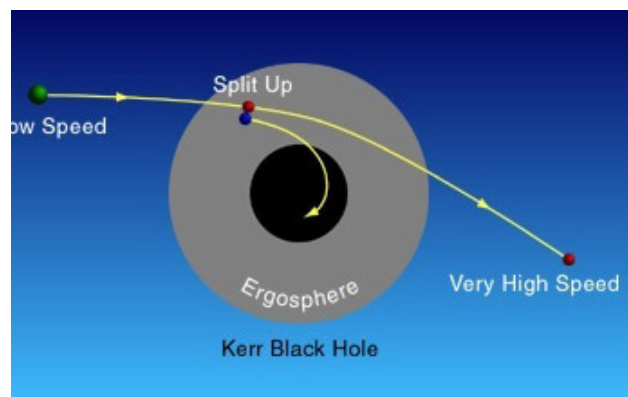
In practice we could be sending an object, let's say an asteroid (A), into the ergosphere and carefully split it in two so that one piece (B) falls past the event horizon and is lost forever and the other one (C) breaks free from the ergosphere.

With careful arrangement, the infalling piece would have negative mass-energy and the escaping piece would have greater mass-energy than the original piece of matter as the following equation shows:

$$E(A) = E(B) + E(C)$$

The infalling energy $E(B)$ becoming negative then the escaping energy $E(C)$ must be greater than the initial energy $E(A)$.

The effect is that more energy can be extracted than was originally provided, the



The "sling-shot" effect

difference being given by the black hole itself.

We've made a deal: we give the black hole some mass-energy and it gives us some of its rotational energy, slows down and loses a little mass in the process while its ergosphere shrinks.

This could be repeated every time an energy boost is needed but there is still a limit to the quantity of energy that could be extracted from a black hole: it's the energy that corresponds to 29% of the mass-energy of the

initial black hole.

Instead of sending an object, an asteroid for example, there is an even better and simpler way to get that boost of energy from a black hole.

Picture a Dyson sphere that would be built around a fast spinning black hole with a small aperture through which we could shoot electromagnetic waves at the black hole: the waves travel through the ergosphere at light speed, half would disappear past the event horizon but the other half would travel through the ergosphere where they would steal some of the black hole momentum and get amplified in the process and, bouncing around between mirrors through the ergosphere, they would get stronger and stronger, exponentially stronger as a matter of fact!

By opening some windows in our Dyson sphere we could extract energy from the waves for trillions of year.

Or, by closing all windows and preventing the waves from being released they would grow stronger and stronger until the all structure would explode, creating the largest explosion we could ever dream of creating.

Jean-Luc Gaubicher

Sources:

Kurzgesagt

Wikipedia

Pictures courtesy of

Quora.com

Post-Scriptum

Just as a matter of curiosity, I tried to calculate for how long we could extract energy from a black hole.

For this calculation I will take the example of the nearest black hole V616 Monoceros at just 3000 light years and the energy we are consuming this day.

First we have to calculate the mass-energy of this black hole using the famous $E=mc^2$ equation.

It is estimated that this black hole has a mass of 6.6 solar masses, which gives us $M = 6.6 \times 1.9891 \cdot 10^{30} \text{ kg} = 13.13 \cdot 10^{30} \text{ kg}$

So the total energy contained in the mass of V616 is:

$$E = 13.13 \cdot 10^{30} \text{ kg} \times (3 \cdot 10^8 \text{ m/s})^2 = 118 \cdot 10^{46} \text{ J (joules)}.$$

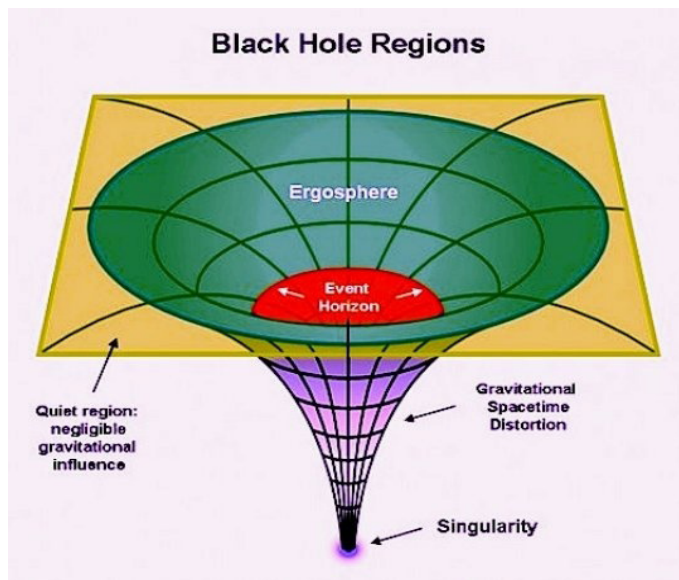
But remember that there is a limit to the energy we can extract from a black hole, 29% of its total energy. Accordingly in this case we have $34.22 \cdot 10^{46} \text{ J}$ at our disposal.

Now let's consider our annual production of energy.

The International Energy Agency estimates that in 2018 the energy produced was around 13,865 Mtep. As the energy consumption increases every year let's round up this figure to 14,000 Mtep, of which, it's worth noting, 85% still come from fossil fuels.

1 Mtep, or megatonne equivalent petrol equals 42 PJ (petajoules), that's $42 \cdot 10^{15} \text{ J}$. Therefore our yearly energy consumption is $14,000 \cdot 10^6 \times 42 \cdot 10^{15} = 588 \cdot 10^{24} \text{ J}$.

Assuming that we could limit our consumption to this figure the energy extractable from V616 Monoceros could last us $34.22 \cdot 10^{46} / 588 \cdot 10^{24}$, which is $5.82 \cdot 10^{20}$ years or 582 trillion years



If you are not afraid of zeros, that's 582 000 000 000 000 000 000 years! Even if we had to increase our energy needs tens of thousands fold, we would have enough reserve maybe not till the end of times but still for a very long, long time indeed.

Now, let's go a bit further: what if the Sun, for some unknown reason, switched off? Could we extract enough energy from our black hole to replace the one we currently receive from the Sun and makes life possible?

It's easy enough to calculate. Knowing that the density of the solar energy that reaches our planet is approximately 1370 W/m^2 and that the Earth intercepts an area of $127.4 \cdot 10^{12} \text{ m}^2$. So the energy Earth is receiving from the Sun per second is:

$1370 \times 127.4 \cdot 10^{12} = 174.5 \cdot 10^{15} \text{ J}$
And for a year of $31.536 \cdot 10^6$ seconds:
 $174.5 \cdot 10^{15} \times 31.536 \cdot 10^6 = 5.5 \cdot 10^{24} \text{ J}$.
The extractable energy from our black hole being $34.22 \cdot 10^{46} \text{ J}$ it would take $6.22 \cdot 10^{22}$ years to exhaust our resources. Again, a very long time.

As a matter of comparison the most powerful nuclear plant ever built, though no longer in service following the Fukushima disaster, is the Kashiwazaki-Kariwa Nuclear Power Station in Japan with a nominal output of 7,965 MW.

H

i all,
With this last issue for 2019, and its 12 pages, Reflections is going out with a bang. Can we expect to see even more great pictures, and maybe even a few articles, in 2020? Hopefully, yes as it seems that our members have taken a fancy to the Monthly Showcase.

Great things to come for our Society this coming year.

As I understand it, the activity program will be choke a block with, on top of the usual monthly meetings and observing and outreach nights, a couple of shorter trips to dark sites in addition to the HVSP. Obviously for all these projects to come to fruition helping hands will be needed.

So, expect to get requests from the organizers and if you think you can help, do not hesitate to volunteer; I can assure you, nothing will be too time consuming.

On behalf of the Editorial Committee, that is Ben and myself, I would like to wish to all our members, their families and friends a very relaxing festive season and a happy New Year.

Jean-Luc Gaubicher

October Showcase

A flurry of images this month, some members entering multiple pictures, which made the choice for the winning entry that more difficult! And the winner is Nick Angelini with a shot of saturn being occulted by the Moon.



The first photo is of the Saturn entry and the second the exit.

Both photos were taken using a smartphone which was attached to a 14mm EP on my 8" Evolution SCT by way of the Celestron Next YZ 3 Axis smartphone adapter.

I took a video as well as a series of still shots.

The entry photo (left) is taken from the video and edited using Photoscape X which is a free photo editing program not specifically designed for astrophotography but which still enabled me to sharpen and crop the images and adjust the brightness to better equalize the relative differences between the two objects.

The exit (below) is a still shot also edited using Photoscape.

In this case I didn't crop the image but sharpened it and played around more with HDR and vibrancy levels, hence the stronger colours.

Nick Angelini





M17 Omega Nebula

Live shot @ Terry Hills

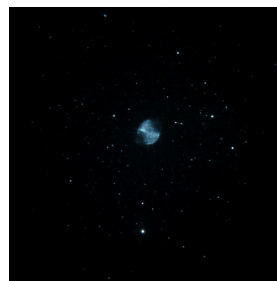
Gen 3 White Phosphor Image Intensifier

Astronomik 6nm H Alpha filter

55mm TV Plossl

14" F4.6 Dobsonian

David Armen



M27 Dumbbell Nebula

Specs, same as above

I have attached 4 pictures; all were taken with ASI294MC camera.

The Trifid Nebula taken with Esprit 80.

The Omega Centauri, The Grus Quartet and the Helix were taken with Esprit 150.

The Trifid, the Grus and Omega were taken from Newport and Helix at Camp Duckadang QLD.

Igor Hodoba





The Central part of Milky Way

Telescope	Nikkor 28mm f/2.8 AI-s at f/5.6
Camera	Nikon D700
Mount	Star Adventurer
Field of view	A big chunk of the sky
Exposures	15 x 2min
Location	Hunter Valley Star Party
Date	28 September 2019
Processing with	PixInsight, GIMP

You can also easily see, roughly in line from top to bottom, Antares, Jupiter, Lagoon Nebula and Saturn.

Kym Haines



NGC 104,

Better known as 47 Tucanae, is the second largest and second brightest globular cluster in the skies.

AstroPhotography from my Backyard in Lane cove park 21 October 2019, 4:05 AM
ZWO224MC (color) Camera and SkyWatcher 1500/127 Maksutov
SharpCap V3.2.59 with Fitswork to process.

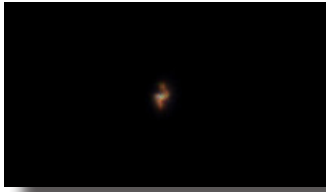
Jupiter, the same gear and location.



These are taken with my pocket camera:
Canon-IXUS-105

Jupiter with its moons, Jupiter

Mehdi Sanayei



The International Space Station!!!

I know it's extremely small and un-detailed, but still!

It's a single image taken on 21/10/19 at about 8:32pm. using a Skywacether HEQ5Pro without the clutches engaged and just moving the red dot in the finder scope ahead of the ISS and letting it pass through at intervals.

Skywatcher ED80 and a ZWO ASI385MC.
1119us, gain 284.

I focused on Jupiter and adjusted the gain a little based on that beforehand.

Ramon Goldfried

I took this on 28 September at Wiruna.

Equipment:

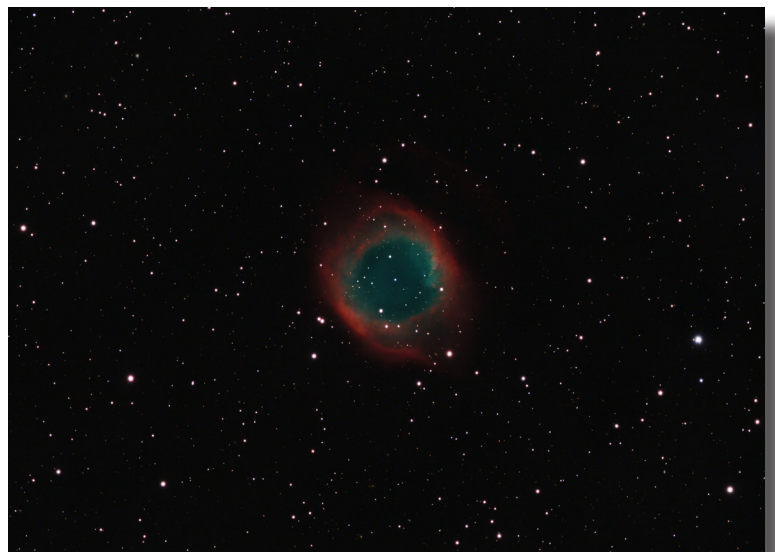
SkyWatcher Esprit 120
SkyWatcher EQ6-R Pro Mount
Camera, ZWO ASI294MC Pro

Exposures:

44 x 5 minute subs

Used master darks and master bias frames.
I was sloppy and used flats from another season (I wasn't able to get flats the next morning for some reason).
Pixinsight: I'm still taking baby steps with Pixinsight!

Rodney McCallum



KAGRA joins the Gravitational Wave Hunt

The Kamioka Gravitational Wave Detector (KAGRA) is a project of the University of Tokyo. It is due to join LIGO and Virgo this month in the hunt for gravitational waves.

KAGRA is the first of his kind to be built 200m underground and whose detectors use cryogenic mirrors.

Despite its 2 arms being shorter (3km versus 4km) it is expected KAGRA will match LIGO performances thanks to its cryogenic installation that cools its sapphire mirrors to 20 kelvins and their very sophisticated suspension system.

When operational KAGRA will help in locating gravitational waves source more accurately.

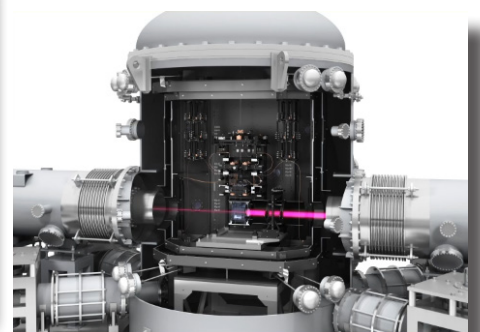
For more information go to <https://gwcenter.icrr.u-tokyo.ac.jp/en/category/latestnews>



Shinto groundbreaking ceremony



Inside the tunnels during construction. Note the plastic sheets to prevent water dripping on to the equipment.



One of the cryostats



Christmas Party

This year, our popular Christmas party was held on December 8th.

Again it was well attended by more than 50 guests, members and their families.

The barbecued steaks and sausages as well as the salads all lived to their reputation but, as usual, the longest queue formed once the desserts were brought out.

Unfortunately solar observing proved to be a flop, the only one for the day, on account of a very quiet Sun and overcast sky.

Once again, many thanks to the organising committee.

