CYGNUS

Quarterly magazine of the Norwich Astronomical Society

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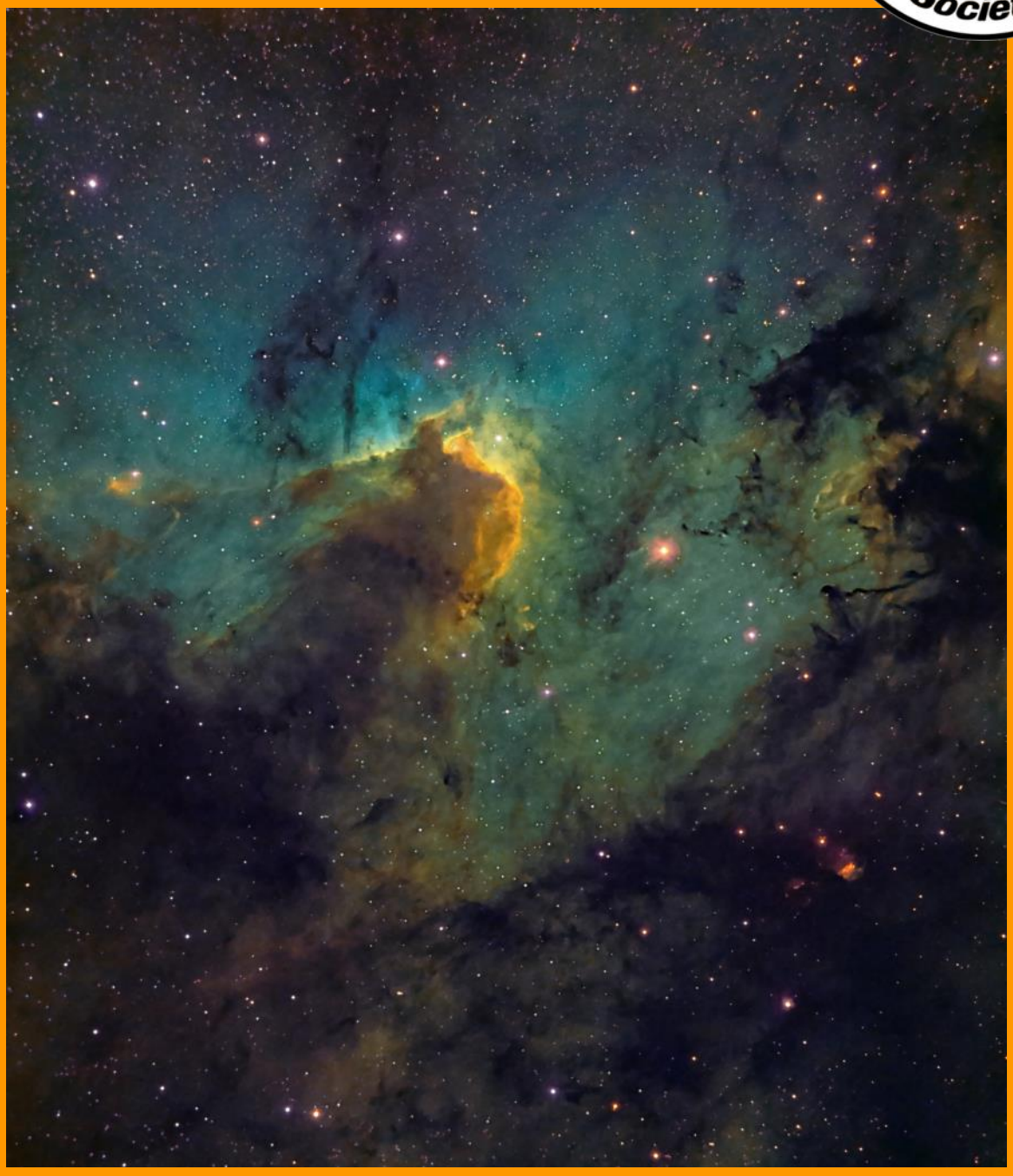

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Autumn 2018

EDITORIAL

Hello!

Well, it's that time again. Now the season has begun, we have already had our first open weekend, which was a great success. Nights are getting darker and the hope is that the weather holds for clear skies so far every time we have an astronomical event, true to British weather, the weather never fails to hinder.

Thank you to all that have contributed to this issue and apologies for my consistent nagging. We are getting articles for radio and spectrometry. I do need articles for new people and more for visual observing.

For those of you on a tight budget (most of us lol) and are on Facebook, Jason Durrant has set up a page for budget astronomy £1000 and less "UK Budget Astrophotography (Sub £1000 Astrophotography) also Mark Shepherd has also set up a page "Blood Moon—Sky Watcher Events) to keep you informed of whats happening. Also the International Astronomy Show is on 12th\13th October (which unfortunately clashes with our open weekend) but a good place to see what equipment there is out there, and of course to drool over lol. There are also lectures there.

Well, I hope you enjoy this edition of Cygnus and hopefully we will have clear skies for the next six months. If we are fortunate to have clear skies, write your experience down, plus pic's/sketches if possible and send them to me.

Tom

cygnuseditor@norwichastro.org.uk

I have a caption for the picture on the right!

"when I nod my head, hit it!"

Thank you
David Curson

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COVER

Image by Shaun Reynaulds

Cave Nebula in Cepheus
SH2 - 155 . Emission nebula in the Hunble Palette
Ha O3 S2 , 15 hrs total , 5 In each

DISCLAIMER

Cygnus is a quarterly publication and is produced by and for members of the Norwich Astronomical Society.

Opinions expressed in Cygnus are those of the contributors and do not necessarily reflect those of the Society

CHAIRMAN'S REPORT

Well, it is that time of year again. By the time you read this the equinox will have passed, that particular astronomical event twice a year, spring and autumn, when daylight and dark are approximately the same length. Any solar planet with a tilted rotational axis will have equinoxes. The Saturn example is especially spectacular, as it involves the planet's majestic ring system being edge on as viewed from earth. Would the early telescopic observers of Saturn have noticed the rings if it had been equinox time when they looked? As we have been informed by the Cassini mission, the rings are only, on average, ten metres thick. What would a seventeenth century telescope have made of that? At closest opposition, the two planets are 1.2 billion kilometres apart. Answers on a postcard, please.

If you are reading this, you have renewed your Society membership, or joined for the first time. Many thanks for that. This year's membership form includes a question concerning whether you are happy to be contacted by email regarding volunteering for events. I must admit that personally I have never been a fan of the 'use it or lose it' type of slogan. Of course many of the events we stage require volunteers, but helping out should be motivated by a person wanting to do it. Our members have all kinds of personal circumstances or work commitments. Perhaps they just want to do some observing at a dark sky site. Whatever the reason, you will only be contacted if you want to be.

We are sometimes asked about our sources of funding, especially as we have a site and equipment to maintain, of a magnitude that is not usual for most astronomical societies. Apart from our membership fees, our main sources of income are the events we run, whether for the general public or for organised groups. One problem is that it is difficult to forecast revenue from attendances. A run of clear, dark skies during open evenings is a definite benefit, as was clearly shown last season when we held the Seething star party in February and had really good numbers of the public turning up.

There is a general feeling amongst astronomical societies who stage public events that the 'BBC star gazing effect' is wearing off. There is no doubt that the first couple of years that the programme was running there was a dramatic increase in public attendance at astronomical events, but this effect was diminishing even before what many of us thought was the BBC's ill-advised decision to host the annual event from Australia. After all, it is not exactly possible to be enthused by the sight of the Southern Cross and then rush to Seething that weekend to see it. Showing the antipodean night sky and talking about it is absolutely fine but surely more appropriate to the Sky at Night than Star Gazing live, which is sadly no longer with us anyway.

Regarding our other main activity, our group visits, we have concluded that the presentations that we have run for a number of years are starting to look a little stale and tired. So this year is a make-over year for the evenings, starting with those added features we need when, unfortunately, it is a cloudy or rainy night at Seething. Some of our new activities are based on presentations run at the Young Persons event this summer. We might even find a way of fitting in one of the most popular in June – the rocket building workshop.

Clear skies to everyone

Roger Preece

MOONWATCHERS

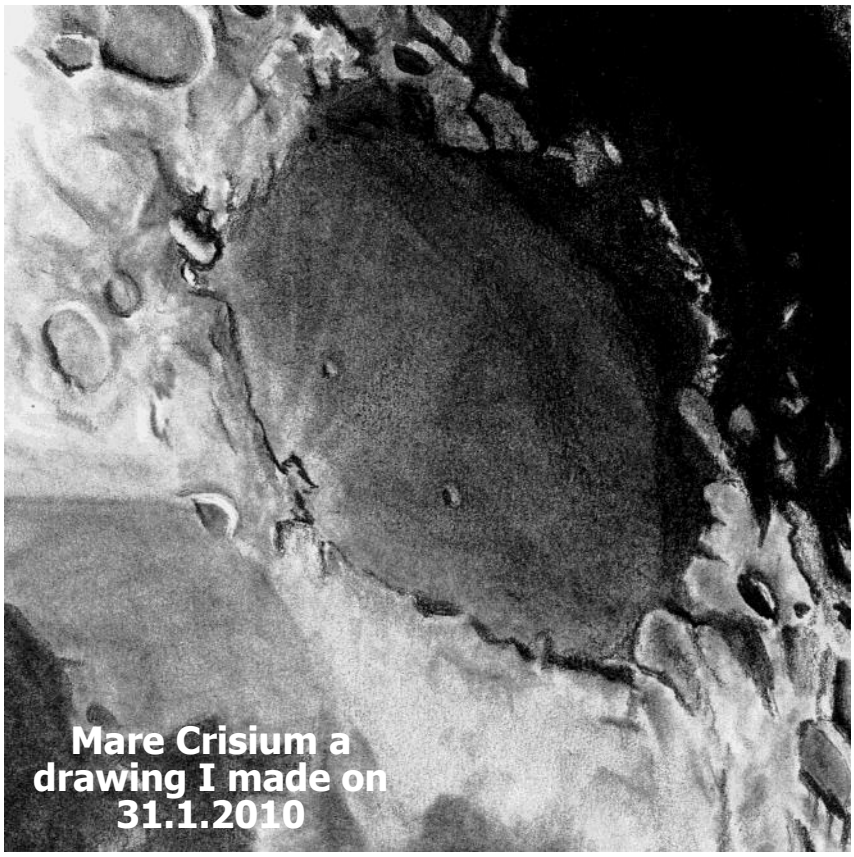
Down to the Sea…

I must go down to the mare again,
To the mare in the sky,
And all I ask is a twelve inch Newt,
And a drive to steer it by.

I like to think that John Masefield might have begun his famous poem that way had he been an amateur astronomer and been fascinated by the lunar 'seas'.

As we know, the darker areas of the Moon were once assumed to have been areas of water and were given names accordingly, names that have survived despite their true nature being revealed after the invention of the telescope. Thus we have Mare Tranquilitatis, Mare Frigoris, Oceanus Procellarum and so on. Beginners shouldn't be put off by the Latin names; 'mare' simply means sea and the plural is 'maria'. 'Oceanus' I reckon you can work out for yourself!

It's my intention in the next few issues of *Cygnus* to focus on some of the maria and describe the features that can be seen both on them and on their immediate shorelines. It seems to me that the logical mare with which to start this seaside excursion is Mare Crisium – the Sea of Crises – which was given this name by Riccioli in 1651. This is the first of the lunar seas to come into view on the growing crescent early in the lunation, and is unique in that it is the only one of the Moon's major seas isolated from the other mare, that is visible to the terrestrial observer.



Mare Crisium a drawing I made on 31.1.2010

Mare Crisium is the most obvious feature on the two day-old crescent and those with good eyesight may even be able to discern it with the naked eye as a 'bite' in the terminator. At this stage the terminator bisects the mare and only the eastern half is lit. A telescope will reveal several wrinkle ridges close to the eastern shore, the most prominent of which are the 150 km Dorsa Tetaev and the 200 km Dorsa Harker. They are very obvious at this time, with the Sun low in the Moon's sky and casting their shadows across the mare, and they sweep in arcs north–south.

Like all lunar maria (a possible exception being Oceanus Procellarum) Crisium was formed by a large meteorite that impacted here between 4.5 and 3.8 million years ago. The wrinkle ridges formed as lava that flowed into the impact basin cooled. The lava also covered craters that had formed in the basin in the years following the larger impact and as the terminator moves to the west on Day Three, revealing the whole of the mare, look for the outline of one such crater.

The partially obscured crater Yerkes (36 km) lies close to the western shore, just over a third of the way up from the southern boundary of the mare. Also close to the western shoreline is another ridge, Dorsum Oppel (300 km) and you may spot Dorsum Termier which winds for about 90 km across the southern central floor of the mare.

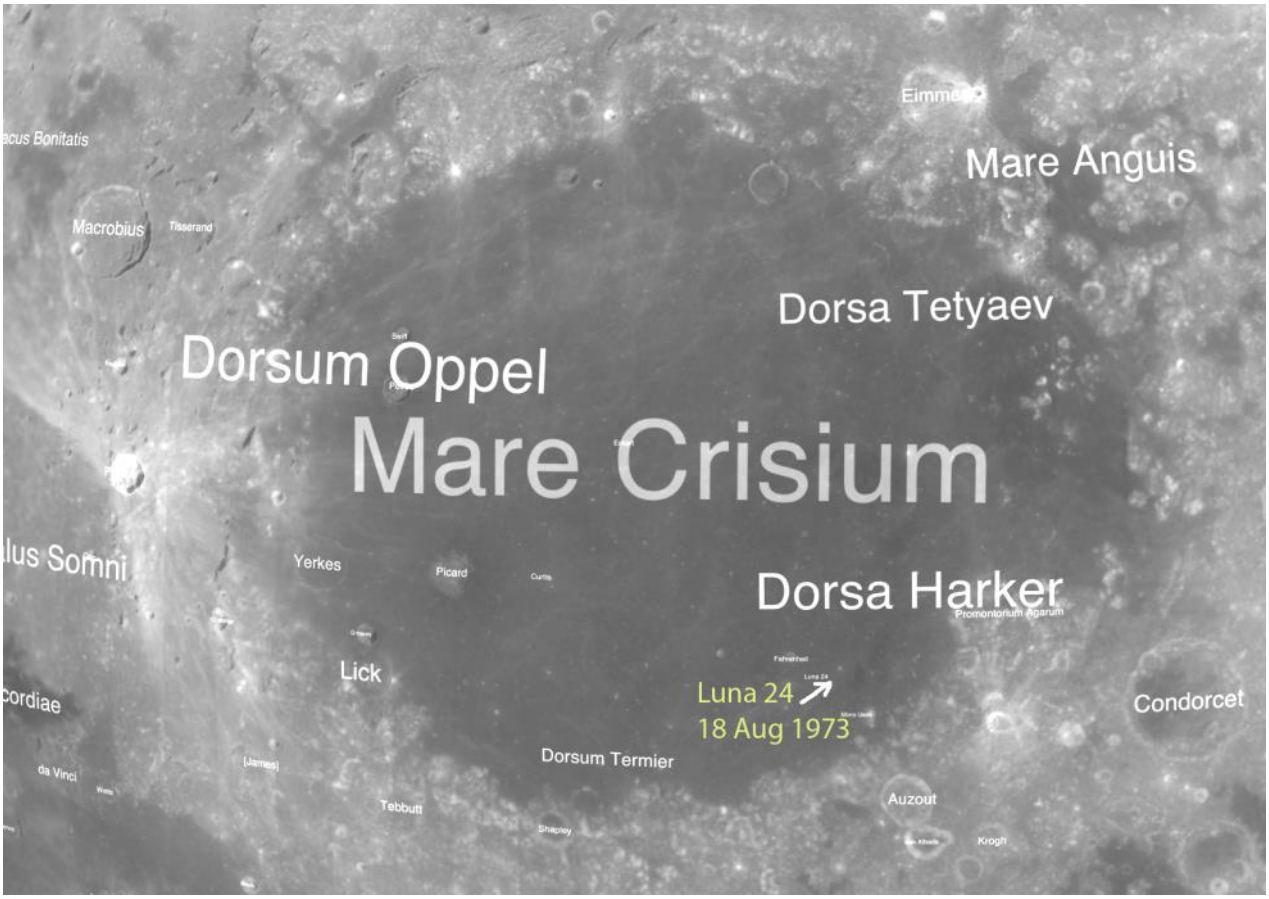
Newer craters than Yerkes can now be seen. These were clearly caused by impacts following the cooling of the lava that filled the basin. Swift (11 km) and Peirce (18.5 km) can be seen close to Dorsum Oppel and further south the 23 km Picard lies level with the previously mentioned Yerkes. Below Yerkes the craters Greaves and the flooded Lick can be seen, the 14 km Greaves appearing to be joined to its 31 km neighbour. High magnifications will reveal many smaller craters.

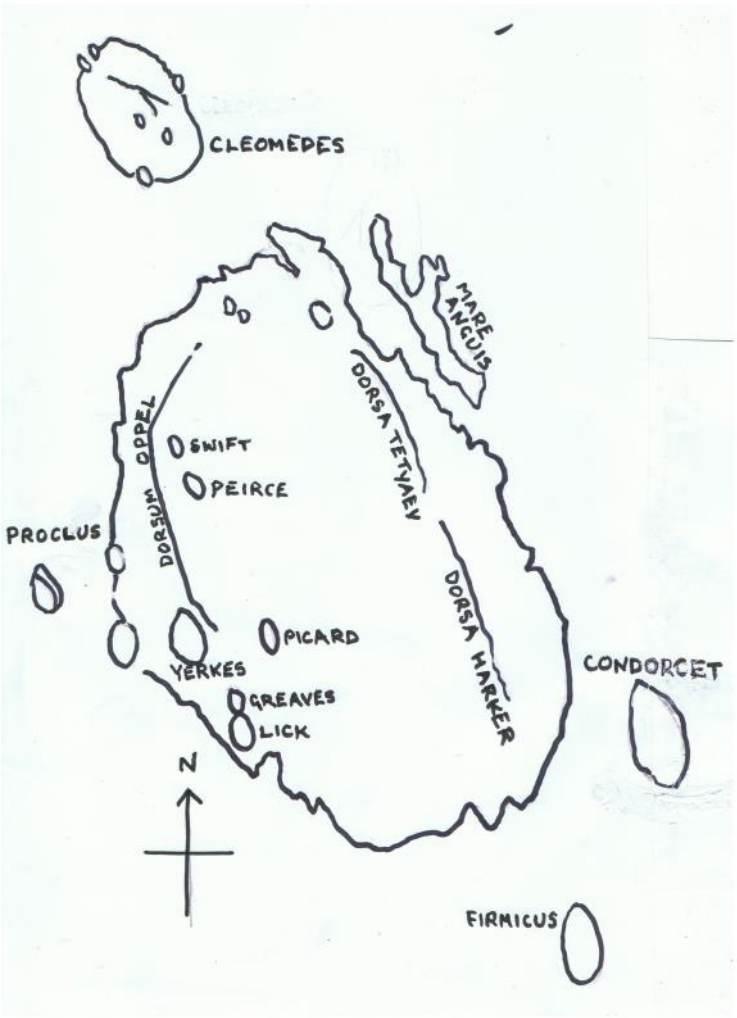
Among the craters that surround Mare Crisium are Cleomedes, Condorcet, Firmicus, Apollonius, Tisserand, Macrobius and Proclus. At 126 km Cleomedes is the largest of these and worthy of some attention. With apertures of 150 mm and above you should be able to make out its central peak and the forked rille Rima Cleomedes, that cuts across its smooth floor. Macrobius will be seen to have terraces and a prominent central mountain, Condorcet and Firmicus and Apollonius are flooded craters with dark floors.

Proclus is worthy of note. Situated some way from the western boundary of Crisium it is unmistakeable, having bright rays that extend northwest and southwest to either side of a dark area known as Palus Somni – The Marsh of Sleep. 28 km Proclus is visible for the greater part of each lunation and is unlike other ray craters, having this distinctive gap in its spreading rays. The generally accepted explanation of this curious ray pattern is that a meteor striking at 45 degrees or more may produce an ejecta pattern that extends in all directions, but the more oblique the angle the less symmetrical the ray pattern. It has been found that a body striking at 15 degrees or less will throw out ejecta in a butterfly wing pattern and this must have been the case with the meteorite that formed this sharp-rimmed crater.

One last feature to look for near Crisium is the Mare Anguis, which lies close to the north-western shore. This narrow, lava filled valley has the distinction of being the smallest named mare on the Moon. Its name is appropriate for this sinuous feature for it translates as 'Serpent Sea'.

Being close to the eastern rim of the Moon the Mare Crisium is foreshortened and we see it as being oval in shape with its north-south axis longer than the east-west. In reality the mare measures more east-west (560 km) than it does north-south (400 km). The photo below shows the true shape of Mare Crisium (lacking the resources of NASA or Elon Musk I wasn't able to provide an image of the real thing and had to settle for a snap of the mare as depicted on my lunar globe).





Finally I should mention that Mare Crisium has quite a bit of hardware deposited there by the former Soviet Union. Luna 15 crashed not far from Peirce in 1969 – a failed attempt to steal the thunder of Armstrong, Aldrin and Collin by making an automatic recovery of lunar samples. In 1974 Luna 23 also landed on Mare Crisium and in 1976 Luna 24 was finally successful in returning a core sample to Earth (well, I suppose it's traditional to return from the seaside with a stick of rock!).

Another trip to the lunar seaside in the next issue.

Spadge

Charlie Daniels

Exploring the dark universe with Einstein's telescope.

Dark Matter and Einstein's Theory of General Relativity are closely intertwined when discussing the effects of Gravitational Lensing. Gravitational lensing – also referred to as Einstein's telescope - is predicted by Einstein's theory, and is pivotal to proving the existence of Dark Matter. Dr. Nick Bate provided a dynamic and inspiring talk that made complex themes accessible.

To those who didn't attend, below is a summary that barely covers an iota of the detail Dr. Nick provided, however I hope it reminds each of us at NAS exactly why we are so passionate about our Universe and its never-ending set of mysteries!

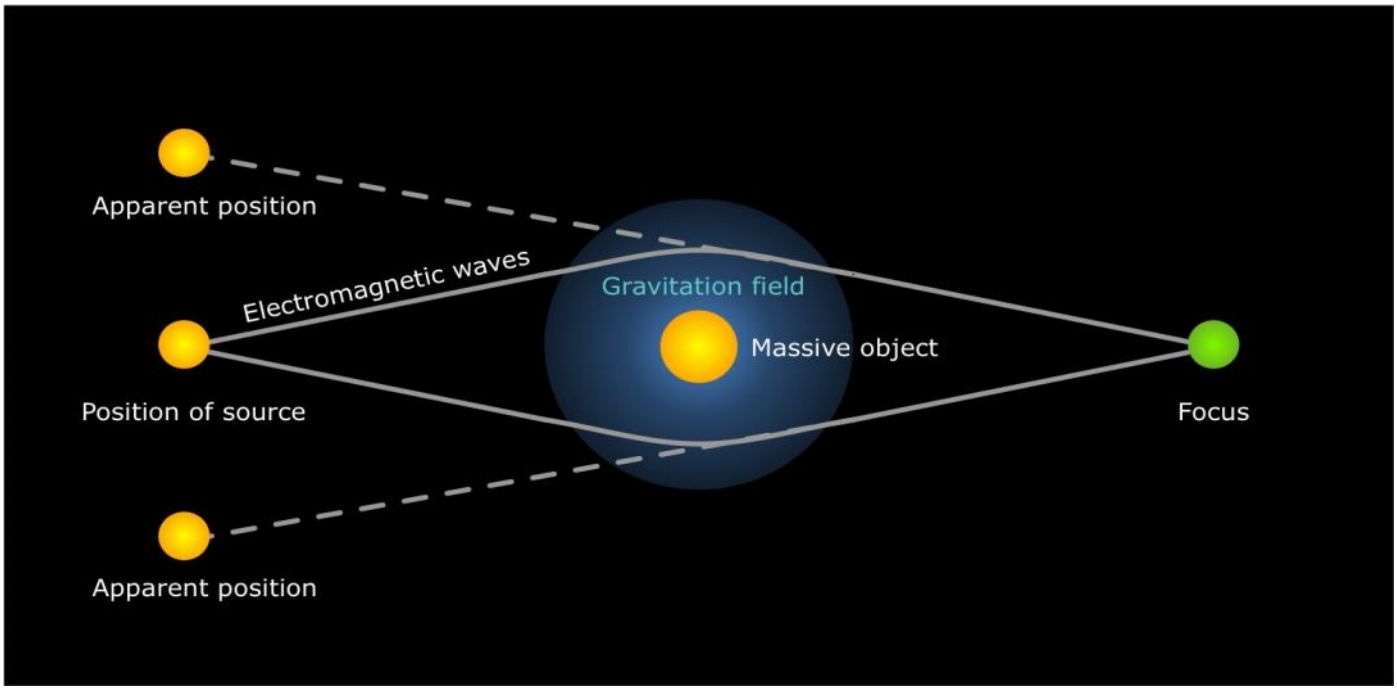
As the talk covered, our Universe is made up of approximately 5% baryonic or 'normal' matter; the remaining 95% (ish) is comprised of Dark Matter and Dark Energy. Dark matter's existence is supported by the effects of gravitational lensing. Clusters of galaxies are hypothesised to form in dense regions of dark matter, in fact Dr. Nick described dark matter as potentially 'scaffolding' for normal matter; paving the way for our early Universe to form.

NAS were lucky enough to receive Dr. Nick in late August, when he provided the perfect blend of presentation and discussion on gravitational lensing, also referred to as 'Einstein's Telescope' due to the relativistic relationship between light and gravity demonstrated. General Relativity predicts that a mass, M, will deflect light from a source by an angle θ via the following equation:

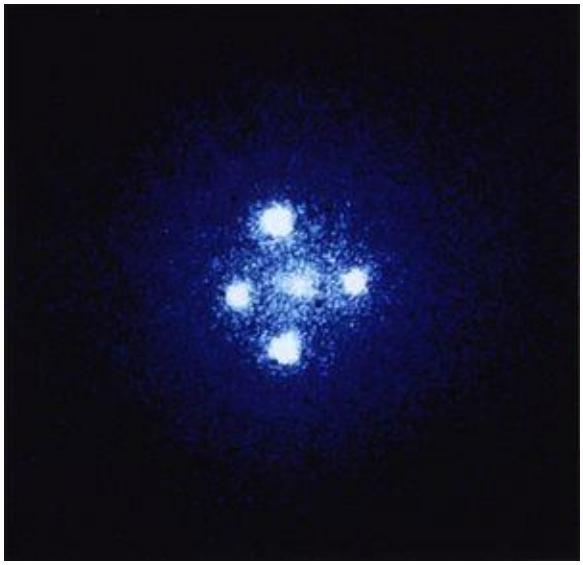
$$\Theta = \frac{4GM}{C^2 b}$$

Where G is the gravitational constant, b is the impact parameter of the light, and C is the speed of light.

Gravitational lensing occurs when light/electromagnetic waves emitted by a background star are 'bent' and focussed by the gravitational influence of a foreground galaxy or star, causing an observer to see a magnified and distorted image of the background star. As we saw, this phenomenon has also been witnessed for entire galaxies! The extent/angle to which this light is deflected will be influenced by the mass of the foreground massive object, as Relativity predicts. We also learnt that lensing is affected by both normal *and* dark matter, which is key!



Gravitational lensing teaches much about the formation and behaviour of galaxies, clusters, stars… our Universe as a whole. It allows astronomers to view information, on a magnified scale, of distant galaxies that would otherwise not be visible, and as they would have appeared billions of years ago. By measuring the size and shapes of clusters and galaxies, mass distribution in the Universe can be inferred in addition to (over time) determining how the Universe has evolved.



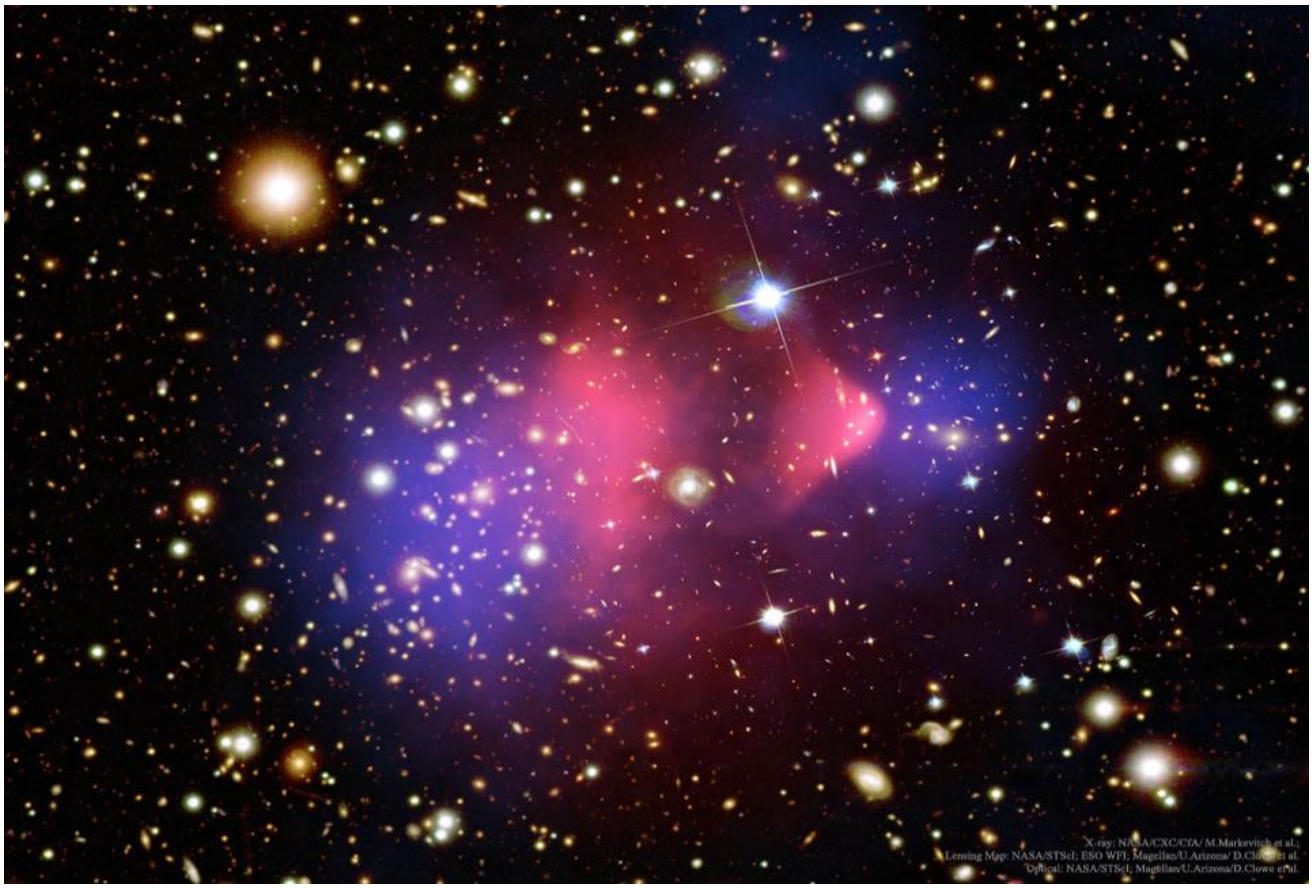
Throughout Dr. Nick's presentation, NAS members saw some incredible images that demonstrated the true extent of the distortions experienced via lensing. We also witnessed how the effects can vary wildly depending on the alignment between the telescope, and background and foreground objects (when perfectly aligned, an Einstein Ring would be witnessed).

For instance, Quasar 2237 (Einstein's Cross), displayed a lensed image of background quasar via a lensing galaxy and exemplifies the distortion and magnification potential of lensing. The image of the background quasar was lensed four times via the foreground lensing galaxy!

Dr. Nick showed us the below image of Galaxy cluster Abell 2218. This is a well-known and powerful lensing galaxy that is situated in constellation Draco. Given its size and density of stars, Abell 2218 distorts and multiple images background galaxies into thin arcs (as shown left). In denser regions of the cluster the distortion of the background galaxies is further increased, providing a wealth of information for astronomers on early galaxy formations and clusters in addition to suggesting that pockets of dark matter is also behind a significant part of the distortion.

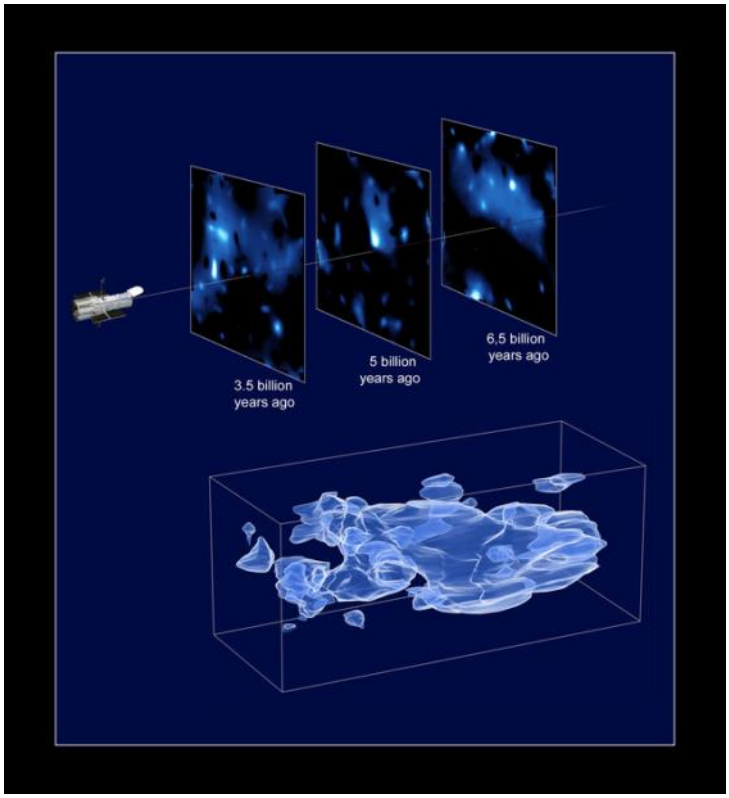
The direct proof of Dark Matter?

Dr. Nick also presented an image of the Bullet Cluster (next Page), which comprised overlays of X-ray and infrared imaging. The image actually shows two clusters of galaxies that have collided with one another. The blue, infrared elements of the image show dense regions of clusters and dark matter that have passed straight through the collision (because dark matter doesn't react with ordinary matter). Meanwhile the smaller portion of normal matter, has collided as expected and heated up emitting X-rays (pink image). This image provides strong proof of dark matter's existence!



Utilising the Gravitation Lens:

We subsequently learnt how lensing has become a tool for physicists today. An example is via planetary microlensing, which has been used to discover almost 80 planets in distant galaxies to-date; this number is rising all the time. Dr. Nick provided images of light curves to demonstrate the 'spikes' demonstrating temporary brightness when the lensing star moves in front of the source star; magnifying its image and allowing astronomers to infer the size and mass of the object. Naturally, the utilisation of planetary microlensing has significantly increased the potential to discover new (and Earth-like) planets!



What next?

Dr. Nick mentioned within the talk that there is approximately a one-in-a-million chance of spotting a star lensing another star given the resources used to-date. The focus is now on developing 3-Dimensional models, such as the one pictured by the Cosmic Evolution Survey ("COSMOS"), in order to compare observations directly with the simulations of dark matter developed to-date.

This 'cosmic web' as Dr. Nick described shows the distribution of dark matter growing 'clumpier' (and therefore eventually forming galaxies).

The need is therefore for a greater amount of sophisticated data over time, to capture more lensing events.

Some further questions for Dr. Nick:

Could the use of gravitational lensing as a 'tool' for planetary/ cosmological lensing be further refined? How so?

Dr. Nick: More data helps us find more gravitational lenses. The more of the sky that you can continuously monitor, the more of these events you will see. And likewise, searching for gravitationally lensed galaxies and (especially) quasars is like searching for a needle in a haystack. If you've covered more of the sky, down to fainter and fainter magnitudes, then you can find more lensed galaxies and quasars. And when you do find them, you ideally want to monitor them for long periods of time, so you can watch them change.

The good news is we're about to have a deluge of new data. Surveys like LSST (the Large Synoptic Survey Telescope) will image the entire sky once every few nights, which will give us a huge (and constantly-updating) dataset to search for new lenses. Next-generation telescopes like ALMA (the Atacama Large Millimetre Array) and 30-metre class telescopes (such as the Extremely Large Telescope, under construction in Chile) will give us extremely high resolution images of very faint objects, which is wonderful for studying detailed structure in lensed galaxies or quasars.

Do you anticipate any further applications for gravitational lensing in the near future?

Dr. Nick: First, I think we'll discover more gravitationally-lensed supernovae, and that's exciting both because we'll be able to study what supernovae were like when the Universe was young, and because it will help us to build more precise models of the mass in the foreground galaxies and galaxy clusters that are acting as lenses.

Scientists are hoping to use gravitational lensing to map out the shape of dark matter halos in individual galaxies (rather than in statistical samples of galaxies). By doing that, we'll be able to learn about whether star formation worked differently in the early Universe, compared with now. A lot of our measurements are based on the assumption that star formation has always been the same, but that may not be true. And if it's not, then there'll be a lot of consequences! It's a tricky thing, though, measuring dark matter distributions in individual galaxies.

The real hope, of course, is that our measurements will get precise enough that we'll be able to map out how dark matter is distributed in three dimensions.

You mentioned in your talk that the focus is now on trying a develop a direct, rather than statistical look at Dark Matter. What more needs to be done in order to accomplish this?

Dr. Nick: To do this, we need two things. The first is still more (and better) data. In the case of dark matter distributions in individual galaxies, we need long-term monitoring. That lets us build up gravitational lensing light curves, which encode detailed information about the mass distribution of the lens galaxies (how much of the mass is in compact objects like stars, how much is in smooth dark matter, what masses are the stars, etc). Currently that is a serious effort, but in the near future, (with surveys like LSST) we'll get that data for free -- light curves observed once every few nights over a period of 10 years.

We're then going to have to develop new tools for analysing those light curves.

They contain a lot of information, but they're tricky to decode. Current methods require huge computer simulations which are only feasible for a handful of gravitational lensing systems. In the future we'll have hundreds or thousands of these systems, and so we'll need a new way to analyse that data. We haven't figured that one out yet, but machine learning might be useful. You can train an algorithm on large sets of simulated data, and then give it a real observation, and hopefully it'll be able to tell you what set of parameters (dark matter fraction, mass distribution of stars...) led to that real observation.

I guess the short answer (as always for astronomers!) is more data, and better simulations!

Quote: The name "dark energy" is really just code -- we know something is causing the expansion of the Universe to accelerate, but we have no idea what it is, so we call it "dark energy" Dr. Nick Bate.

Last, any final words on Dark Energy?

Dr. Nick: I would say that unlike dark energy, dark matter is at least generous enough to experience one of the four fundamental forces. Ordinary matter experiences electromagnetism, the strong force, and the weak force, as well as gravity. Dark matter (at least as far as we can tell) experiences only gravity, but at least that's something familiar. Dark energy is something else entirely. It is causing the expansion of the universe to accelerate, but how it is doing that is a complete mystery. There are almost as many ideas for what dark energy might be as there are physicists who study it!

Charlie

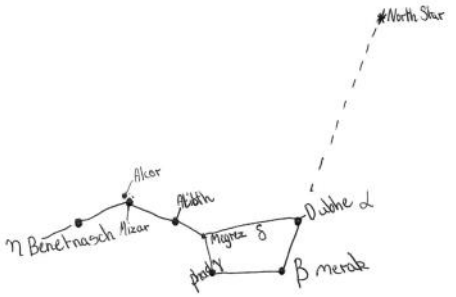
MY FIRST STAR PARTY

This was my first star party and my first time ever looking through a large telescope. I got invited to stay in a caravan for the weekend at Kelling Heath.

We looked at planets, Saturn and Mars, we also looked at some Galaxies and Nebulae such as Andromeda, the Milky Way, the Ring Nebula and the Witches Broom Nebula. We looked at many constellations

I loved Kelling Heath since everyone was so friendly and willing to let me look through their telescopes; I even looked through an eighteen inch Dobsonian Reflector telescope which the man had made himself and an 80mm Refractor telescope. I went to the stalls to have a look and bought two incredibly magnetic meteorites and a small mars rock. The man running the stall was very friendly. We went to one of the talks; it was in 3D and they showed and told us all about the different Nebulae and Constellations. They were so beautiful!

Each star within a constellation has a different Greek letter which varies depending on their brightness; the main stars also have names. Another astronomer showed me how to write some of the Greek alphabet! They have pretty walks at Kelling and some very friendly sheep; you can buy food to feed them!



Lacie Flood
(aged 9)
(September 2018)

07/09/2018 kelling

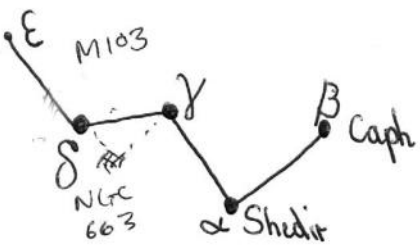
Planets

Mars

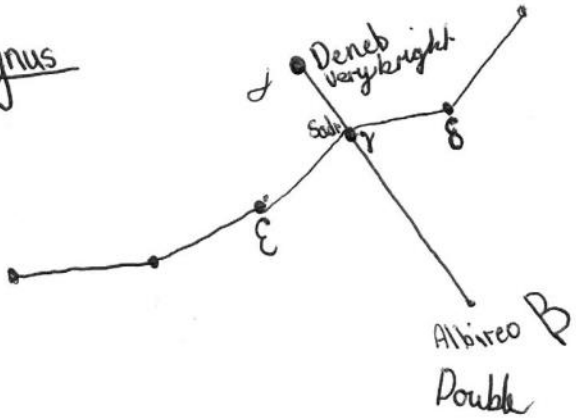
Saturn and its rings.

Constellations

Cassiopeia



Cygnus



Galaxies

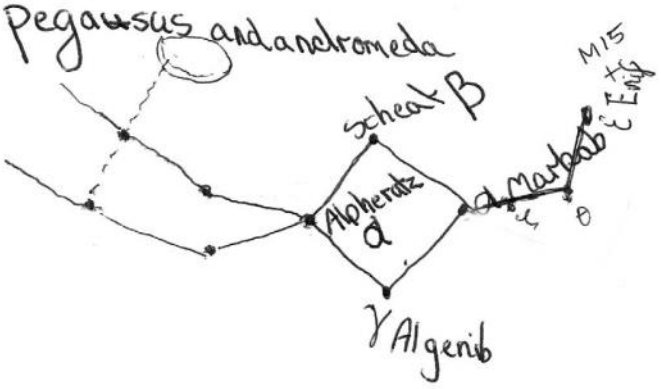
Andromeda

Milkway

Clusters

Double cluster

Pegasus and andromeda



Nebulae

The ring Nebula

The dumbell Nebula

The witches Broom

Andrew Sutkowski

Wolf-Raylet Stars

Wolf-Raylet (WR) stars are rare stars with unusual spectra comprising peaks for highly ionised helium, nitrogen, oxygen or carbon. I agree, I had never heard of them either, until I looked for some more interesting targets for my Paton Hawksley star analyser grating (SA200). However, being tenacious I managed to track them down. The WR star designation does not appear in common databases (Deep Sky Planner, Stellarium, etc.) so I had to hunt them down. I found a web site for Wolf-Raylet star spectroscopic survey (www.astrosurf.com/buil/survey/wrstars/wrstars.html#WR1) which lists the stars, along with their Henry Draper (HD) catalogue number, R.A., Dec., type and magnitude. The site also contains example spectra from these stars. The list contains 30 WR stars from magnitude 6 to 13 visible in the Northern hemisphere. There are only ~150 WR stars known in our galaxy. From the HD number I was able to find the stars in Deep Sky Planner and produce an observing list. I then waited for clear night skies and on 7th March 2018 performed my first observations. As soon as the telescope slewed to the target star (WR1), I completely understood why they have unusual spectra (Below).

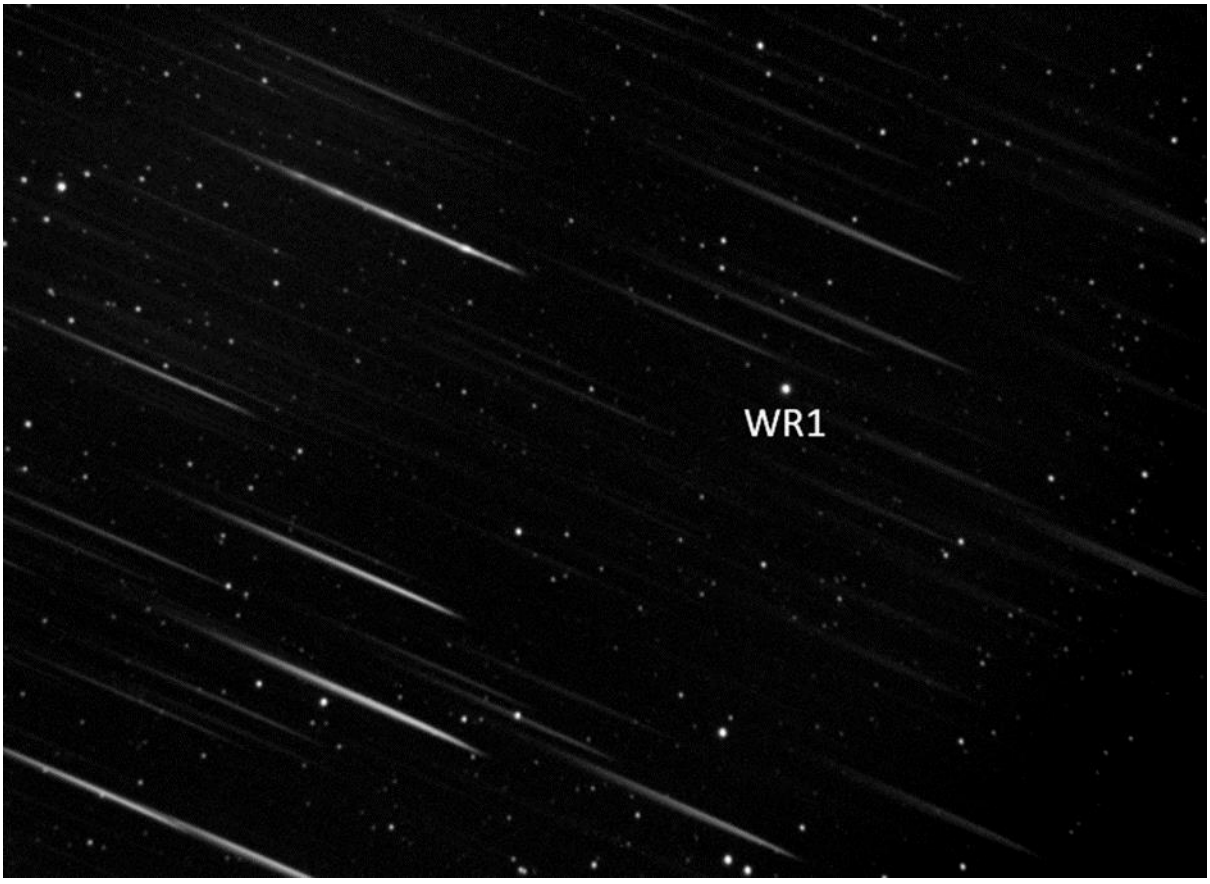


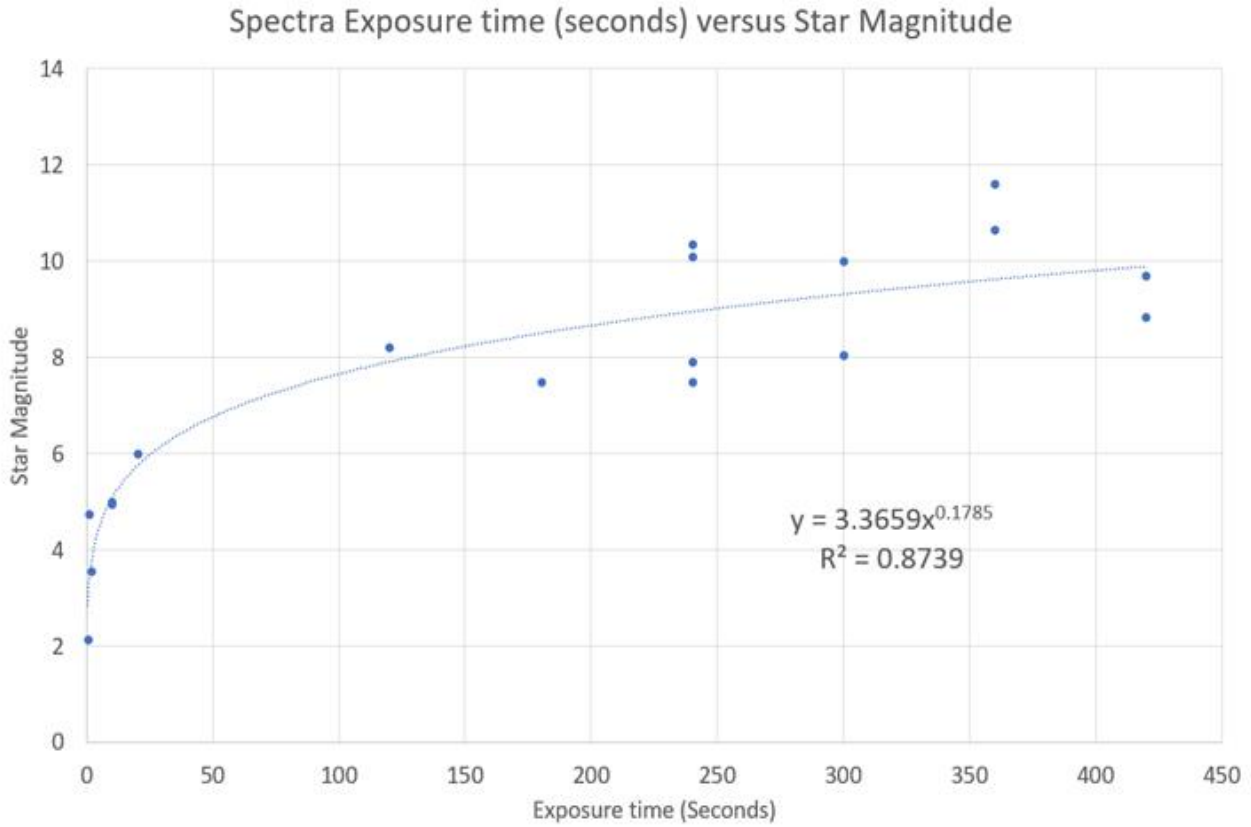
Figure 1. Image of WR1 (HD4004) taken through 8"SCT with 0.63 field flattener, SA200 grating using Atik314L camera with guided 300 sec exposure.

When you observe stars through the SA200 (or SA100) grating the presence of streaks of light, that contain the spectral information, are also observed. These spectra streaks appear on both sides of the star (the actual orientation being influenced by the specific rotation of the grating to the imaging sensor) but, normally one side is significantly more intense than the other. Hopefully you can see, from Figure 1, the presence of the spectra streaks from other stars within the field of view along with one streak that looks 'lumpy'. This 'lumpy' spectral streak originates from the star WR1 (indicated in Figure 1) and shows why they are classified as having unusual spectra.

Wolf-Raylet stars are large, over 25x the size of the sun, towards the end of their evolution. They are ejecting hot gas at high speed (typically 2000 km/s) but also have exceptionally high surface temperatures (about 100,000 K). Owing to this they have lost their atmospheres, having exposed their heavy cores. There are three types of Wolf-Raylet stars, WN, WC and WO. The WN type have dominant spectral lines for helium and nitrogen whilst the WC type have dominant spectral lines for carbon, oxygen and helium. The WO types are rarer and similar to the WC type but with a more prominent oxygen spectral line.

In 1867 Charles Wolf and Georges Raylet, using a 40 cm Foucault telescope at the Paris observatory, discovered three stars in the Cygnus constellation with these unusual emissions bands in their spectra. This led to the WR designation for stars of this type. Edward Pickering had various theories about the cause of these emission lines but noted that the spectra of the Wolf-Raylet stars was similar to that for nebula. This led to the conclusion that some, or all, of the Wolf-Raylet stars were the central stars of planetary nebulae.

I experienced a number of challenges in obtaining spectra of the Wolf-Raylet stars, notably the absence of clear night skies (until May) and the stars actually being above my observable horizon! However, in order to provide an educational and fulfilling article I have persisted in this quest. A minor but, somewhat limiting challenge, is the fact that my equipment struggles to observe objects with a magnitude >7-8 (Graph Below).



Graph:
Plot of spectra exposure time versus star magnitude for the current series of observations.

It is possible to gather multiple exposures and combine them, along with stretching an image to bring out fainter details, to visualise fainter objects. However, my use of the RSpec analysis software is strictly opening a raw data file and processing to create the spectrum for the stars in the filed of view. Thus, I restrict myself to single exposures of varying length to find the optimum for a given star.

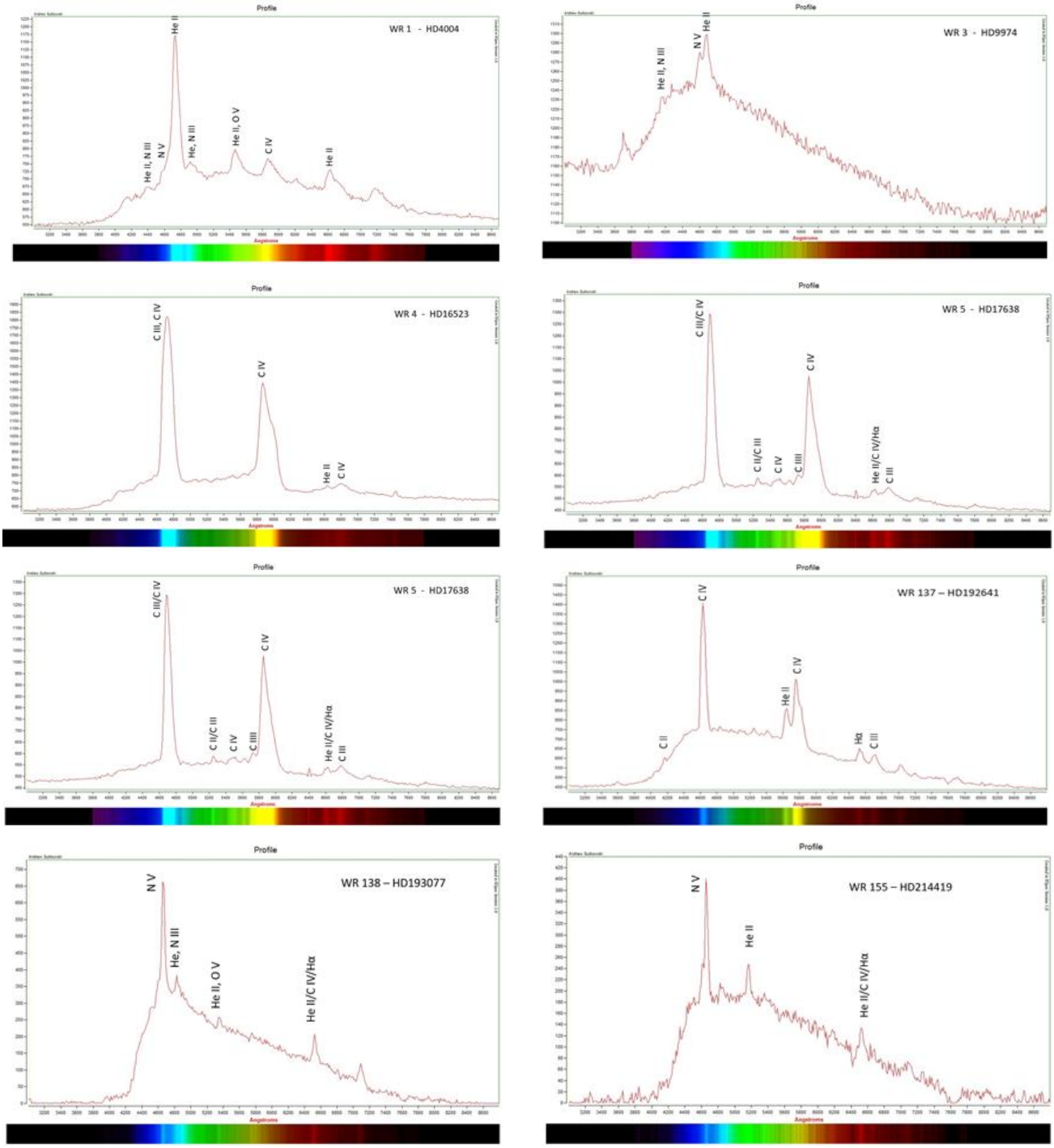


Figure 3: Spectra of the Wolf-Raylet stars WR 1, 3, 4, 5, 137, 138 and 155 with the main peaks assigned (tentatively).

The spectra of the Wolf-Raylet stars I did manage to capture are shown in Figure 3, along with peak assignments. However, I give no guarantees on the accuracy of the peak assignments as different sources on the internet have different definitions of peak assignment. Of these spectra, WR 1, 3, 138 and 155 are WN type with dominant Helium and Nitrogen spectral lines whilst WR 4, 5 and 137 are WC types with dominant carbon, oxygen and helium spectral lines. For comparison the spectra from 'normal' stars Vega and SAO30230 are shown in Figure 4. These stars exhibit the normal spectral curve with dips where wavelengths of light have been adsorbed as it passes through the atmosphere of the star or a gas cloud (nebula) in between the star and observer. The pronounced peaks from emission of light at specific wavelengths in the Wolf-Raylet stars is now obvious.

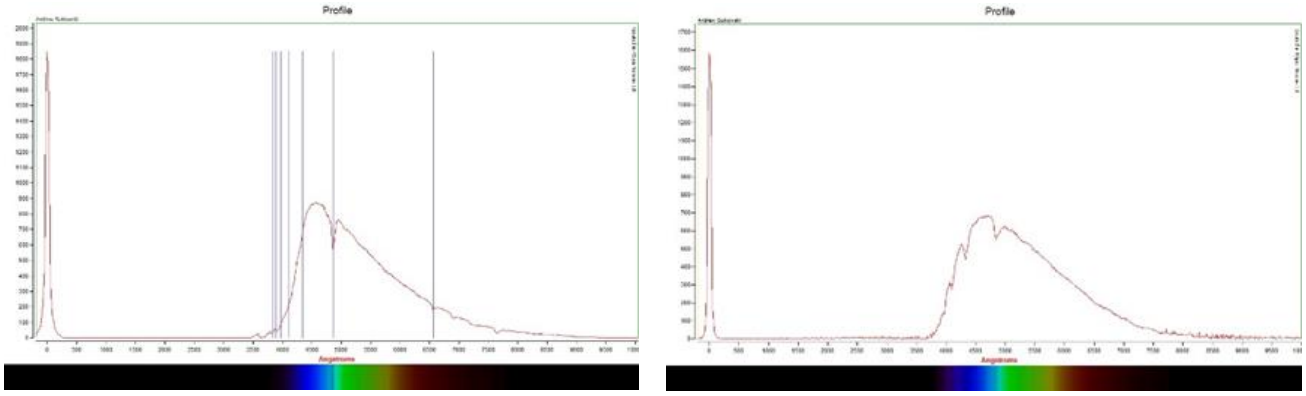


Figure 4: Left - spectrum of Vega overlaid with H Balmer line series where adsorption of Hβ at 4861 Angstrom is visible as dip in curve; Right – spectrum of SA030230 which shows a series of adsorption lines for hydrogen as dips in the curve.

As explained earlier, it has been suggested that some, or all, of the Wolf-Raylet stars were the central stars of planetary nebulae. In performing this investigation I have used a dual-scope set-up where I use a high magnification scope to capture the spectra images but simultaneously capture a wide field view with a second scope. I have only managed to find one example, from those observed, where the Wolf-Raylet star lies at the centre of a planetary nebula. WR 136 lies at the within the Crescent Nebula, as shown in Figure 5. My own opinion is that WR 136 is not central to the nebula, thus there is probably another star that gave birth to the nebula, but I am no expert!

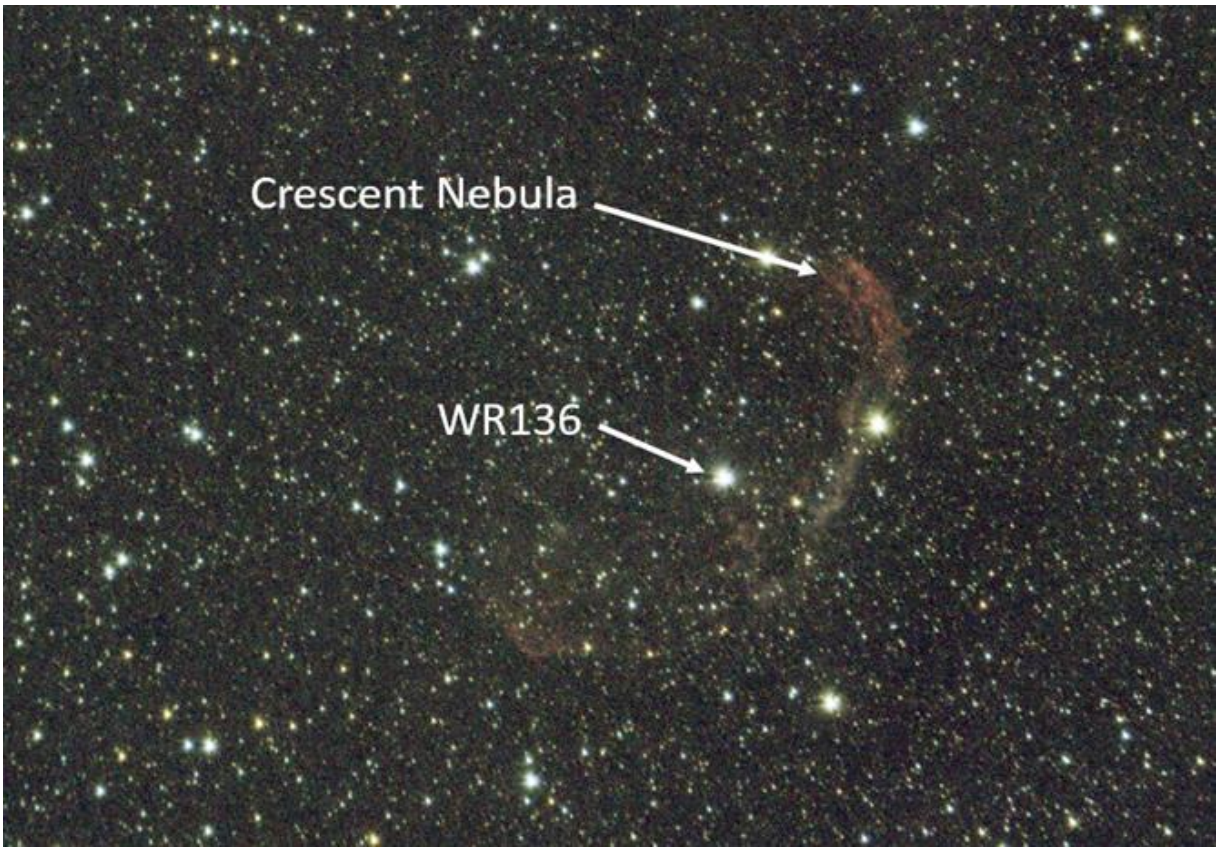
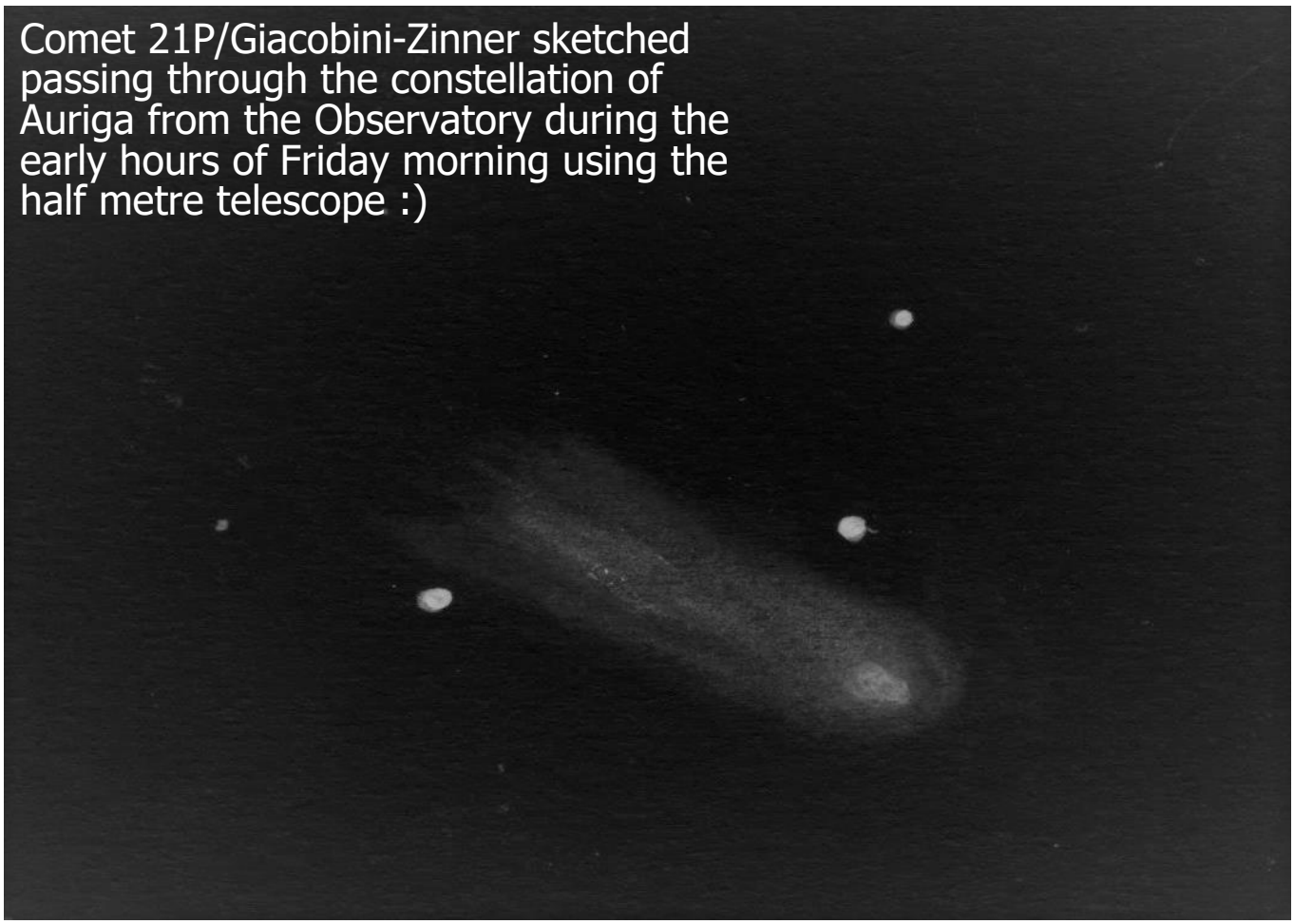


Figure 5: Image showing the position of WR 136 within the Crescent Nebula (34 x 50s OSC images processed and stacked).

Ok, I admit I had never heard of Wolf-Raylet stars before looking for something else to point my Star Analyser (diffraction grating) at. This voyage of discovery has demonstrated that there are a wide variety of stars in the heavens, some with distinct and unusual spectra. It is surprising how varied the spectra of stars are, and I hope you will join me in marvelling at the night sky, through a grating, someday.

MEMBERS'IMAGES



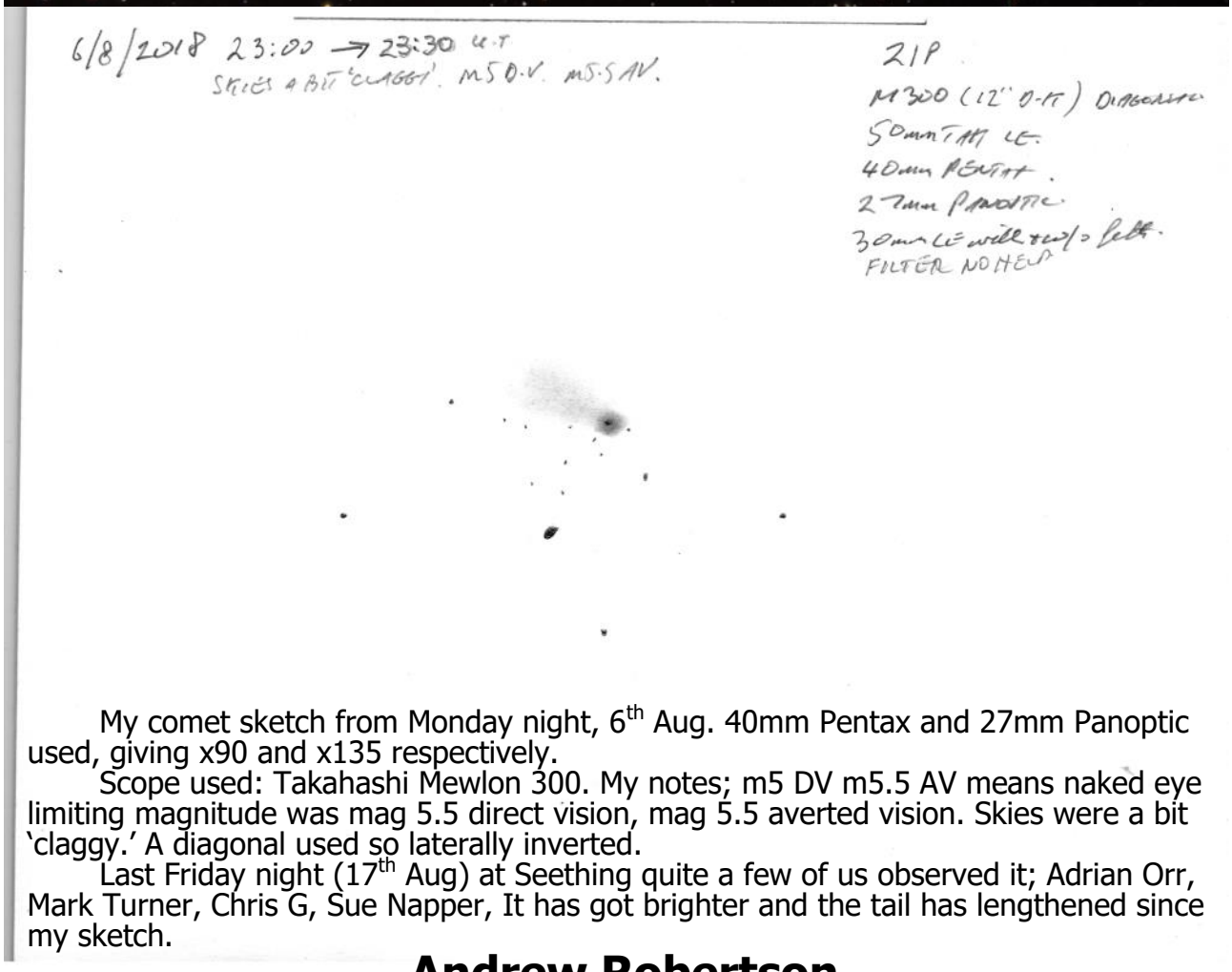
Visual Observing at Seething.
Observers are
Andrew Robertson
Adrian Orr
Chris Greenfield and
Sue Napper.

Image by

Tom Latham

It's been a very challenging apparition with Mars so low down in the murk and then the dust storm obliterated most of the surface detail around opposition.

Geof Lewis



My comet sketch from Monday night, 6th Aug. 40mm Pentax and 27mm Panoptic used, giving x90 and x135 respectively.

Scope used: Takahashi Mewlon 300. My notes; m5 DV m5.5 AV means naked eye limiting magnitude was mag 5.5 direct vision, mag 5.5 averted vision. Skies were a bit 'claggy.' A diagonal used so laterally inverted.

Last Friday night (17th Aug) at Seething quite a few of us observed it; Adrian Orr, Mark Turner, Chris G, Sue Napper, It has got brighter and the tail has lengthened since my sketch.

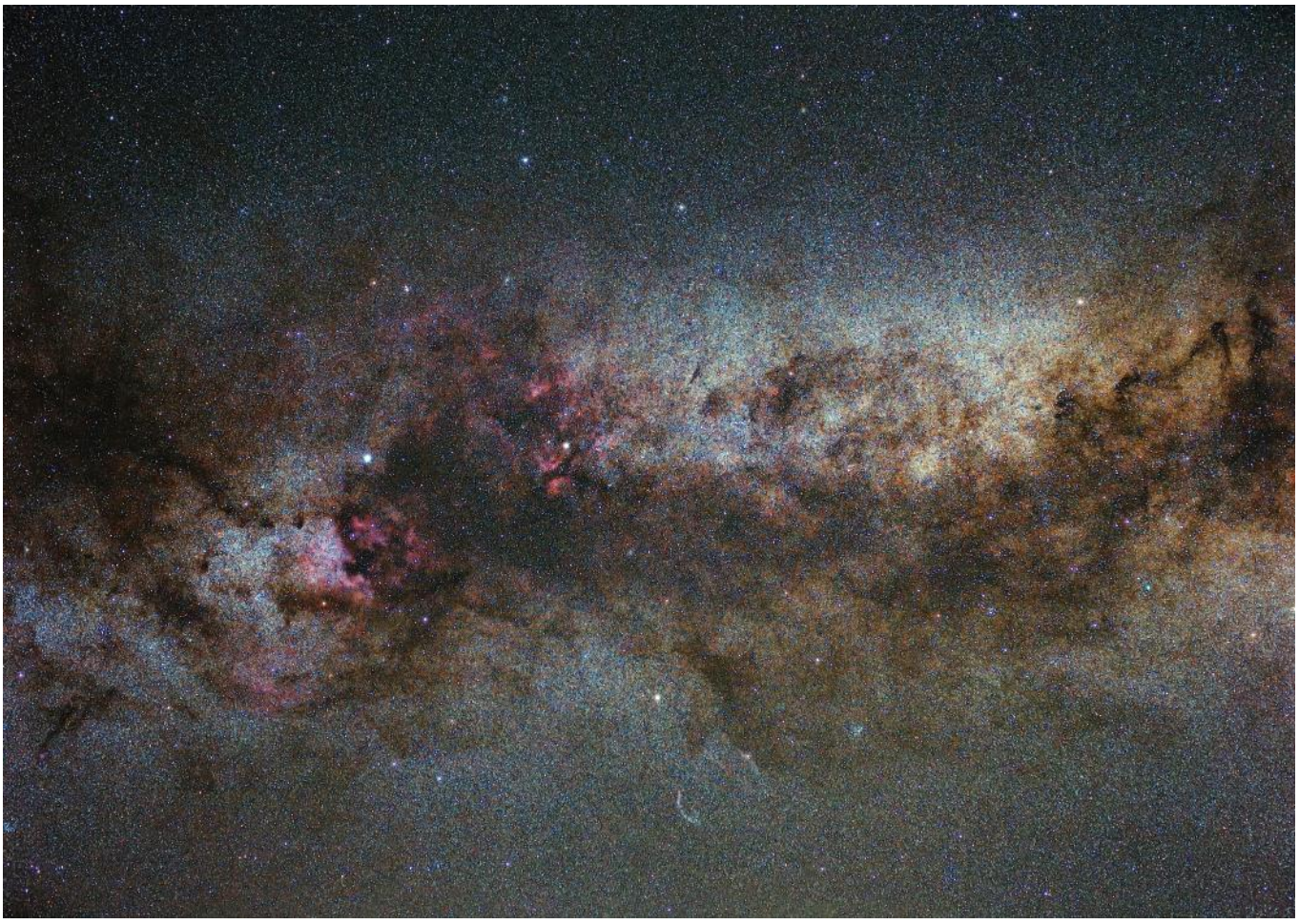
Andrew Robertson

The Milky Way, a closer Look

By Shaun Reynaulds

I have had the idea of perhaps doing some tracked constellations for some time now but have never got round to doing it. Partly because I like to get my deep sky imaging in at the times when we get clear skies through the winter (a rare thing these days) but more so because I tend to be lazy in doing something new!

I got the very good Skywatcher Star Adventurer actually last year at Martin Striland's UK Astro Show. I had the notion of taking it to New Zealand with me this year but alas, the weight and complexity of setting up in a totally different location with unfamiliar skies filled me with dread. So, consequentially it sat there in its packaging for over a year just gathering dust. However, with the dark nights about to return I turned my attention to having a look at this dust gathering box and got it out to try. And to my delight, found it very easy to put together and polar align.



I had a go at first in the back garden pointing to Cygnus and did 10 by 50 second exposures. The result was immediately obvious, the detail and clarity not to mention the better and smoother resulting image was obvious. (Fig 1)

So, without fail I set off the next night to my favourite dark(ish) site around Ilketshal St Margarets along with Cathy who likes to observe. She had forgiven me for the previous time when we were confronted by 6 cows !

I did a series of exposures and settled on 1 minute at ISO 2000 f2.8 and did a stack of 10. I went from Cygnus which was right overhead at the time and did my stack. I decided pretty much there and then to do a Panoramic so I continued to do 10 x 1 min exposures between Cygnus to Sagittarius.

The moon started to rise by then so we headed home.
I put these together in Photoshop after using Auto Pano to stitch the 5 stacked images and was pleased to see the detail (Fig 2 above)

However, true to my obsession , I wanted more and decided to add the other part of our Galaxy from Cygnus to Cassiopeia (any further brought me into heavily light polluted skies)

I arranged another trip the next night, I called Jason Durrant to see if he wanted to go with me which he did.

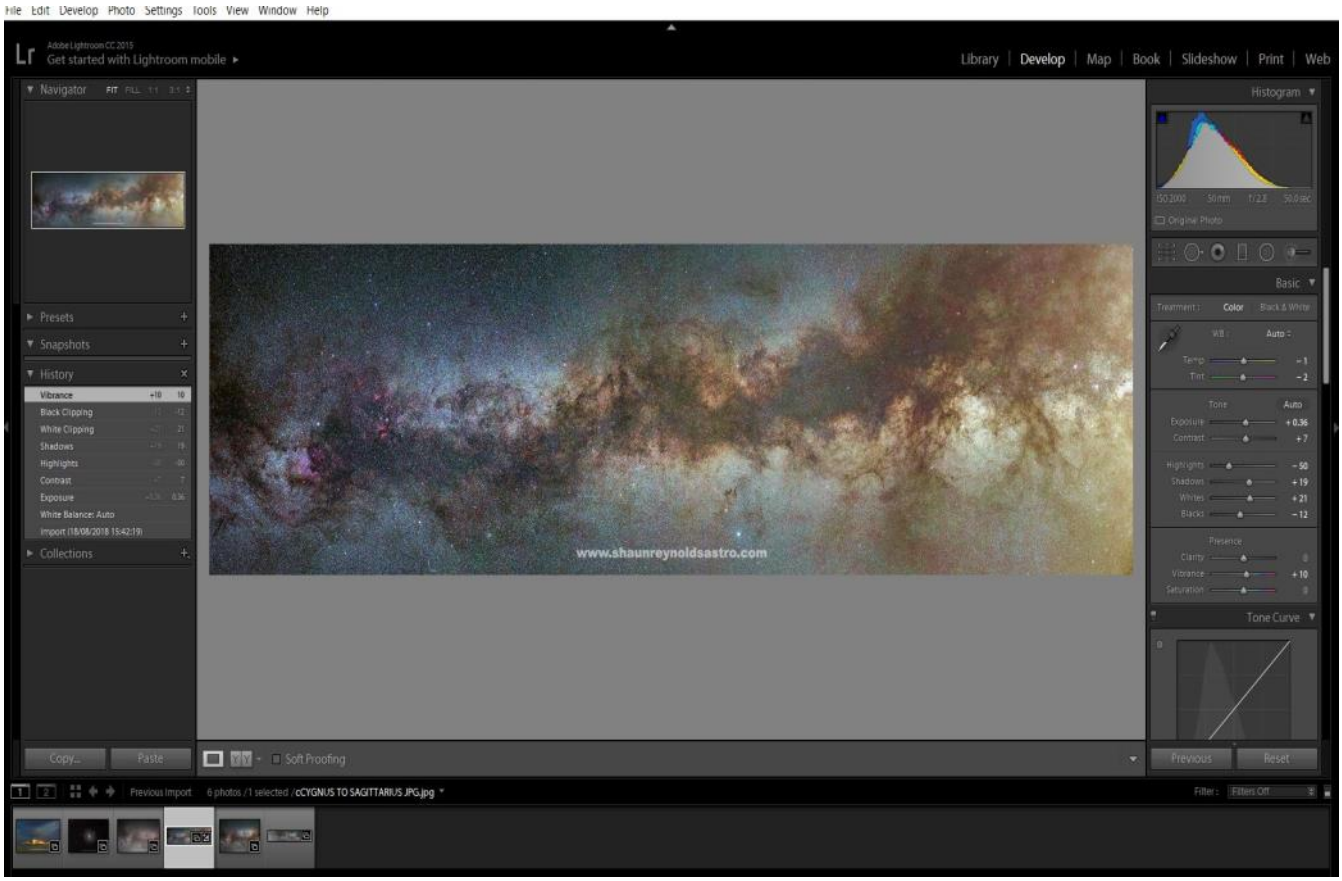
We arrived there and set up. Takes a while with the Adventurer to set up but all was good. Once setup however it became obvious we were in for some shall we say, obstacles, namely, a Combine Harvester going up and down the field directly behind us! Never to be put off we soldiered on like pro's!-) Unfortunately, said Harvester decided he was finished with that field and promptly drove off and turned directly towards us! Lights blazing like (in the quote from Jason) a travelling Pink Floyd Light show!!

I had to very quickly pick up my carefully aligned mount and run to the side of the road and drive the car off so he could make his way somewhere else. Jason said he gave the farmer a polite salute!

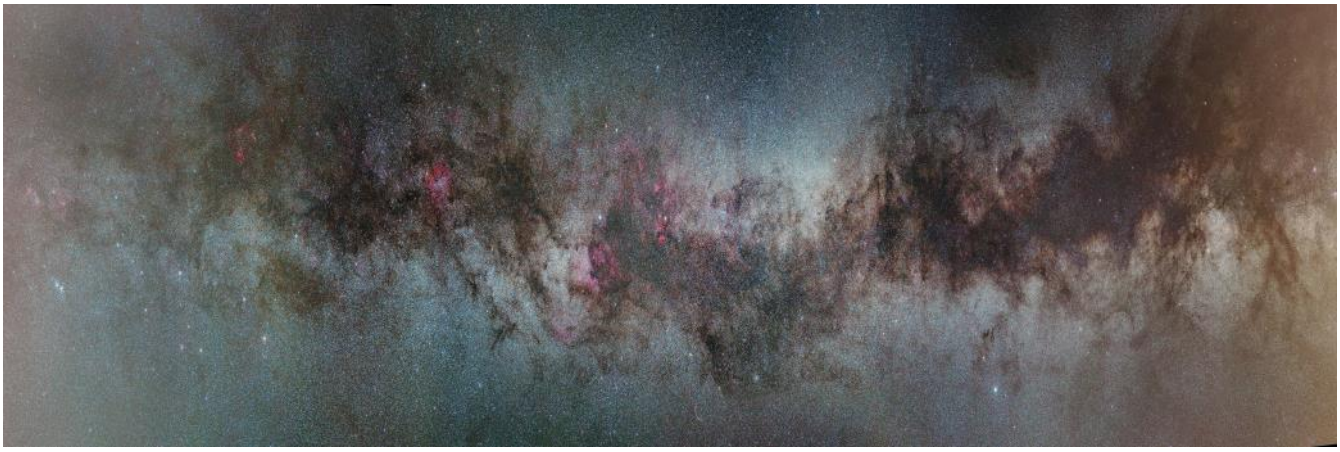
I set up once again and we carried on, he didn't move far, in fact he went to the field opposite us this time and carried on up and down . The exposures had to be timed around his ploughing. In the end though we both got what we came for and I ended up with a 9 pane stacked panoramic of most of the milky way seen from our latitude.

The processing took quite some time from converting all 80 images to Tiff files so as to stack in Photoshop, then the stitching was done in Auto Pano. Once stitched, it was taken back into Photoshop and Lightroom for some serious manipulation.

There were many steps to this and to explain all would take the entire magazine! So to summarise A white balance , exposure , highlights and shadows were adjusted to suite. Some defringing applied and small noise reduction (Fig 3 Next Page)



From there, it came back into Photoshop. Levels, Curves and some layer blending were used along with colour selective enhancement. Being such a wide field of view, the gradients were quite severe so a lot of gradient matching was also done to help with Light Pollution etc. Some selective curves also used within the milky way lanes to help give some detail



The final result (Fig 4) gave quite some detail and for an unmodified camera (Canon 6D) the nebulosity was very good.

My only wish is that I persevered earlier with the Star Adventurer and took it with me to New Zealand.... ah well, guess ill have to go back and do it properly!

Shaun

Roger Preece

Life, The Universe, and Everything!

During the Astronomy & Space for Young Persons event at Seething this year, I was walking back from the rocket assembly workshop to reception alongside two couples, with both the men pushing buggies, and with a number of children trailing along. Two of the children were listening avidly to the passionate discussion taking place between the two women. The subject was the possibility or otherwise of alien life in the galaxy. 'How splendid', I thought, 'what an excellent subject for discussion on a June afternoon in Norfolk!'

Of course, it is not a new discussion. There are even mathematical postulates involved, such as the famous Drake equation where $N_{b,}$ the number of civilisations in the galaxy $= R^*F_pn_cF_lF_iF_cL$, with R^* being the average rate of star formation in our galaxy, F_p the fraction of those stars that have planets, n_c the average number of planets per star that can potentially support life, F_l the fraction of planets that could support life that actually do so at some point, F_i the fraction of planets with life that actually go on to develop intelligent life (civilisations), F_c the fraction of civilizations that develop a technology that releases detectable signs of their existence into space and L, the length of time for which such civilizations release detectable signals into space.

Frank Drake first wrote the equation in 1961, and emphasised that it was largely a device for stimulating discussion about the subject, his passion being SETI, the Search for Extraterrestial Intelligence, based at the National Radio Astronomy Observatory at Green Bank, USA. The Fermi Paradox, originating with the physicist Enrico Fermi, had already posed the question "where are they?" In Fermi's view, if alien intelligence was widespread, why was it that there was apparently no evidence of it? The paradox is due to the apparent contradiction between the lack of evidence and the high probability of alien intelligence as a result of calculation.

There have been many efforts to explain away the Fermi Paradox, from the ingenious and logical to the far-fetched, from Dyson spheres which completely enclose a solar system to the notice board just this side of Alpha Centuri written in a number of galactic languages which reads "Wildlife reservation ahead – keep out". It is also worth remembering that there has been a major debate about whether humans should deliberately (rather than passively as a result of television transmission leakage) transmit our presence. The late Stephen Hawkings, for example, was strongly opposed to any such attempt, fearing an interstellar version of the civilisation clashes all too familiar in our human history. Perhaps aliens might adopt a similar point of view, which is why we do not hear from them.

Since the Drake equations, and its variations, was first proposed, there has been major progress in entering realistic values for some of the variables. There are viable calculations for the rate of galactic star formation, and with the exoplanet searches now taking place estimates can be made by extrapolation. Using new systems likely to be available over the next few years, such as the James Webb space telescope and ground based adaptive optics, astronomers should be able to start entering values for $n_{c,}$ the habitable planets per star value.

Estimates for such variables as the lifetime of a civilisation will remain pure guess work until such time as one is encountered, if ever. My own personal view is that we are more likely in the future to make such estimates as a result of astro-archeology rather than astrobiology. Given the timespan of the galaxy and the distance apart of any potential civilisations, we may be more likely to encounter long abandoned ruins on some far flung planet, than to have the unnerving experience of a vast star ship breaking heavily into orbit around the earth.

Roger

Andrew Sutkowski

What difference do 'dark skies' make?

I have been curious for some time about how much difference do 'dark skies' actually make in astrophotography. It is obvious that dark skies, i.e. absence of light pollution, make a large impact with respect to visual observing where feinter objects are easier to observe. However, with astrophotography you are gaining huge levels of contrast and signal to noise through stacking multiple exposures of the same object. Thus, do dark skies actually make a significant impact in astrophotography? I can already hear the chorus of 'of course' but where is the evidence?

I have tried over a number of sessions to capture images of the same object from my home location in Norwich and the Seething observatory with the same equipment under as near identical conditions. I finally achieved this goal on 29th/30th June (home) and 2nd/3rd July (Observatory). The moon was 60-70% but low in the sky and rising late (I was able to observe it from the Genesis at ~2:00 am on 3rd July, having already viewed Venus, Jupiter, Saturn and Mars).

In both sessions I imaged M101 over the period from ~11:30 pm to ~3:00 am. Prior to and after these times daylight impacts the images. The equipment used was an i-Optron CEM25 mount loaded with 6" SCT, f6.3 focal reducer, 5 position filter wheel and Atik 314L mono camera. Piggy-backed on this is an Explore Scientific ED80 with Altair Astro 183C one shot colour camera.

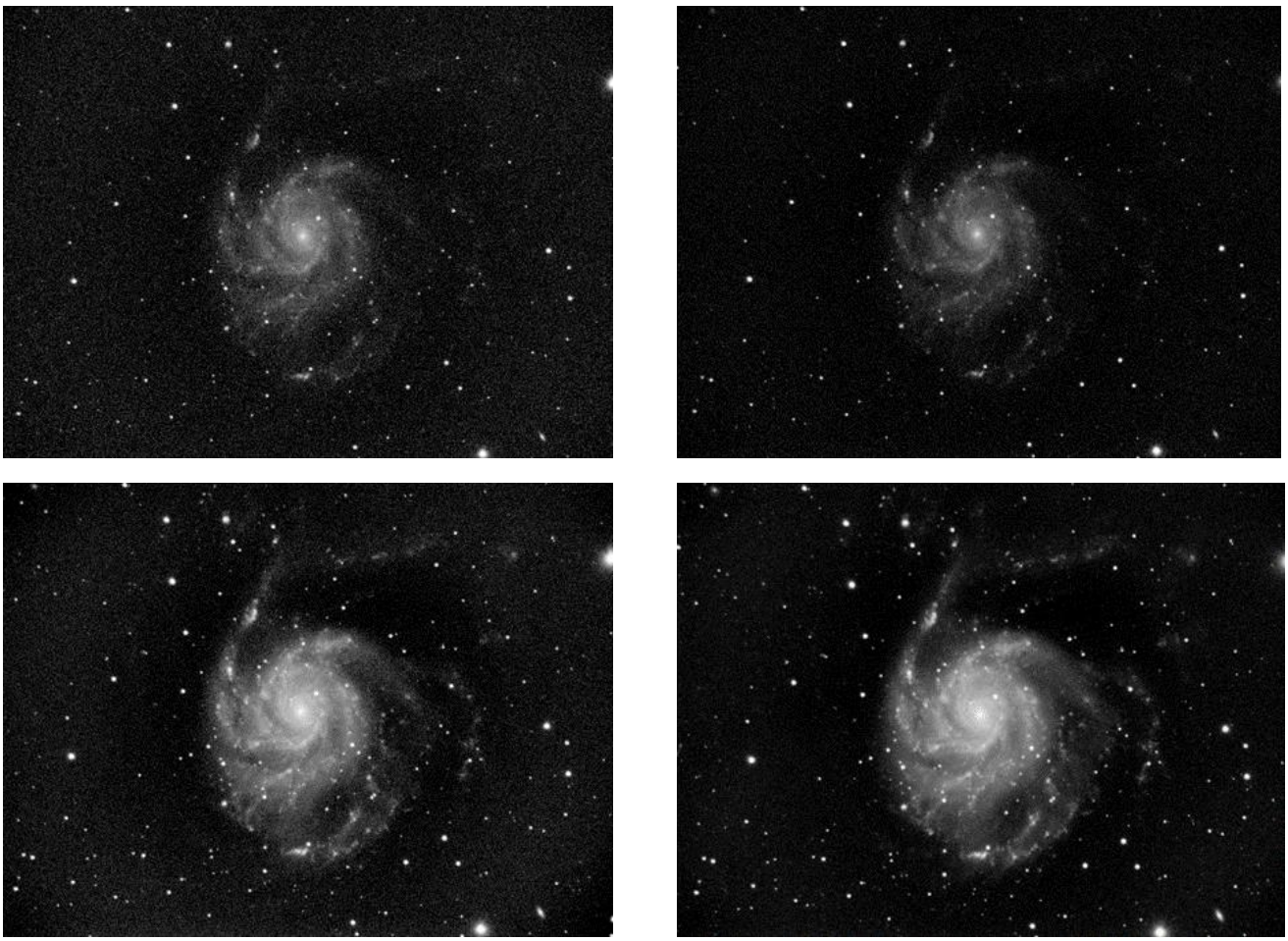


Figure 1: Atik 314L luminence exposures; Top left 10 x 30s from home; Top right 10 x 30s from Seething; Bottom left 5 x 600s from home; Bottom right 5 x 600s from Seething.

The images in Figure 1 are calibrated (Bias, Dark, Flat) stacked images which have been stretched to make the background dark but, without any artistic or more complex processing. From these there is little difference between images captured at home or at Seething. Figure 2 compares 5 versus 10 600 s exposures taken from Seething. On balance the greater the number of exposures has a larger impact than location where the images were captured.

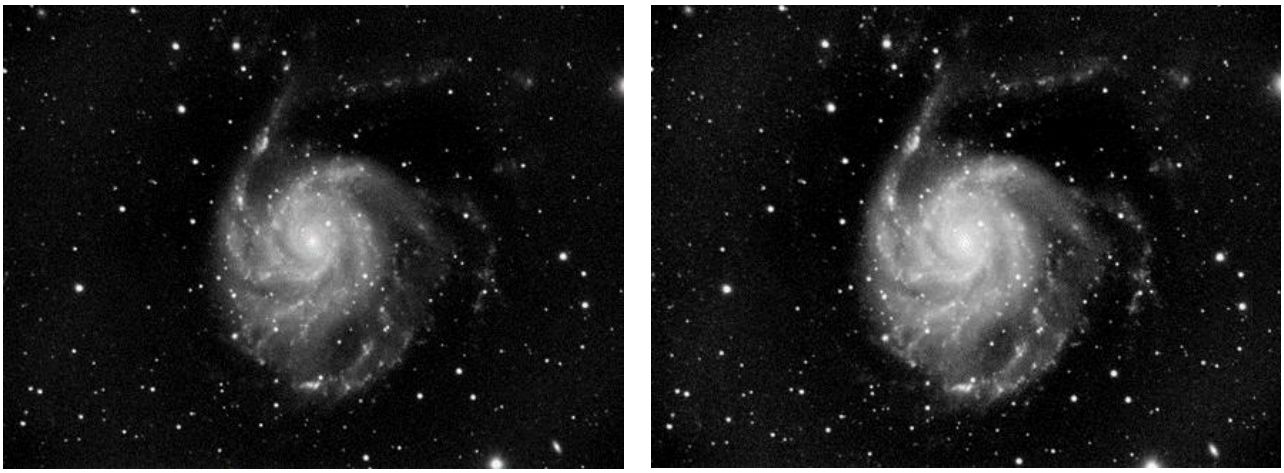


Figure 2: Atik 314L luminance exposures from Seething; Left 5 x 600s; Right 10 x 600s.

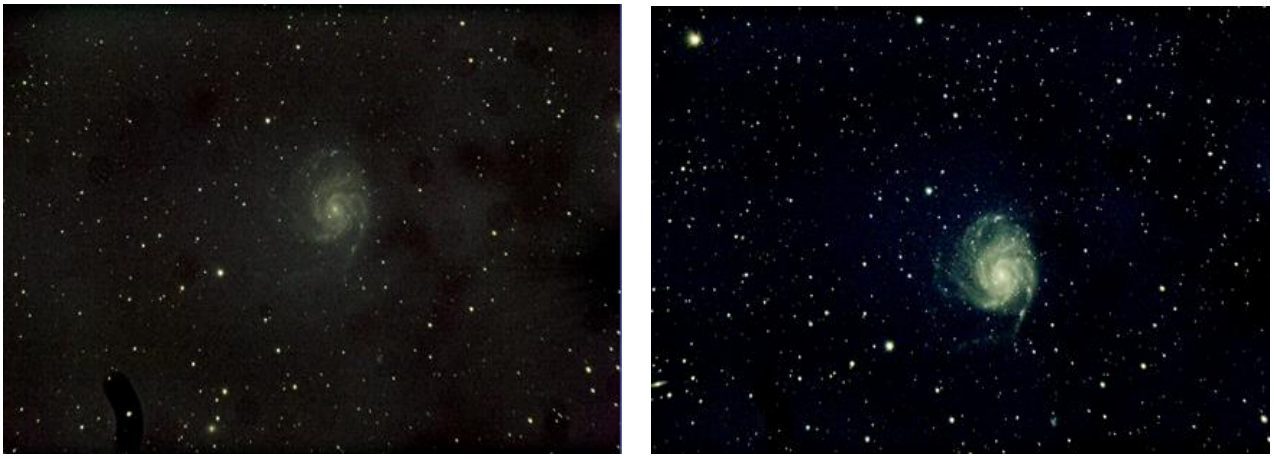


Figure 3: Altair Astro 183C images; Left 137 x 50s exposures from home; Right 137 x 50s exposures from Seething

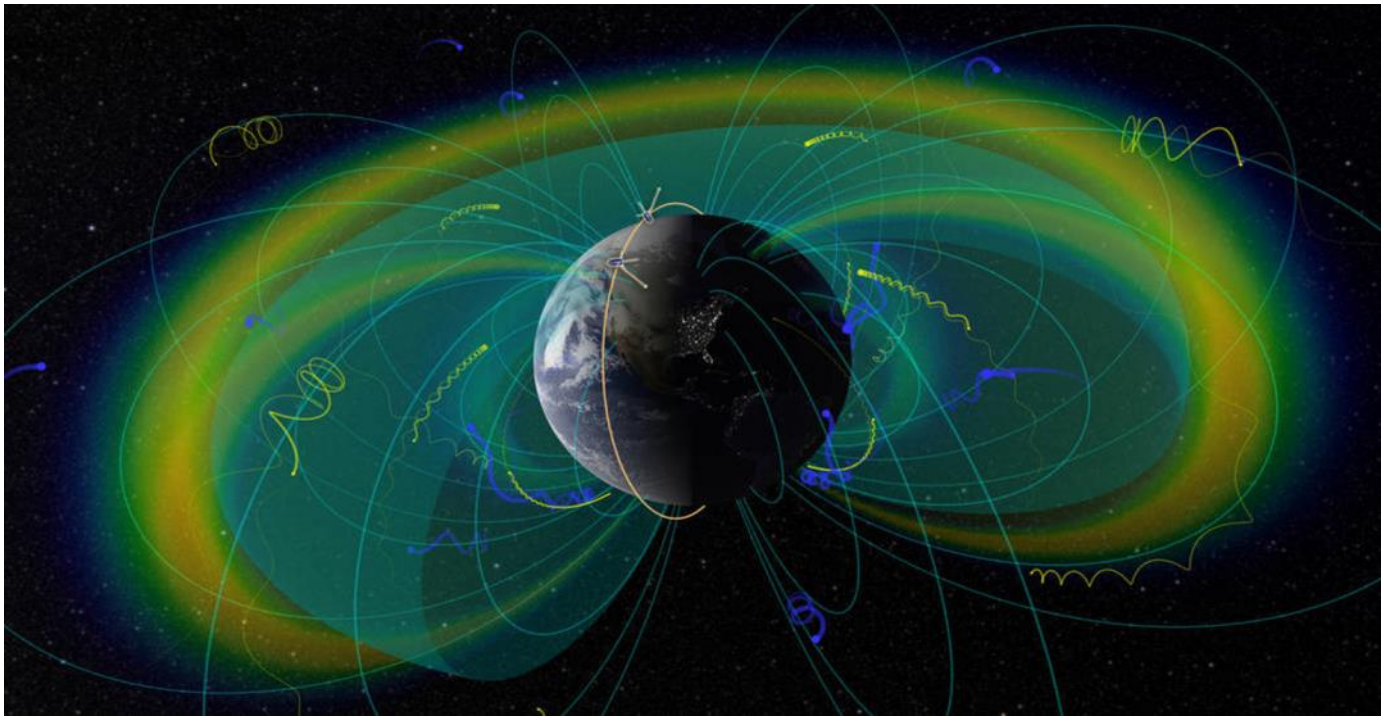
Figure 3 shows the comparable images from the one shot colour camera. Here there is a distinct difference with the images from Seething having greater contrast and depth of colour. There is a difference in position (due to movement in the alignment of the ED80 between locations) but, again these are calibrated (bias, dark), stacked images and stretched images without further processing. It is possible that the stretch on the Seething image is stronger than the home image, but there remains a huge difference in the level of detail and contrast from the two locations.

My conclusion from this is that light pollution has a far greater impact on one shot colour images than on monochrome images. An additional insight is that I was unaware just how many galaxies you can see (image) in the night sky. There are at least 5 additional galaxies in the images present here.

Andrew

ELFIN - Study How Electrons Get Lost - Designed, Built by UCLA Students

ELFIN is a CubeSat mission. CubeSats are small and lightweight satellites.
When magnetic storms form in near-Earth space, they create waves that jiggle Earth's magnetic field lines, kicking electrons out of the Van Allen Belts and down into our atmosphere. ELFIN aims to be the first to simultaneously observe this electron precipitation while also verifying the causal mechanism, measuring the magnetic waves and the resulting "lost" electrons.



An artist's depiction of the Van Allen Belts, showing Earth's magnetic field lines and the trajectories of charged particles trapped by them.

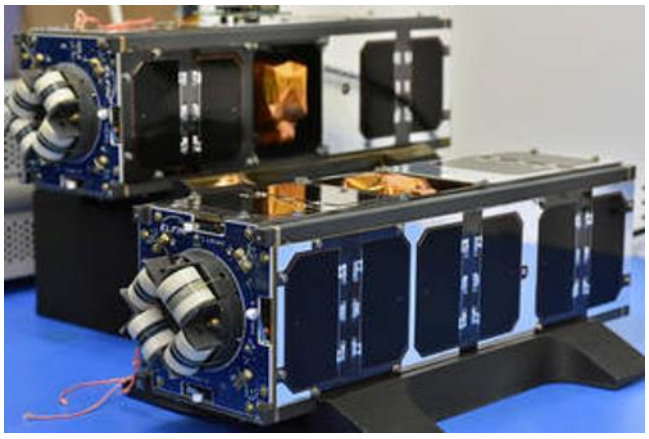
The twin ELFIN spacecraft are shown following their inclined polar orbit, traced in yellow.

Credits: UCLA EPSS/NASA SVS

The twin ELFIN CubeSats. Each are roughly the Size of a loaf of bread.

Credits: UCLA EPSS

CubeSats are small and lightweight satellites, measured in standardized 10-by-10-by-10 cubic



centimeter units, that are comparatively quick to develop and come with a price tag at a fraction of larger satellite missions. By using two satellites instead of one, ELFIN will be able to measure how the precipitated electrons vary across space and time. Designed, built and tested by a team of 250 UCLA students, ELFIN will be the first satellite developed, managed and operated entirely by UCLA, but funded by NASA. Advantage of CubeSats is that they allow inexpensive means to engage students in all phases of satellite development, operation and exploitation through real-world, hands-on research and development experience.

ELFIN hitched a ride on 15/9/18 as a secondary payload on the Delta II rocket with NASA's Ice, Cloud and land Elevation Satellite-2 (ICESat-2 mission).
ICESat-2 will measure the thickness of ice sheets, glaciers, sea ice and more.

Taken from NASA article with UCLA EPSS student taking the images

Debbie

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Robert Turner
Rick Greer
Chris Stanghan
Daniel O'Toole

FORTHCOMING EVENTS

12th\13th October	Open Weekend. Mark Shepherd
16th\17th November	Open Weekend. Dr David Lamb
13th\15th December	Open Weekend. Roger Preece
11th\12th January	Open Weekend. Mark Turner

Please see website for further information :- www.norwichastro.orh.uk/events

THE DEADLINE FOR COPY FOR THE NEXT ISSUE OF CYGNUS IS
5th December 2018

This is the very latest date by which articles should reach the editor. Sooner than that would be much appreciated .