Breckland Astronomical Society

Affiliated to the British Astronomical Association and the Federation of Astronomical Societies

EXTRA TERRESTRIAL

Newsletter November 2020

Registered Charity no, 1044478

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Copy is always needed for this newsletter. Articles with an astronomical theme are welcome but anything of likely interest to the membership will be considered. Text or Word documents preferred but handwritten submissions also welcome.

Chris Bailey is the newsletter editor. newsletter@brecklandastro.org.uk

Mick Ladner has kindly stepped in as visitor organiser. **visitors@brecklandastro.org.uk**

The society would benefit greatly from having a local area advertiser, please contact the chairman if you are interested.

Chairman's Notes November 2020

Gloomy clouds summed up October. So, it's been both INCREDIBLY rainy and Covid is wreaking havoc across the country putting us all on an increasingly risky path. We have restricted our movements to follow the government guidelines, but at the time of writing can still visit the observatory in a limited capacity. We have arranged, thanks to Mick, one or two personal visits until the end of the year. Of course, even this may change. Just to throw this message in, 55% of those who tested positive, didn't know of any contact who could have given them it.

So it's a waiting game for us in terms of our usual activity. End of month meetings are cancelled. We have a Zoom tour / Q&A planned for a class of school children November 2nd, at the observatory. The world is gonna be more virtual for us for a little longer.

Observatory rules November 2020 (as of October 22):

- Outdoor based meetings but now no more than 6 by arrangement.

- Sign in/out required – we'll delete your data after the 21 day period is up.

- Shared use of Observatory Eyepieces not permitted. In addition, we can record label and assign one of our existing collection of old eyepieces to each person/household, and quarantine for 72 hours.

- Maximum 2 persons with social distancing still in place in main room, dome, 1 in kitchen/toilet area.

- Hand sanitiser should be used and hand washing at sinks.

- Disposable or own brought mugs for coffee and disposable cutlery/towels.

- Visitors by arrangement only and one household at a time.

Getting back to astronomy, I managed a quick look at Mars during opposition, through Bob Greef's 8" Dobsonian telescope and compared it to our 8" Skywatcher. Mars was slightly larger in the Skywatcher and it just had the edge, optically. We used separate eyepieces. The moon rose beautifully later that evening, turning the sky from an inky black between showers, to the usual misty moonlit clag.

The Sky in November

Jupiter and Saturn slowly approach low in the South West, getting closer to their evening twilight conjunction near Christmas. Mars is a rare beacon in the evening sky – nice and high, and its phase will turn more gibbous again as it recedes. The pictures I've seen are stunning compared to its last close opposition due to the nice Northerly declination and improved seeing at higher altitudes. Don't forget Uranus and Neptune are also evening objects now.

Orion rises later in the evening still, and this is a reminder of the Leonid shower on the dark morning of the 18th – although not many expected this year, it may prove stunning in the year 2031 when comet Swift-Tuttle returns, bringing concentrated dust streams. The Leonids are very fast, they intersect Earth at about 70 km/s, producing sometimes bright green trains. This is because they ionise Oxygen atoms in the upper atmosphere, causing a chemi-luminescence. This may be a good time to check out radio meteor observation also. If you wait until next month, a better shower should be the Geminids around December 12th and 13th, which is also more of a late evening shower rather than an early morning one as the Leonids are.

I love to scan the barren region of the 'sea' (nautical themed constellation) for deep sky objects. Try searching for NGC 246 the Skull Nebula in Cetus – this is a large faint object emitting most of its light in Oxygen III (blue-green). Up high is NGC 7331 in Pegasus, which is a great galaxy to hone your observing skills. M31 is the obvious first thing to look at, but there is the beautiful edge-on NGC 891 at the other end of Andromeda.

Periodic comet C/141P Machholz appears at the start of November just North of Sagittarius in the evening after twilight – to the right of Jupiter and Saturn. It should reach a bit better than 7th magnitude and pass above the planets during December. I have seen Machholz before, and it is a faint fuzzy. This time it is passing a bit closer. We have Nick James, the BAA comet section director, speaking next year, so it may be worth planning photographic opportunities with this comet to try and impress him.

Talks

Nik Szymanek's talk started very much as usual astrophotography talks did, but towards the end the new things he was doing were mind-blowing. It was really engaging for any level of astrophotographer. Nik talked about virtual telescopes, where you can buy time in dark skies. Particularly itelescope, where he has managed to use a 1-metre scope for many hours to get ultra-ultra deep images of nebulae. He is still ahead of the rest of us in this sense. of today's standard many years ago. Ian King and him have a scope hosted in Spain, which required his attention after the talk, but he stayed on and answered the forthcoming questions, thoroughly.

Annual Quiz Night – November 13th 19:30

As has somehow become tradition, we will have the quiz night again this November. The quiz will be shorter and for individual households this year. So please tune in for the usual pub style fun and feel free to open your wine and beers. Despite it being free to join, there will be a prize for the winner, tailored to your particular taste. Donations of course are welcome, via the website PayPal button is easy, and you don't need a PayPal account.

While keeping the general knowledge theme, so it is open to everyone (and I really have tried to get a broad range of questions), this year I have interspersed the rounds with some mind-blowing awe inspiring type astronomy facts, while you can enter your

scores. I'll be broadcasting from my lab at much better resolution than usual, and will have a spreadsheet open on another PC to tot up the scores instantly.

Link to Quiz – for members of this group and can be passed on to friends of members.

https://meet.google.com/ijx-dibh-dgp

The year will end with a look again at North Norfolk's Dark Sky Festivals. We heard from Kate Dougan several moons ago when setting up a Dark Sky reserve. She has inspired us to educate and enthuse others – as this is a major way we can change people's attitudes to preventing light pollution. This is an important message for us astronomers. To complement this, we will present the clubs amazing astro-photographs from 2020. There has been something different about this year's images, we have new members sharing their new joy of new equipment and lockdown has given us more time to image from home when possible.

More fascinating tales to come in the first half of 2021 – check out the updated speaker programme.

Dan Self

Astro Dairy

November 2020

Jupiter and Saturn less than 5 Degrees apart for most of month

Comet M3 Atlas visible through Orion

Thanks to Stuart Atkinson/Cometwatch

1st November	Minor planet 8Flora reaches opposition in Cetus at Mag +8.0
2nd November	M110, M32 & M 31 well placed
3rd November	Topocentric conjunction of Hyades and Moon.
5th November	Peak of meteor shower Southern Taurids ZHR=5 (3rd-5th)
	02:30 Moon passes across the lower part of M35 Open Cluster in Gemini.
10th November	Mercury at greatest elongation 19.1Degrees Morning object
12th November	Peak of meteor shower Northern Taurids ZHR=5
12th November	Topocentric Conjuction Pluto and Jupiter (Closest conjunction of 42 arcmins is after it has set but should be visible after sunset)
15th November	New Moon 0508z
16th November	Mars stationary against background as it completes its retrograde motion and starts to move east against the background stars
17th November	Peak of Meteor shower Leonids ZHR=20+
21st November	Peak of Meteor shower Alpha Monocerotids ZHR variable
25th November	Topocentric conjunction Mars and Moon separation 4.5 Deg 2340z
27th November	Topocentric conjunction Uranus and Moon Separation 3.6 Deg
30th November	Full Moon (penumbral eclipse not visible from East Anglia).

JOHN'S NEWS BITS

November 2020

Some additional information from my October newsletter that I omitted, re. the phosphine detected on Venus.

The phosphine was detected in the intermediate cloud layer from 50-65km above the planet's surface where the temperature and pressure is almost Earth-like at 27deg.c

Above 65km the cloud temperature drops to -73deg.c and below 50km from 100-127deg.c.

The phosphine was confirmed with the James Clerk Maxwell telescope and backed up with the Alma array observatory in Chile.

NASA has developed a space toilet also intended for use on the moon for the princely sum of 23 million dollars!!

It is best suited also for use by women. I guess for 46 million dollars you could have a 'his' and 'hers'. Wet potty training will be provided for the astronauts.

The BepiColombo spacecraft heading for Mercury will first do a flyby of Venus twice to give it a gravitational boost. It will get to within 6,800 miles from Venus's upper atmosphere on October 1st 2020 with the second pass on August 11th 2021.

As reported on Science.com, astrophysicists at the Central Astronomical Observatory at St. Petersburg in Russia have been investigating what look like massive black holes except that they emit gamma rays; but black holes emit UV radiation and close to the event horizon X-rays. So accretion discs in AGN's cannot emit gamma rays as the temperature is too low. The theory is that these must be wormholes where the surrounding plasma can reach temperatures of 10 million deg.c and produce gamma rays with energies of 68 million eV's.

Wormholes are supposed to be tunnels in space-time in which you can enter and exit into another part of the universe or even another universe, also predicted by Einstein's general theory of relativity.

The 2020 Nobel Prize has been awarded to Richard Genzel (Director of the Max Plank Institute for Extra-terrestrial Physics) and Andrea Ghez (Professor at the University of

California LA) for research into the Milky Way's supermassive black hole in Sagittarius A* at the centre of our galaxy.

The work was done with the ESO (European Southern Observatory) telescopes.

Genzel's team have been working since the early 1990's tracking star movements at the centre of the Milky Way that shows they were rotating around what had to be a supermassive black hole.

Also a recipient of this year's Nobel Prize for Physics I s mathematician Sir Roger Penrose from the Mathematical Institute in Oxford who won the prize for producing the maths proving that general relativity makes black holes inevitable.

Astronomers at the European Southern Observatory (ESO) in Chile saw a black hole devour a star (spaghettification) in a spiral galaxy in Eridanus constellation..

Quite a rare observation. They observed the light emitted as the star was shredded into thin streams of material (CNN report).

Looks like Jeff Bezos is snapping at Musk's heels.

His space company just launched (Tuesday Oct. 11th) the New Sheppard booster developed by Blue Origin with the capsule attached. Once it reached space, the space capsule detached and parachuted to earth. The rocket followed with a perfect vertical power landing. The flight was used to simulate a landing on the Moon with the 'SPLICE' payload (Safe and Precise Landing Integrated Capabilities Evolution) some mouthful! The capsule has the largest viewing windows ever flown in space and will be used initially for space tourism. No covid-19 out there.

NASA's Osiris-REX spacecraft touched down on asteroid 101955 Bennu on October 20th. It collected a sample of material, of between 60gms and 2 kg. from the surface of this 4.5 billion years old asteroid using an 11 foot robot arm as it could not land because of the low gravity. Bnnu is approx.. 200million miles away so this was a major feat as it is only 510km across. The samples will give us a greater insight into the early solar system.

It will return it to Earth in 2023.. It was launched on an Atlas 5 rocket on September 2016 arriving at Bennu on December 3, 2018.

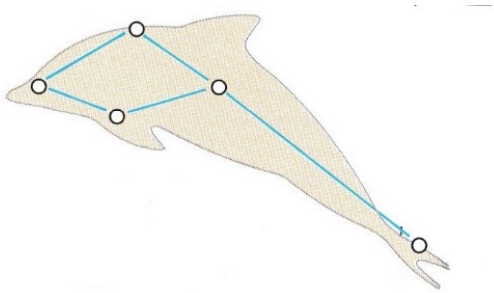
This follows the Japanese Hayabusa2 mission which landed on asteroid Ryugu and is due to bring samples back in December

John Gionis

Myths and legends of the cosmos,

Alison Chapman

Delphinus: the Dolphin and Auriga: the Charioteer



Last month I wrote about the constellation Pegasus. Next to it in the sky, a little to the east, is the small but distinctive constellation Delphinus, whose arrangement of stars actually resembles a dolphin.

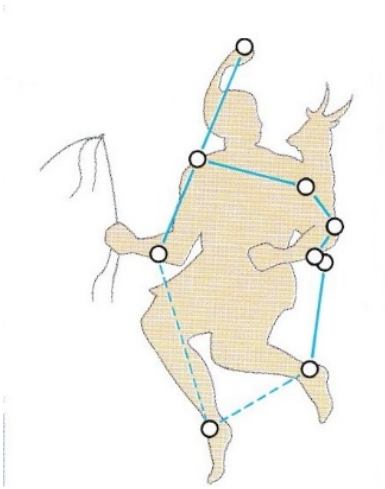
Among various dolphin stories attached to this constellation is one involving Arion, a historical figure of the 7th century BC. Arion was a famous and gifted lyre-player who lived in Corinth. He travelled one day to Sicily to take part in a musical contest, won all the prizes and was showered with gifts. When these were being loaded on to the ship for the return voyage, the sailors began plotting to kill him and steal his treasure. Arion became aware of this and asked for one last favour before he died. He stood on the prow of the ship, singing and playing his lyre. A passing school of dolphins was enchanted by his music and swam closer to listen.

Arion jumped off the ship, was caught up by the dolphins and carried safely back to Greece.

The two brightest stars in Delphinus bear the unusual names Sualocin and Rotanev. When they first appeared in 1814 in a catalogue published

A theatre in Sicily

by the Palermo Observatory they puzzled astronomers. Eventually somebody worked it out-when written backwards the words become Nicolaus Venator, the Latinized version of Niccolò Cacciatore (i.e. Nicholas the Hunter) an assistant at the Observatory. In 2016 his ruse



received a degree of official recognition when Rotanev and Sualocin were added to the International Astronomical Union's Catalog of Star Names.

The arrangement of stars for Auriga shows the driver of a horse-drawn chariot. According to one myth it represents Erichthonius the fifth king of Athens. He was said to have invented the four-horse chariot and so was immortalised on his death in the stars as the constellation Auriga.

Hephaestus the blacksmith god one day attempted to molest the goddess Athena. He was unsuccessful and instead managed to fertilise Mother Earth. The child of this 'union' was Erichthonius who was born with a serpent's tail instead of legs. Mother Earth gave the baby to Athena to look after. She in turn put him in a basket with a lid and entrusted him to the three daughters of king Cecrops. She warned them on no account to look inside the basket. However, two of the sisters could not resist the temptation and were so horrified at what they saw that they threw themselves off the Acropolis in Athens. The third sister, Pandrosus, was rewarded for her obedience by having a shrine dedicated to her.

Athena brought up the child herself and when he grew up, he became king of Athens. Naturally, he encouraged everyone to worship Athena and set up a wooden statue of the goddess on the Acropolis. This misshapen piece of olive wood was said to have fallen to earth from heaven and was reverently worshipped by the Athenians. Perhaps Erichthonius invented the chariot to hide the fact that he had ‘serpent legs’.

The Acropolis, Athens

The star *alpha Aurigae* is known as Capella (the she-goat) and *zeta* and *eta* are ’haedi’ (the kids). However, these have no connection with the myth of Erichthonius, but rather with a myth involving Zeus as a baby. When he was being hidden on the island of Crete to keep him safe from his father Cronus (Saturn), he was fed on the milk of a goat. From one of the goat’s horns flowed ambrosia and from the other nectar. In gratitude Zeus put the goat and her kids in the sky as stars. Later, one of the goat’s horns became the original ‘cornucopia’ (horn of plenty). It would produce whatever food or drink its owner requested.

The nymph Adrasteia, one of Zeus’s nurses, made him a beautiful ball of blue and gold. When thrown in the air it flamed through the sky like a shooting star.

Astrophotography

Part 6

Guiding

Next up is guiding. Long exposure work requires that the telescope follows the stars exactly. If it does not you will get odd shapes for the stars instead of round, or you will get streaks or wobbles. To avoid this we use an auto guider which watches a star and sends minute corrections to the mount computer to make sure it is dead on accurate. One thing to note is that the larger the field of view a telescope has the easier and more forgiving the need for guiding is.

So why does a mount not track accurately? The first reason is that they are based on mass produced mechanical gears which are far from perfect. When the gears are ever so slightly out of round, mismatched or not mashed correctly this can cause periodic error, which is an error which repeats after a period of time. With some higher end mounts this can be mapped and then applied to cancel out the error. Any error of polar alignment will also affect the tracking. It is always best to use the drift align method to get the best polar alignment for the mount. Some high end mounts use encoders to help make the best tracking possible.

Lastly we have the atmosphere itself. As the telescope tracks the atmosphere changes, and this changes the amount of refraction and therefore the apparent location of the target.

So even if you could adjust out all periodic error, and get a perfect polar alignment you cannot correct for the atmospheric effects and so we must use guiding.

Methods

Traditionally, before the era of digital imaging, guiding was manual. An astronomer had to sit looking through a guide scope and keep the guide star in the cross hairs (normally double crosshairs forming a square in the centre of the field). This involved the astronomer continuously watching and making corrections to the telescope mount.

With the advent of digital technology the possibility to automate the system was possible.

The most common method is the use of a guide camera and guide telescope attached to the main telescope. To make this work effectively there are several points that we must consider.

The first is the focal length of the guide scope relative to the focal length of the main scope. Small bit of maths:

Resolution=(206.265Xpixel size) / Focal Length

So in my case for my William Optics 110mm F7 using a camera with pixels 4.67um:

(4.67 X 206.265)/770 =1.25 arcSec/pixel

Using my 80mm F5 Guidescope and camera with 2.68um pixels:

(5.2 X 206.265) / 400 = 2.68 Arcsec/pix

This means that when the guider is off by 1 pixel it moves the mount 2.68 arcsec; this then moves the main camera 2.09 pixels. So with a few tweaks, being off by more than one pixel is rare and movement is limited.

ORION
STARWAVE

If a small guide scope is used the difference increases and this can be seen on the final images. A small guide scope will work on short focus telescopes - I use one on my W.O. Star71 F4.9 with good results on a portable setup.

The formula quoted above is highly dependent on your camera, telescope, guide scope and guide camera, so what works for me may not work for you. Be sure to keep the formula and keep the difference to a minimum. This is particularly important with high pixel count cameras which have a very small pixel size. This is often the reason for a technique called binning, which I will try to cover later in the series.

Also bear in mind the 1 pixel movement can be in any direction so the minimum area for detection is a square of 9 pixels.

Also bear in mind that the pixel size of the guide camera is important. The smaller the pixels the better the ability to guide.

Examples:

Orion Starshoot Autoguider (As shown above)	5.2 um
Altair GP2-130	3.75um
Altair GPCAM3 178M	2.4um
Starlight Express X2	8.2um
QHY 5L-II	3.75um

It is best to use a mono camera as there is no advantage to colour and the sensitivity is better due to the lack of a mask.

For long focal length telescopes particularly with folded optics (SCTs ODKs etc) there would be a problem in getting a focal length guider long enough. It is theoretically possible to use barlows on the guide scope but

this can introduce problems of rigidity. Rigidity is where the camera on the guide scope and the imaging camera are not moving together. This can be from various causes including the mounting of the camera and the structure holding the guide scope to the imaging scope. This needs to be substantial to ensure there is no flexing between the two.

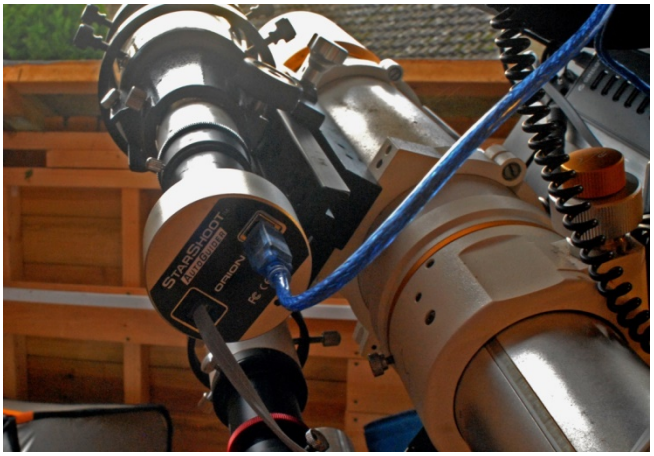
To avoid this a technique called “Off Axis Guiding” (OAG) is used. This is where a small amount of light from the edge of the main telescope is redirected to a guide camera. This has the advantage that it is using the same light train as the imaging camera so any flexing in the mount is corrected out. It is used by most of the top imagers using long focal length telescopes. (It was mentioned by Nik Szymanek in his recent lecture). Some cameras such as the QSI range have it built in to some models.

A small prism is fitted to one edge of the imaging train, shown below on the bottom of the tube. This has no noticeable effect on the final image. The one difficulty that may be found is getting a suitable guide star. With some nebula this can be a real problem. Obviously there is no real way you can offset the guiding setup to find a suitable star. With the 2 telescope system it is possible to move the guide scope a bit to find a guide star.

For SCTs it is possible to fit a separate unit and then add both cameras.

The small Altair guide camera is to the right of the image.

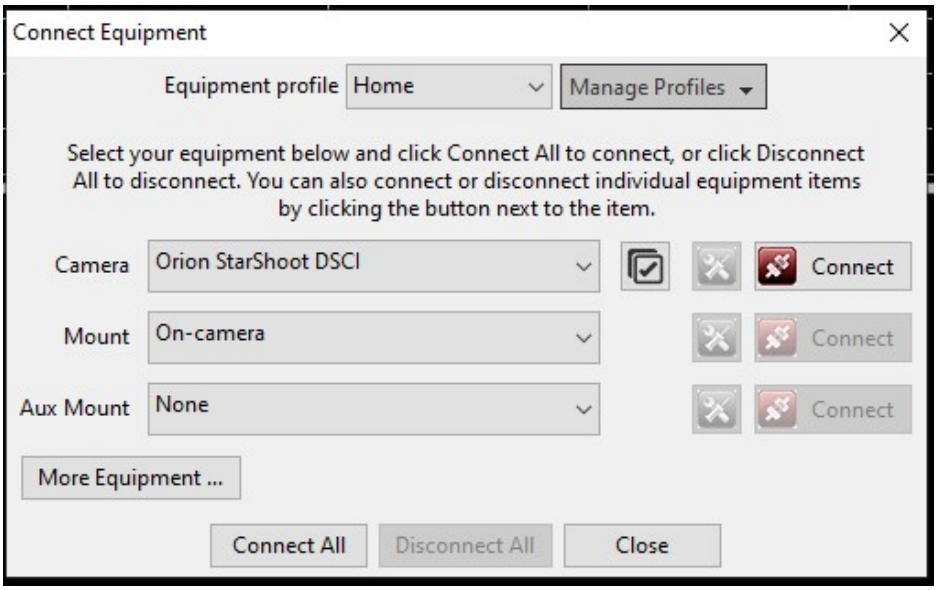
Leads from the guide camera are the normal guide camera USB cable back to the computer. There can also be a second cable that runs from the guide camera to the mount (the flat grey cable in the picture below). This sends the correction signals to the mount. If the mount is being run using ASCOM protocol the signals can be sent from the computer to the mount as part of the mount control software. It is probably easier to start with the cable from the camera to the mount which is type ST4



Guiding Software

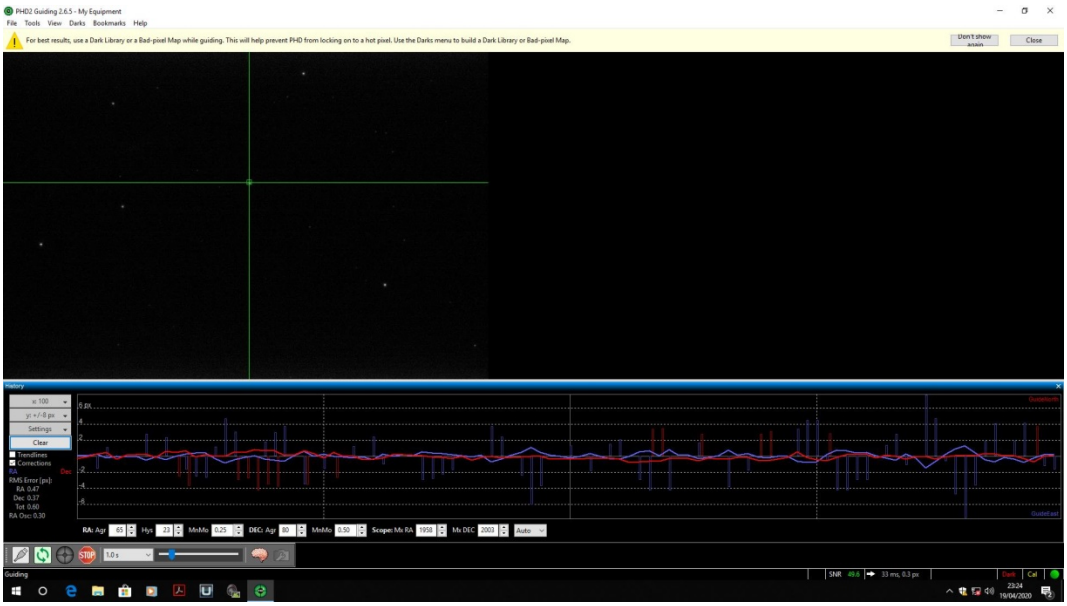
The de-facto standard software for guiding is PHD by Stark Labs (Freeware). PHD stands for “Push Here Dummies” and is the software that most people use. There are a couple of other options, Guide Dog and Meta Guide, but I have no experience of them and have always been happy with PHD. Basically, download it, install it and use it! The current version is PHD2.

It requires the camera and mount to be selected. If you are using the ST4 cable to the mount then select “On-Camera” as the mount option.



Once running the program will calibrate itself. I find that this is more successful if the camera is orientated such that the pixel rows and columns are aligned with the mount movements.

Once running the screen will be as below.



This shows the guiding down to about 1pixel and the red and blue vertical lines are the corrections being sent to the mount. There is some benefit from tuning the parameters to get the best from your mount. Also if you do a meridian flip to continue imaging, the calibration must be redone. It is a great program but as with any software it takes a bit of time to get the best out of it.

Hopefully we will have a few more clear skies in November. Please submit your images. Any questions, I will be more than willing to answer (if I can!)

Chris Bailey

newsletter@brecklandastro.org.uk

The Quest for Light.

(a cautionary tale)

Every would be astronomer starts small, which is a double edged sword.... Yes it gets you looking at the night sky, a few wow's at the first sight of craters and mountains on the moon, Jupiter as a round globe with bands and four moons as specs of light, or maybe Saturn as a oval disc with the round globe at its centre. But all too often, the disappointment of " is that it" or even "is that what all the fuss is about", results in a nearly new telescope being put back in its box and forgotten about, or sold on.

But, if you get hooked, you are off on the "Quest for Light". This is an account of my journey so far.

Back in the mists of time, when I was a youngster, my summers were spent with older married cousins just outside Salisbury, Wiltshire in a small village, which had fabulous dark sky's. Like most kids growing up in the east end of London just after the war, there wasn't the spare cash for "luxuries" such as a telescope. Fast forward a few years, marriage and children and a move to Suffolk came along, and as ever, inquisitive children begat a 3" refractor in a carrying case, which performed the wow's as expected, but as far as the kids were concerned, that was the school curriculum done, so move on... back in its box, and up in the loft, and life move on.

Into my sixties, kids flown the nest and no longer a drain on the household finances, so the opportunity to rekindle a yearning, to discover what was out there. The 3" refractor on a wishbone alt/az tripod, no longer cut it, so along came a 4" Skywatcher Reflector on a German equatorial mount. The difference in capability of the 4" over the 3" is remarkable. The moon and planets no longer just little specs, but defined shapes and dare I say colours. Andromeda galaxy filled the eyepiece, bright globular clusters such as M13 in Hercules fuelled the drive for more knowledge.

Fast forward to retirement, and my better half allowed me to indulge a whim, and up I went to an 8" Skywatcher Reflector, on a substantial EQ5 mount and tripod. A weighty beast for carting about to find dark sky's, but oh was it worth it. Faint Fuzzys abound, the massive learning curve was cultivated once I joined a local astronomy society, where people of like minds were eager to pass on there experience and knowledge. The more knowledge revealed even greater rewards in the eyepiece, different classes of star, (red giants and white dwarves) double stars, globular clusters, spiral galaxies, nebulars, ring nebulars, countless Messier objects to name just a couple.

This is where my tale take a turn to the dark side. Better eyepieces and yes.... A camera and adaptor to start "Astrophotography". But that's not the end of it... The countless accessories that "make life easy" when observing in the field. Then there's the realisation that Joe Blogs on the stand a few yards away has one bigger scope than

yours, and the invite to "take a look at this" you are hooked on the slippery slope....

The intervening years see many happy outreach events and dark sky observing sessions, where countless members of the public, young and old, have enjoyed the vies through my eyepieces, and the 8" Reflector has done sterling service. My knowledge of the night sky grows continually, with the science involved, becoming ever more of interest, with spectroscopy, exoplanets, active galactic nuclei and fast radio burst among the growing list...

I managed to purchase a 9 1/4" Schmidt Cassegrain Celestron (SCT) tube, which unfortunately, despite the stunning views, was to heavy for my EQ mount and tripod, so had to be passed on. The odd telescope came my way over the years (I had 11 scopes at one time) but the trusty 8" Skywatcher was always my go to scope for serious astronomy.

You never know when an opportunity will present itself. Just at the start of the lockdown, one of our members was in the unfortunate position of having to sell his almost new 12" GoTo Dobsonion telescope, and accessories. With carful negotiations with my financial controller completed, I agreed to purchase it, after there were no takers from the membership. It is a bit of a beast, and just on the edge of my physical capabilities to lift and transport. Some minor additions have been manufactured, such as a trolley with wheels and jacking feet, which mean I don't have to separate the tube from the base to move it about.

The few times I have had it out in the back garden, have given stunning views of all the normal favourite night sky objects, and I am looking forward to the darker autumn night, and possibly a trip to a decent dark sky site, when the current restrictions are finally lifted.

I hope you can tell I am passionate about the hobby, and enjoy sharing what knowledge I have, with whoever will listen.

There is a lot of truth in the old joke, " if you get your kids interested in Astronomy, they will never have money for drugs or alcohol "

Stay safe,

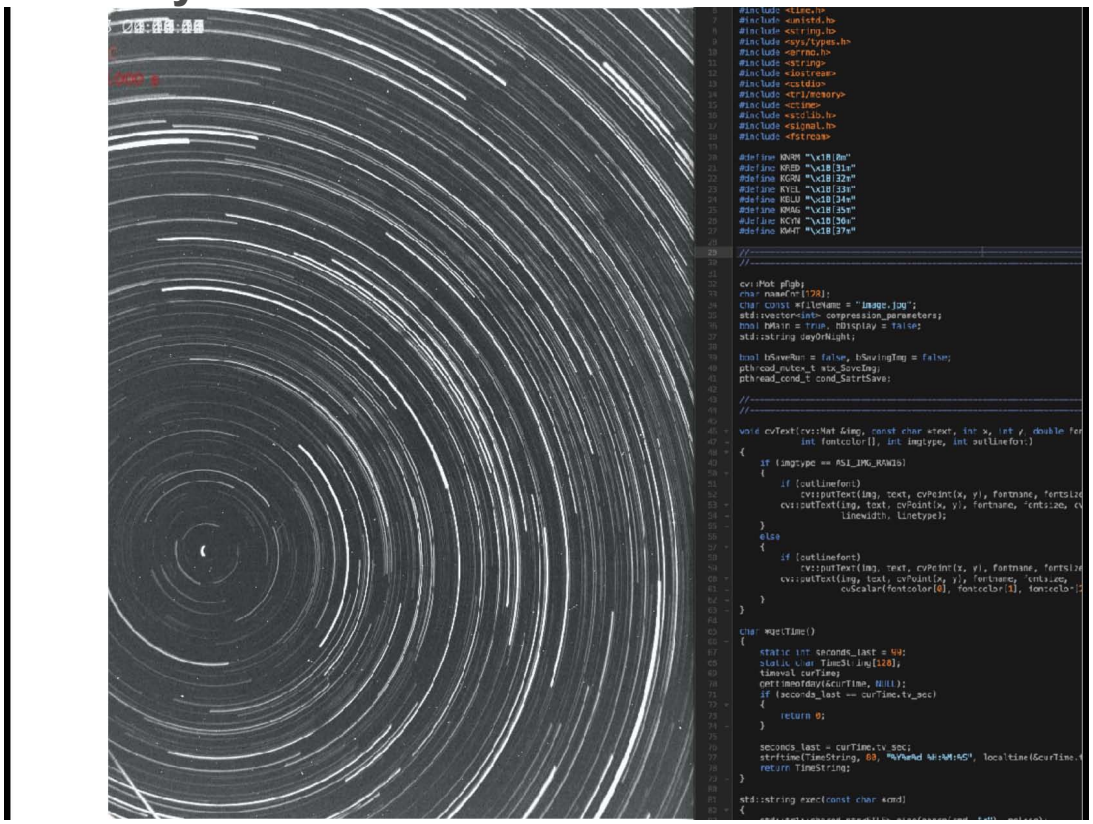
Jim Slight.

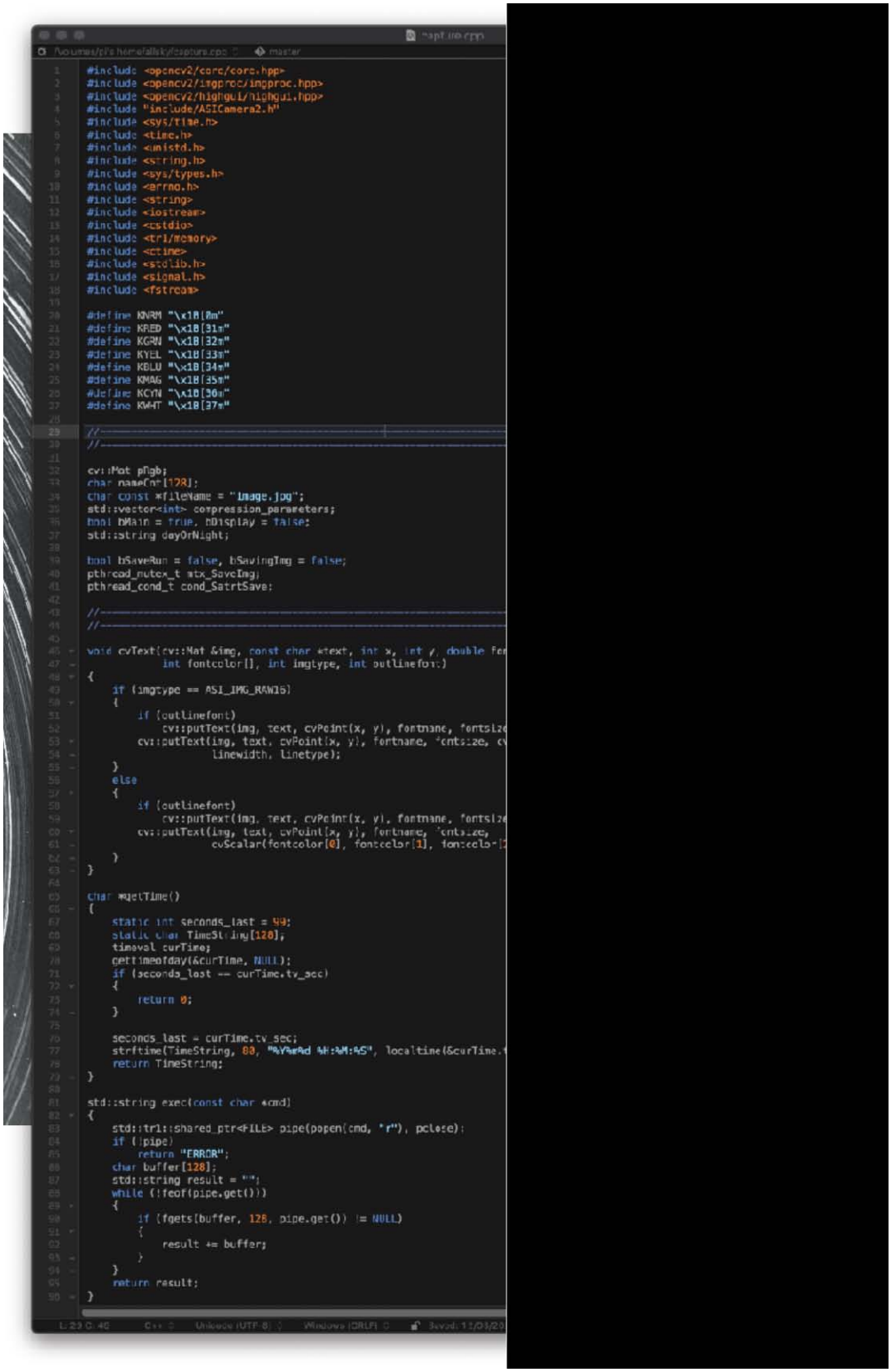
Raspberry Pi

All-Sky Camera

Part II - Software

Anthony Cross




/Volumes/pi's home/allsky/captures.cpp
master
#include <opencv2/core/core.hpp>
#include <opencv2/imgproc/imgproc.hpp>
#include <opencv2/highgui/highgui.hpp>
#include "include/ASICamera2.h"
#include <sys/time.h>
#include <time.h>
#include <unistd.h>
#include <string.h>
#include <sys/types.h>
#include <errno.h>
#include <string>
#include <iostream>
#include <cstdio>
#include <tr1/memory>
#include <ctime>
#include <stdlib.h>
#include <signal.h>
#include <fstream>
#define KNRM "\x1B[0m"
#define KRED "\x1B[31m"
#define KGRN "\x1B[32m"
#define KYEL "\x1B[33m"
#define KBLU "\x1B[34m"
#define KMAG "\x1B[35m"
#define KCYN "\x1B[36m"
#define KWHT "\x1B[37m"
cv::Mat pRgb;
char const *fileName = "image.jpg";
std::vector<int> compression_parameters;
bool bMain = true, bDisplay = false;
std::string dayOrNight;
bool bSaveRun = false, bSavingImg = false;
pthread_mutex_t mtx_SaveImg;
pthread_cond_t cond_SatrtSave;
void cvText(cv::Mat &img, const char *text, int x, int y, double fo
int fontcolor[], int imgtype, int outlinefont)
{
if (imgtype == ASI_IMG_RAW16)
{
if (outlinefont)
cv::putText(img, text, cvPoint(x, y), fontname, fontsiz
cv::putText(img, text, cvPoint(x, y), fontname, fontsize, cv
linewidth, linetype);
}
else
{
if (outlinefont)
cv::putText(img, text, cvPoint(x, y), fontname, fontsiz
cv::putText(img, text, cvPoint(x, y), fontname, fontsize,
cvScalar(fontcolor[0], fontcolor[1], fontcolo
}
}
char *getTime()
{
static int seconds_last = 99;
static char TimeString[128];
timeval curTime;
gettimeofday(&curTime, NULL);
if (seconds_last == curTime.tv_sec)
{
return 0;
}
seconds_last = curTime.tv_sec;
strftime(TimeString, 80, "%Y%m%d %H:%M:%S", localtime(&curTime.
return TimeString;
}
std::string exec(const char *cmd)
{
std::tr1::shared_ptr<FILE> pipe(popen(cmd, "r"), pclose);
if (!pipe)
return "ERROR";
char buffer[128];
std::string result = "";
while (!feof(pipe.get()))
{
if (fgets(buffer, 128, pipe.get()) != NULL)
{
result += buffer;
}
}
return result;
}

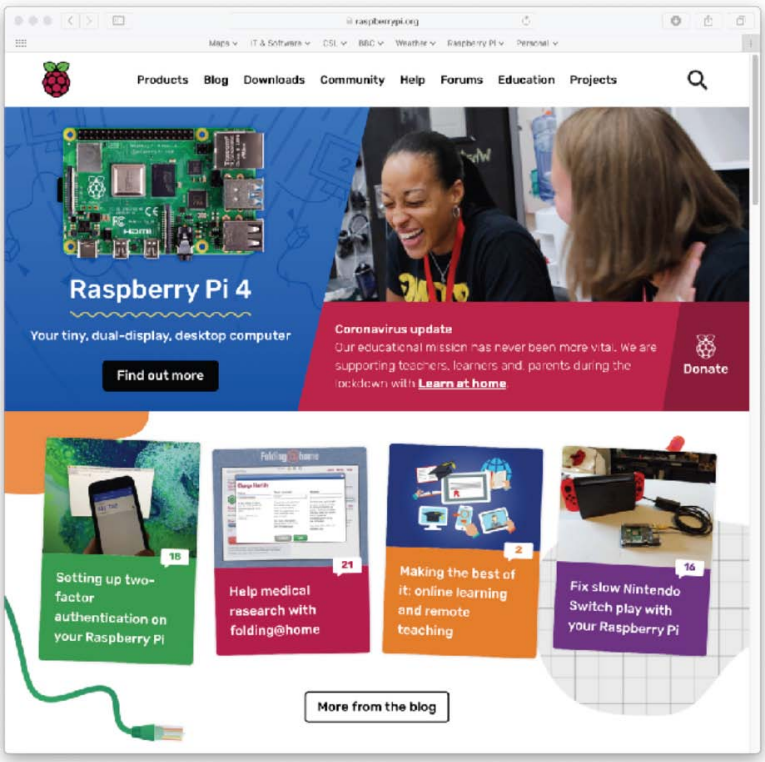
Software

For this project I used a Mac but the same tools I am detailing here are also available for Windows. This part of the project is actually not too daunting and should easily be achievable by uses of almost any level. I have assumed that you know how to download and install apps, access file systems, access the command line and have an SD card slot or writer reader for the computer you are using. Oh, I have also assumed that you have WIFI and know the SSID (name) and password. Please forgive me if I appear to have overly simplified this routine, there may be steps that are obvious to some but not to others; feel free to jump ahead or venture out on your own.

Software www.raspberrypi.org that runs on Windows, Mac or Linux and makes the process even simpler. This app was not released when I first built this project and although I have it installed, I still tend to use other apps and this is the process that I will describe here. Feel free to explore the RPi Imager app and use whatever works for you.

The Raspberry Pi Organisation have a fantastic website that is full of tutorials and resources; well worth a look around.

www.raspberrypi.org



Operating System

The Raspberry Pi operating system lives on the SD card and our initial task is to download a copy and burn it onto the card.
A quick note on SD cards. The RPi uses a micro-SD card and I strongly recommend using at least a 32GB card and the fastest one you can find. There are many Googles that will tell you which is the best but for a few years I have been using Samsung Evo 32GB; they are quick, cheap, come with an adapter and are x-ray proof (safely pass through airport scanners). I have since found that the Samsung Evo Plus is faster and also discovered that larger cards are faster than small; I now use the 64GB for all my projects.

Installs.

Download and install **SD Card Formatter** from:
`https://www.sdcard.org/downloads/formatter/`
Download and install Balena Etcher from:
`https://www.balena.io/etcher/`
Download **Raspbian Buster Lite**Operating System
`https://www.raspberrypi.org/downloads/raspbian/`
Installs. https://www.sdcard.org/downloads/formatter/
https://www.sdcard.org/downloads/formatter/

Format Card

Load up SD Card Formatter, put your SD card into your computer and make sure your card reader is selected before clicking the Format button. I am sure this software cannot format anything other than SD cards or USB drives but good to check each time. It doesn't matter what label you put as this will be changed in the next step.
Once complete you should see the SD card mounted on your desktop (Mac) or in your drives list. We are done with this app, quit it.

Burn Card

It sounds dramatic but really just means write files (comes from a time when CD's would be burnt using a laser). Load Balena Etcher, you will see three main buttons.

Click [Select image], navigate to the downloaded Raspbian Buster image and open it, probably called something like this:

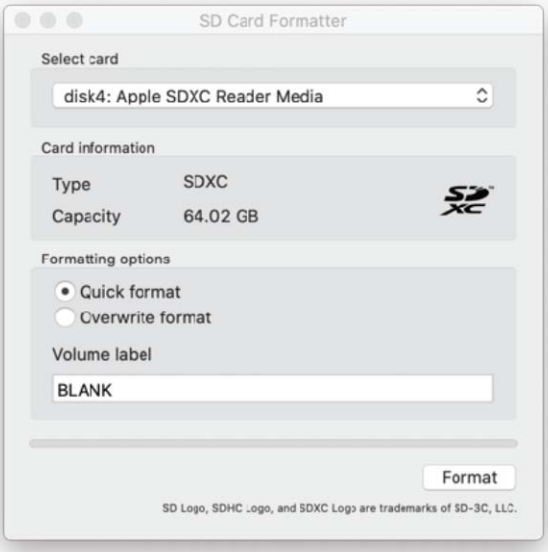
`2020-02-13-raspbian-buster.img`

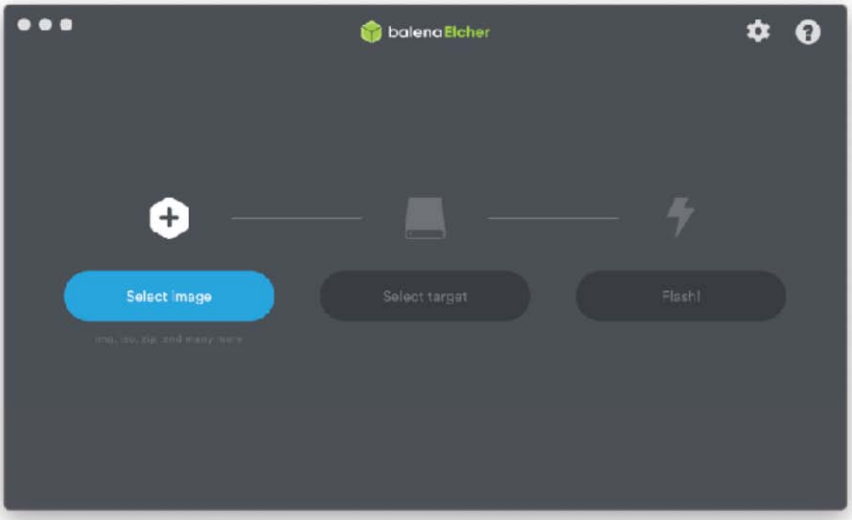
You may find that it has ".zip" at the end of the filename, this doesn't matter and Etcher will deal with it, there is no need to unzip.

Click [Select target] and choose the SD card from the list (there may only be one to choose from).

TIP: Click the settings cog in the top right of the window and turn off "Auto-unmount…", we will be copying a couple of files to the card shortly.

Click [Flash!]. This will burn Raspbian to the SD card and then verify before reporting that it has finished.





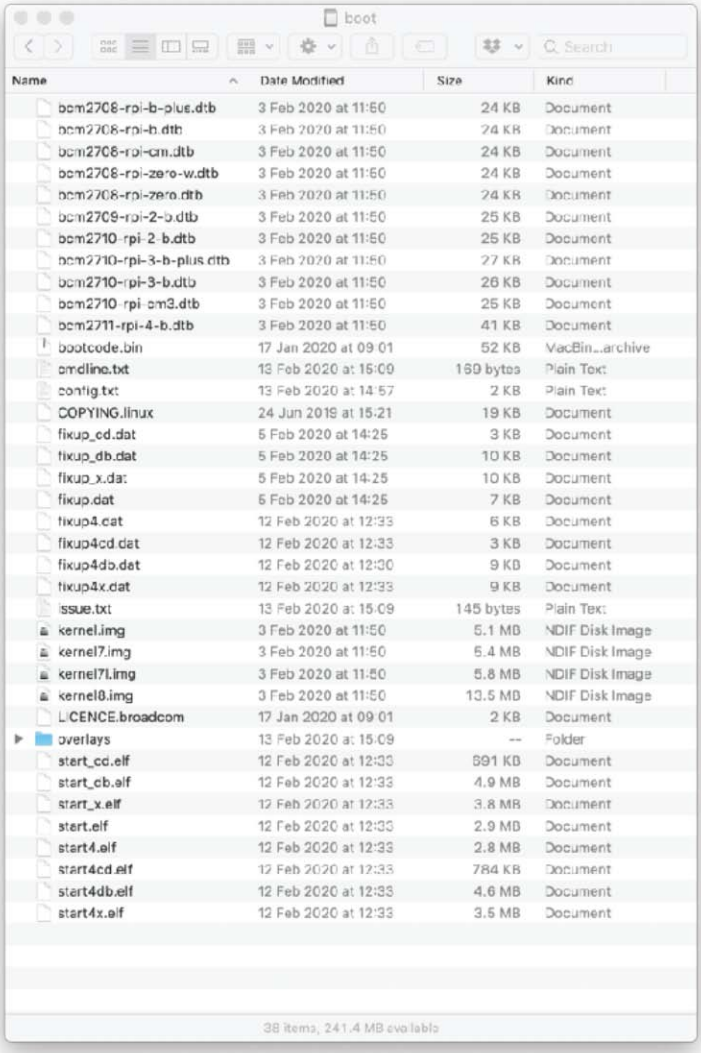
You should now see SD card called “boot” in your list of mounted volumes. If not, its likely been unmounted - pull the SD card out and shove it back in. The contents of the boot drive should look like this. For now there is no alteration needed of the files in this directory, we will only be adding two files and should never need to go back to this.
Although the RPi has physically connections such as a USB slot for a keyboard and mouse along with a HDMI connector for pluging into a screen, we will not be needing any of this and will be remotely setting up the RPi using the terminal using a secure shell (SSH) and WIFI. This is known as a headless system.

Headless

To activate SSH we need to copy an empty file with the name SSH on to the SD card. On Windows start Notepad and save the empty file as ssh with no extension. On a Mac this is a little trickier as the AppleOS always tries to put an extension on the file and removing the extension simply hides it. On Mac (also works on Windows I am told), open up the Terminal and type the following two commands:

```
cd ~/Documents
touch ssh
```

This will make an empty, zero sized file called ssh in the current users Documents folder. Copy this to the boot drive - do not put it into any



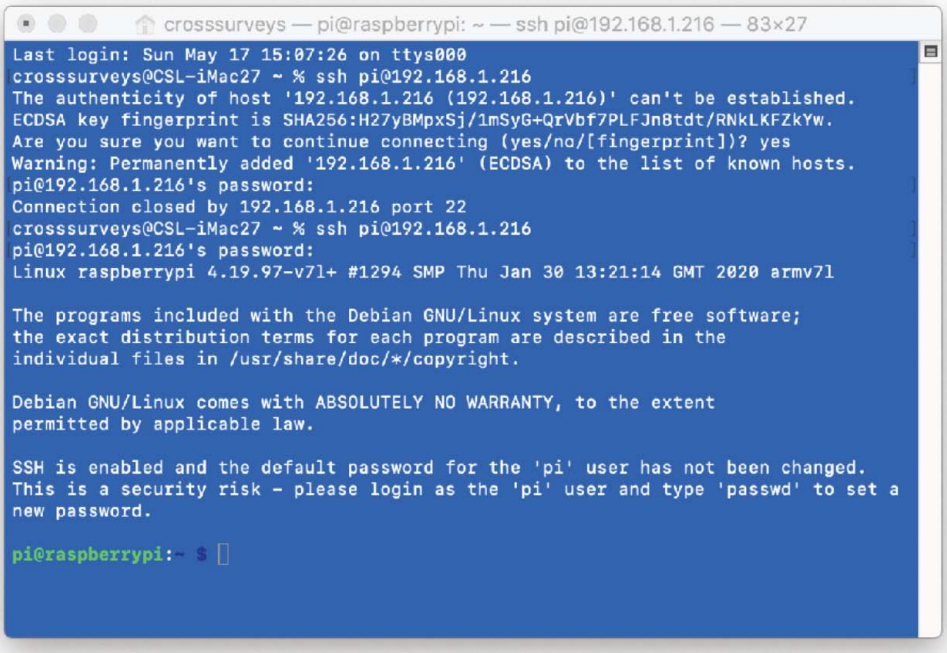
folders.

Next we need to set up WIFI. Grab a copy of your WIFI name (SSID) and the password and make a new text file called wpasupplicant.conf/ containing this lot:

```
ctrl_interface=DIR=/var/run/wpa_supplicant
GROUP=netdev
update_config=1
country=GB
network={
 ssid="Enter_Your_WIFI_Name_Here"
 psk="Enter_the_Password_Here"
 key_mgmt=WPA-PSK
```

```
}
```
If you have two or more (I currently have five) WIFi devices, you can copy the network section and enter more names and passwords. If the RPi is moved to a location with a different WIFI it will know how to connect.
Copy this file into the boot directory, to the same place as we put SSH. Safely disconnect or eject the SD card, push the micro SD card into the slot on the underside of the RPi (with the label facing out) connect the power supply to it and switch it on.
The RPi will display a small green LED that will flicker for a while. After around 1-2 minutes we should be able to find it on the network. For this we need an IP scanner app and there are many available, most of which are free or offer a free-trial period. I use IP Scanner Home on my Mac and can be downloaded from here:
`http://10base-t.com/macintosh-software/ip-scanner/`
There are many Windows apps that will do a very similar job. Open up the scanner of your choice and you will see a list of devices appear, one of which will be called Raspberry Pi and may even have the logo beside to it. In the list you will also see the IP address made up of four numbers with a dot between, for example 192.168.1.75
Make a note of the IP address, load up the Terminal app and enter:
`ssh pi@192.168.1.75`
You should see a message asking to confirm the authenticity of the device, this is normal. Type “yes” and press enter. Next you will be asked for the password, this will initially be “raspberry”.
Congratulations, you are connected to the RPi using SSH, now the work begins.
You should see something similar to the image above. This is the **command prompt** where we issue commands to the Linux shell on the RPi. We will mostly use this to install and set up the camera software. If you are unfamiliar with Linux or working in a shell, there are many, many Googles that can help. In fact it can initially be somewhat bewildering, particularly if you come across an expert as they sometimes assume that you know much more than you do and will leave out steps, which to them are trivial but to us mere mortals can stop play. The important point to remember from this point onward is that ***It does not matter!***
It really doesn’t. You can mess up commands, miss-type something, enter the wrong command at the wrong time and if it all goes wrong simply switch off, wipe the card and re-install the system. Linux is an extremely powerful operating system and used as the foundation for most of the worlds servers, in one form or another. The ease of setting up a Raspberry Pi means we can quickly be back to the same point, with

practice it can only take a few minutes (I have had loads of mess-ups, I mean practice).
If you want to learn more about Linux and the power that you now have at your disposal, take a look at this introduction from the Raspberry Pi Foundation:
`https://www.raspberrypi.org/documentation/linux/`



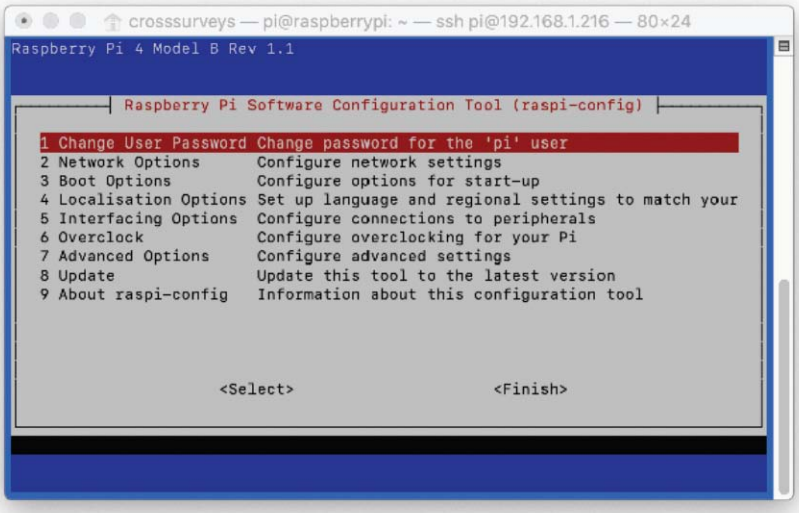
Initial Setup

Lets get your system a little more secure and add a few useful utilities.
At the prompt type:
`sudo raspi-config`
You will se a menu of options. Select item [1 Change User Password] and and press return/enter, to change the default password from raspberry to something more secure. You will be taken to the command line and asked to enter a new password, then asked to re-enter it. I recommend choosing a password with a mix of letters in both upper and lower case and some numbers.
Tip: If you forget the password, you will find it very difficult to get back into the RPi without connecting a screen, keyboard, mouse and bribing a Linux expert with lots of coffee and doughnuts (I am not one).
Or
Follow the above instructions to re-format and reinstall.
Next select [7 Advanced Options] and on the next screen select [A1

Expand Filesystem], pressing enter. I am told this is no longer needed as the system automatically expands on its first boot up but I am a creature of habit. Also, who trusts automation? Pfft…
Now press the escape key to finish or the right arrow key twice to select <Finish> and press enter. There is little else we need to do here but feel free to have a look around.
It is best to now do a restart and log in with the new, secure password. Type:

```
sudo reboot now
```

The connection will be cut, the RPi will reboot and in a minute or two you should be able to log back in again (ssh pi@your.IP.address.here).



Update

Lets do some house-keeping and update the system files. Type:

```
sudo apt update
sudo apt full-upgrade -y
```

You will see lots of text start to appear and scroll up the screen; this means it is working, it also makes you dizzy if you try to read it.
[apt] stands for Advanced Package Tool (Linux operators like to type but not too much - this is a world full of acronyms). This is a utility that is used for installing programs, apps, utilities and other goodies. It also keeps track of what is installed and will (should) update everything in one hit. The first line tells apt to check for any updates of the files installed. The second command tells apt to carry out a full upgrade, including any dependent sub-apps or utilities.

Git

Ah Linux humour… We will now be installing the AllSky software, written by Thomas Jacquin, from GitHub. Type the following lines - there will be many more scrolling lines (it even makes you dizzy trying to count them) but make sure that the prompt is back before typing each line and hitting the enter/return key:

```
sudo apt install git -y
git clone --recursive
https://github.com/thomasjacquin/allsky.git
cd allsky
sudo ./install.sh
```

After running the last command above (and after a few more minutes of dizzy) you will be asked if you want to reboot now. I have never understood why they ask, clearly something fundamental has changed, maybe it is more humour? Type a “y” and hit enter. Log back in after the reboot and type:

```
sudo gui/install.sh
```

Again, you will be asked to reboot. This time when you log back in after the reboot you will notice that the command prompt has changed to

```
pi@alsky:~ $
```

Fin

You are pretty much done, the system is now up and running and you can get down to the serious business of tweaking the settings. For now you can quit the terminal app and load up a web browser (Safari, Chrome, Explorer, Firefox, etc). In the address bar type:

```
http://allsky.local
```

Congratulations, you are now the proud parent of a bouncing baby AllSky camera! So what have we done and where can you go for help? The setup of the RPi is standard and I got this from the Raspberry Pi foundation. As I said earlier they have now developed their own app which does the job of SD Card Formatter and Balena Etcher, all in one place. Keep an eye on their website, there are loads of resources and it is worth signing up to their forum.

The main software comes from Thomas Jacquin. I strongly recommend you visit the GitHub site and read through the extensive instructions, including how to install the software, change settings and take dark calibration images. You can report any bugs directly to Thomas by signing up for GitHub and posting an issue but please read through the list of issues to check if it has already been resolved.

There is a growing Facebook group called Allsky Camera. Drop a request to Jason McDonald, the administrator, and he will add you to the

group within 24 hours normally. Here you can also find Tim Duke and myself. Both Tim and Jason can supply housings, domes, heaters and all manner of equipment needed to build one of these cameras. Jason can even supply a fully built unit but the cost will of course be higher than sourcing and building one yourself.

Where next

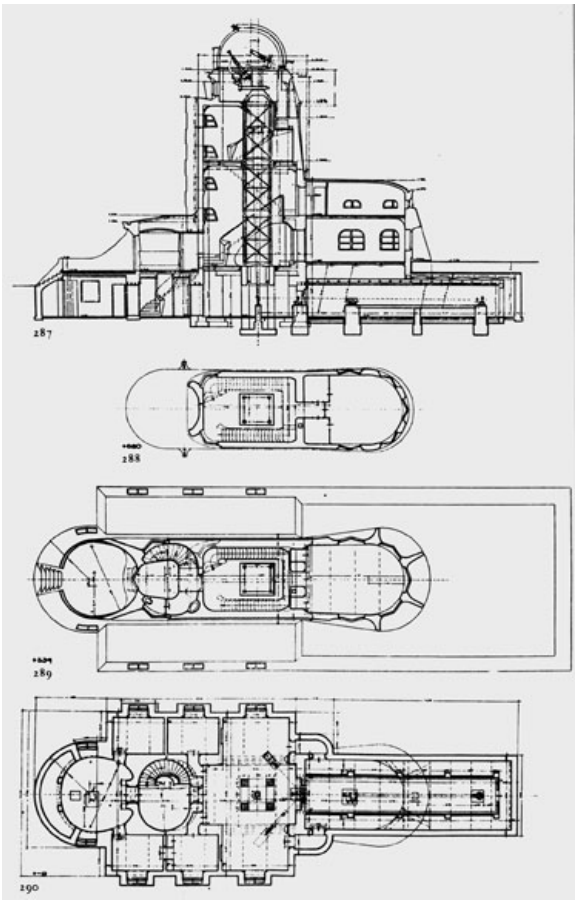
If you have a hosted website or similar facilites, Thomas Jacquin has a complete web template that you can connect into and upload the images straight from the camera to the website.
There are alternatives to the TJ software but from what I can see they need a USB connection to a Windows computer. My criteria from the start was to have a system that was fed by a single power cable as I may want to move the camera to a more remote location. Besides, I don't like Windoze.
Have fun, don't get too stressed with it and enjoy pictures of the night sky. If you get stuck, send me an email or post a question to the FB group; I will try to help out.

Anthony

Einstein Tower

The Einstein Tower is an astrophysical observatory in the Albert Einstein Science Park in Potsdam, Germany. It was built by architect Erich Mendelsohn on the summit of the Potsdam Telegraphenberg to house a solar telescope designed by the astronomer Erwin Finlay-Freundlich. The telescope supports experiments and observations to validate (or disprove) Albert Einstein's Relativity Theory.

The building was first conceived around 1917and built from 1919 to 1921 after a fund-raising drive. It became operational in 1924. Although Einstein never worked there, he supported the construction and operation of the telescope. It is still a working solar observatory today as part of the Leibniz Institute for Astrophysics, Potsdam. Light from the telescope is directed down through the shaft to the basement where the instruments and laboratory are located. There were more than half a dozen telescopes in the laboratory.



This was one of Mendelsohn's first major projects and is his best-known building. Between 1917and1920 Mendelsohn created numerous sketches with the attempt to create a structure that reflects Einstein's ground-breaking theories.

The exterior was originally conceived in concrete, but due to construction difficulties with the complex design and shortages from the war, much of the building was actually realized in brick and covered with stucco. Because the material was changed during construction of the building, the designs were not updated to accommodate them. This caused many problems, such as cracking and dampness. Extensive repair work had to be done only five years after the initial construction. Since then numerous renovations have been done.

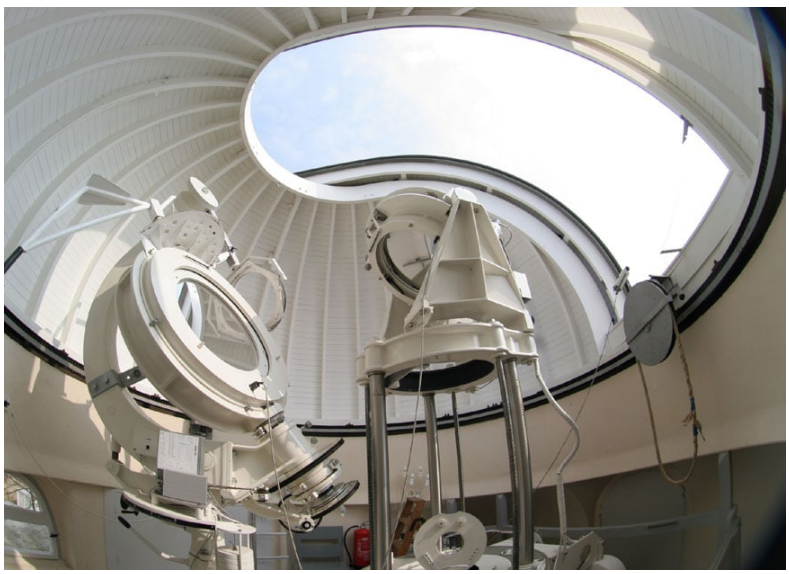
The building was heavily damaged by Allied bombing during World War II. It underwent a full renovation in 1999, for its 75th anniversary, to correct problems with dampness and decay that had meant decades of repair. It is often cited as one of the landmarks of expressionist architecture.

According to lore, Mendelsohn took Einstein on a long tour of the completed structure, waiting for some sign of approval. The design, while logical and perfectly sufficient to its purpose, stood out like an "ungainly spaceship" in the suburbs of Potsdam. Einstein said nothing until hours later, during a meeting with the building committee, when he whispered his one-word judgment: "Organic”.

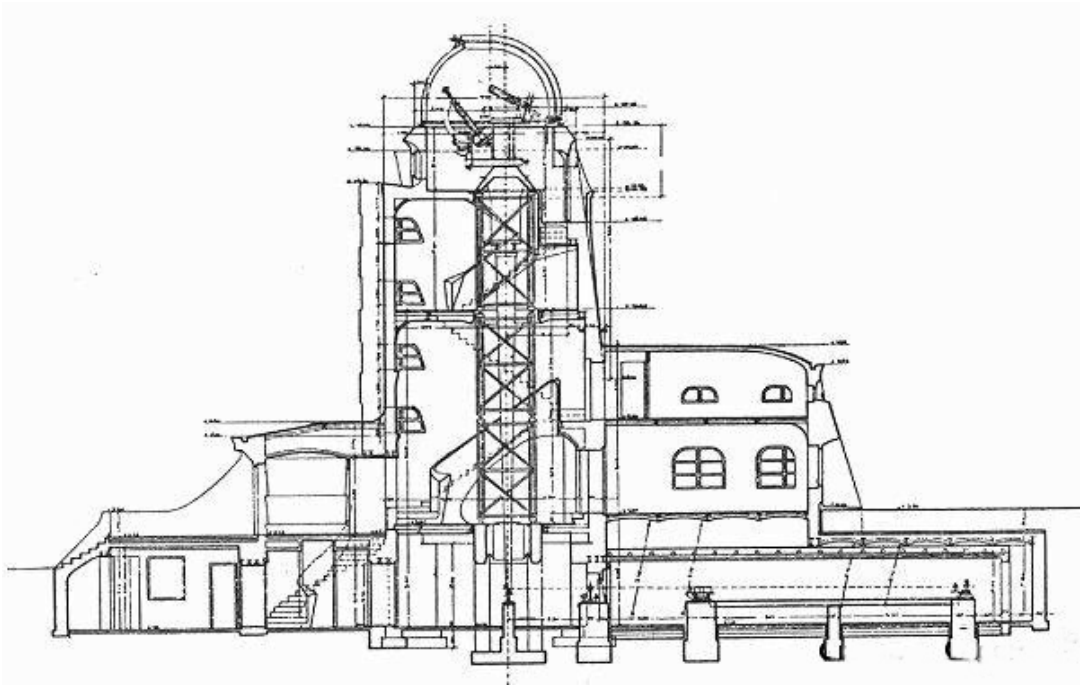
Equipment and initial research focus

In 1911 Einstein published the initial version of his innovative General Theory of Relativity. One of the predicted effects according to the theory was a slight shift of spectral lines in the sun’s gravitation field, now known as the red shift. The solar observatory in Potsdam was designed and constructed primarily to verify this phenomenon.

In tower telescopes a coelostat (a system with two deflecting mirrors, pronounced "seelostat") at the top of a vertical construction directs light down to an objective. The actual lens system is rigidly integrated into the construction. The mirrors at the top are movable and only these small lightweight instrument components are needed to track the sun. Because of the vertical arrangement, air turbulence near the ground has virtually no effect.



In the Einstein Tower the construction containing the optics consists of two wooden platforms, each six metres high, placed one above the other. The telescope has a lens objective of 60 cm diameter and focal length of 14 metres. Rooms for observations and measurements are located at the base of the tower. They are arranged horizontally. Another rotating mirror directs the sunlight to the spectrograph lab located in the basement behind an earthen wall on the southern side of the tower. It is about 14 metres long and thermally insulated. Here is where the light is split up into its spectral components and analysed. This design of a horizontal laboratory wing led to the elongated profile of the entire facility.



Soon after research started at the site, it became evident that the proof sought would be harder to obtain than originally anticipated since the minimal shift of spectral lines was obscured by other solar influences. The reason was atmospheric turbulence on the solar surface. However, Einstein and Freundlich had from the beginning not only been interested

in the specific problem of the red shift, but had also intended basic research in solar physics, and the laboratories were so designed that new equipment could be installed without difficulty. The turbulent behaviour of the outer solar atmosphere soon became the primary subject of research at the Einstein Tower. The red shift could be proved only in the 1950s after it became possible to precisely analyse the complex disturbances of the solar atmosphere.

Present work

In 1999 the building reopened again after 2 years of renovation.

The characteristics and behaviour of magnetic fields provide the key to understanding solar activity and are at the focus of work at the Einstein Tower. The solar magnetic field can be measured with the help of a double spectrograph and two photoelectric polarization analysers. Measurements in the visible light realm permit conclusions about the situation at higher altitude levels. The Potsdam astronomers participate in the operation of the Teide Observatory on Tenerife. Instruments to be used there are first developed and tested at the Einstein Tower.

The Einstein Tower also plays an important role in training students.

Einstein Sculpture

In the tower’s entrance area there is a bronze bust of Einstein which was originally located in one of the rooms of the observatory. After the Nazis' anti-Semitic dictatorship began in 1933, the Einstein Tower lost its name and status as an independent institute. Pictures of Einstein were removed and sculptures were supposedly melted down. However, after 1945 it was discovered that staff members had rescued the portrait bust now to be seen at the base of the tower by hiding it behind crates in the spectrograph lab. As a hidden homage to Einstein a single stone (German: 'ein Stein') was placed where the bust had stood, a tradition that is still kept (the stone is regularly stolen though and has to be replaced).

The Einstein tower is normally open for tours between October and March and visitors are able to marvel at this unique piece of expressionist architecture that was left for such a long time without being taken care of.

Chris Bailey

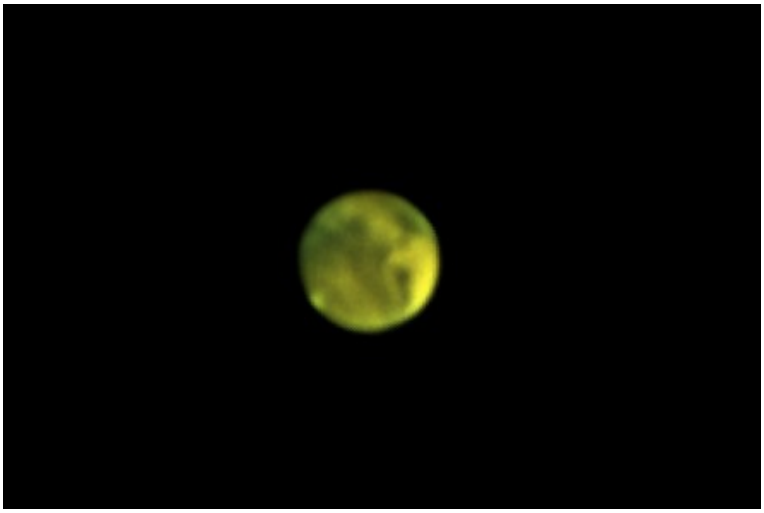
Members Astrophotographs

Dan Self

Mars, Phobos and Deimos Composited from 3 videos at 30ms, ¼s and ½s exposures

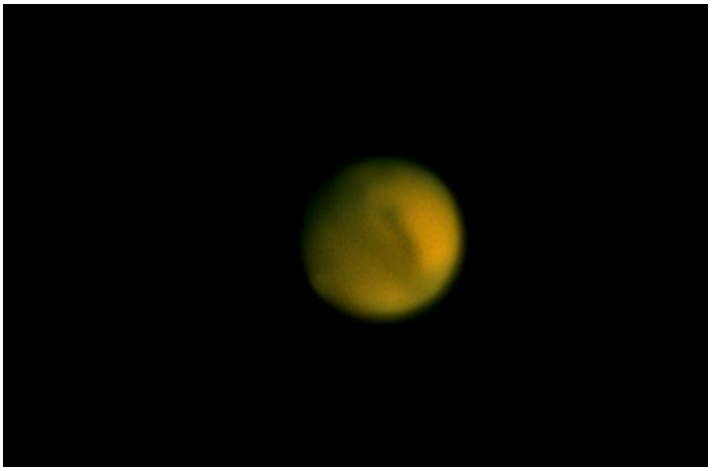
Oberon
Umbriel
Ariel
Titania

John Gionis



Mars imaged with a ZWO120Asi and x3 Barlow on a 10" Meade SNT.

Total of 1000 frames processed with Registax 6.

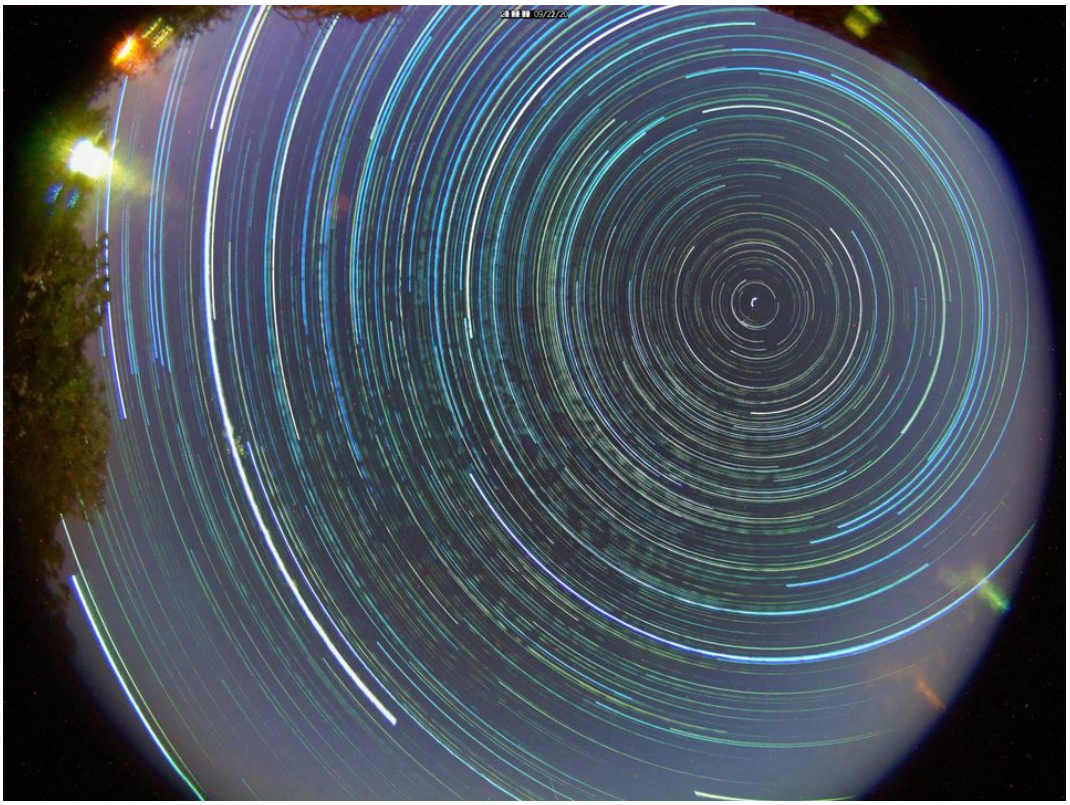


Mars imaged on Oct. 28 (21 arcsec.)

Zwo120asi camera on a 10” Meade SNT.

X2 Barlow attached to a X3, 1000 frames processed with Registax 6 and photoshop.

Anthony Cross



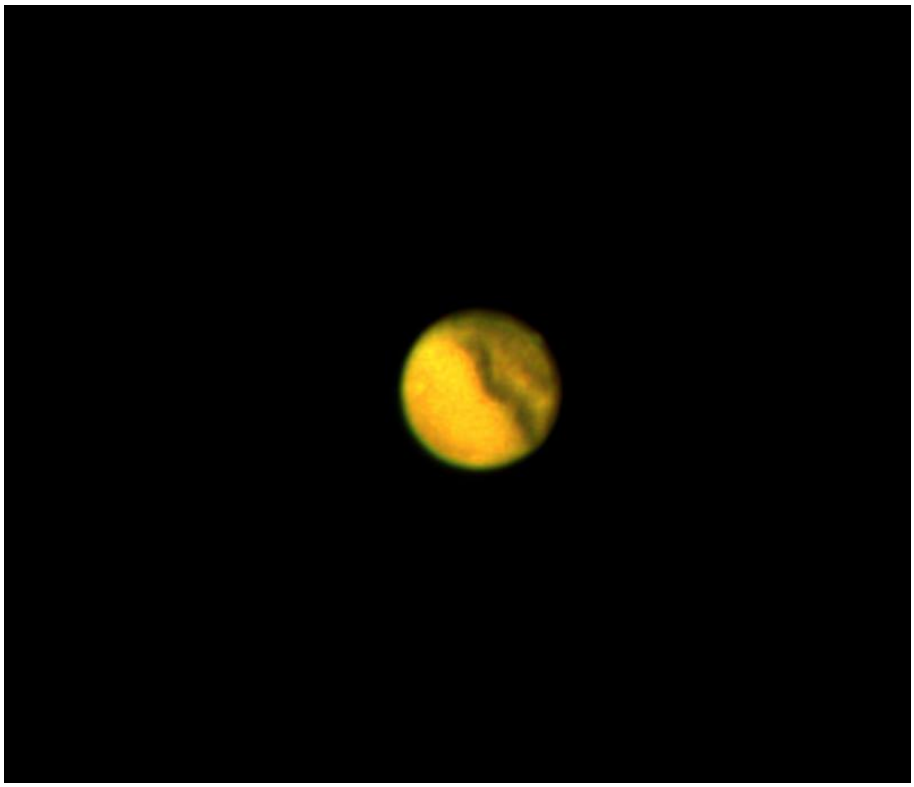
Captured in 21st September, evening of the equinox.

Darrell Brown

Pacman Nebula. just over 1 hour

4 Hours with Quadband filter

Keith Morris

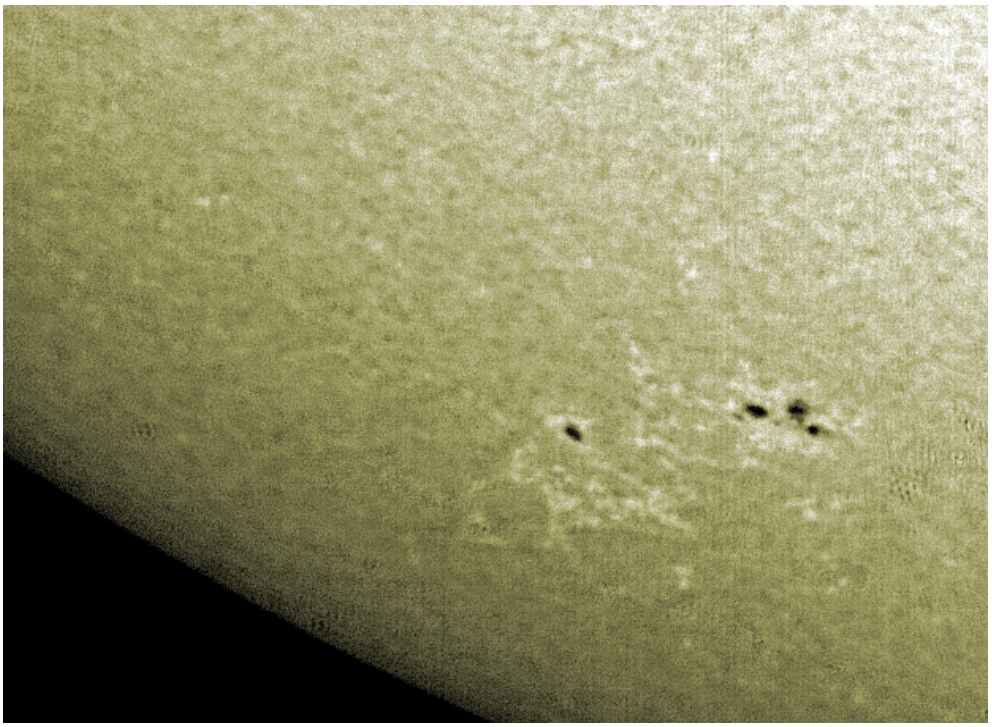


Mars stack of 300/1000 on Tuesday night using ZWO ASI 120 on a Skywatcher 6" Maksutov

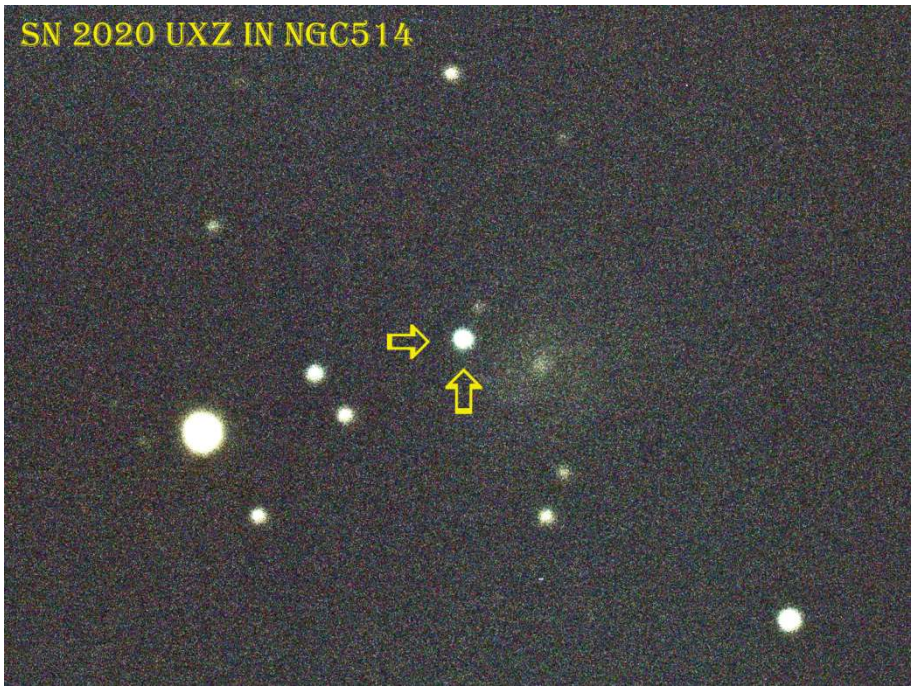
Andrew Luck

Sh2-216, the closest planetary. Some more 1 hour Ha frames to take the total to 17 hours

Chris Bailey



15th Oct



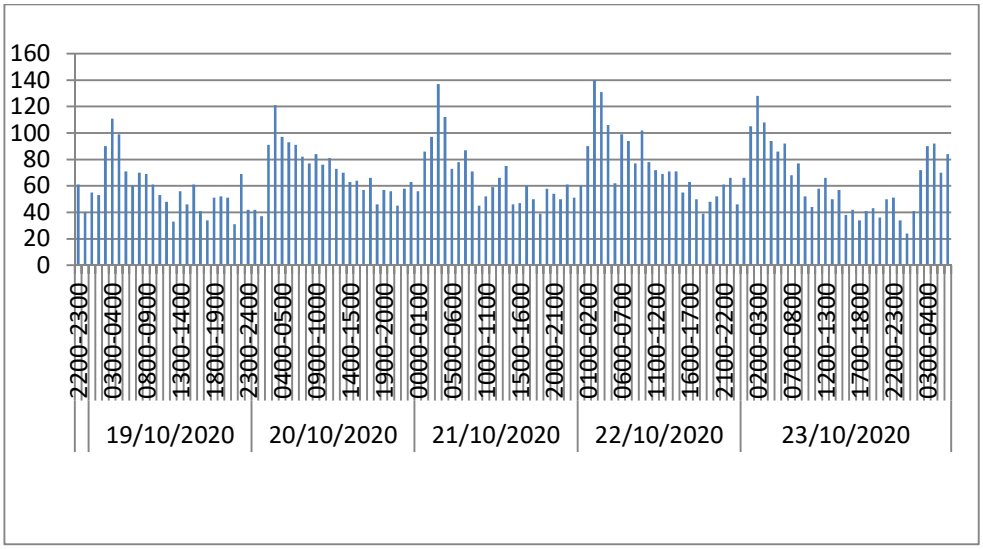
Supernova 2020uxz first discovered 5th October by Koichi Itagaki in Galaxy NGC 514. Not the best time to attempt to image with the moon still lurking about. The galaxy is just to the right and down a bit So the one star far outshines the galaxy.

Radio Observations of the Orionids Meteor Shower

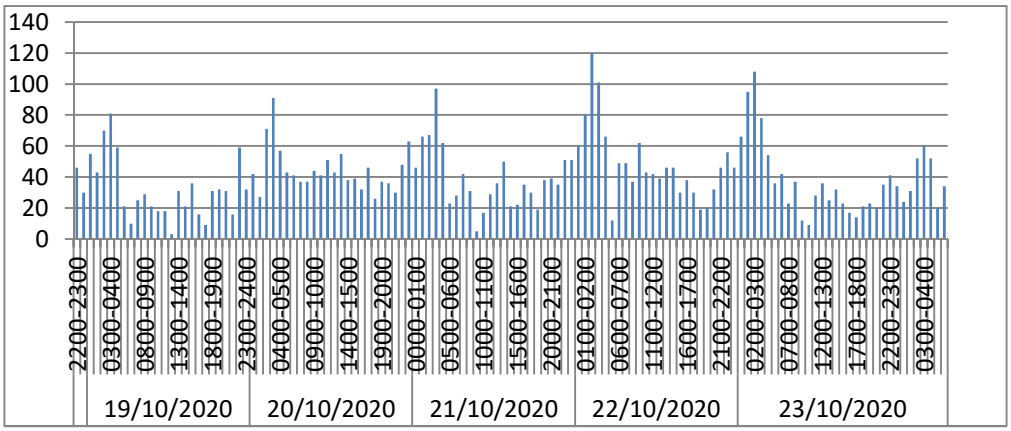
The Orionids of October are by far the best meteor shower since the August Perseids Meteors They start to appear in mid October and peak around the 20th /22nd of the month. It is a fast meteor shower with speeds of 66Km/sec and appears as fast streaks. This shower is a meteoric offspring of the comet Halley. Fireballs are somewhat more common about 3 days after the maximum of the shower.

Unlike most meteor showers the Orionids sometimes offer not one but two maxima that take place between October 21st and 24th. On other years the shower has had one longer maxima. A Hajduk, of the Slovak Academy of Sciences, examined the rates of Orionids for the first 70 years of the 20th century, He noted that the radiant position did not appear with any fixed period. He concluded that the changes are the result of filaments within the dust existing within the orbit of Halley's comet. This may also explain the fireball phenomena three days after the maxima.

Observation of the shower this year has been challenging due to weather conditions, and there appear to be a reduced number of visual observations from the UK. The radio detection is less affected by the weather. Observing the RADAR returns from GRAVES radar transmitter has given the spread of detections as below.



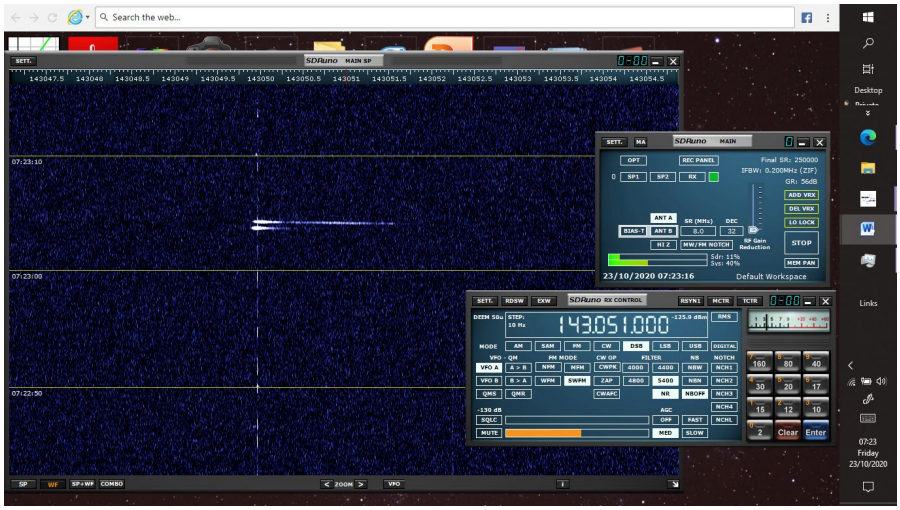
Obviously with GRAVES it is not possible to determine which echoes belong to the Orionids and which may be considered sporadics. Over a period I have collected some idea of the diurnal range of the sporadic echoes such that it can be subtracted from the total received. This is still a work in progress but best current estimate is that with average sparodics removed is as below:



This shows a more defined peak at about 0200 each day which is the time the radiant passes south of GRAVES

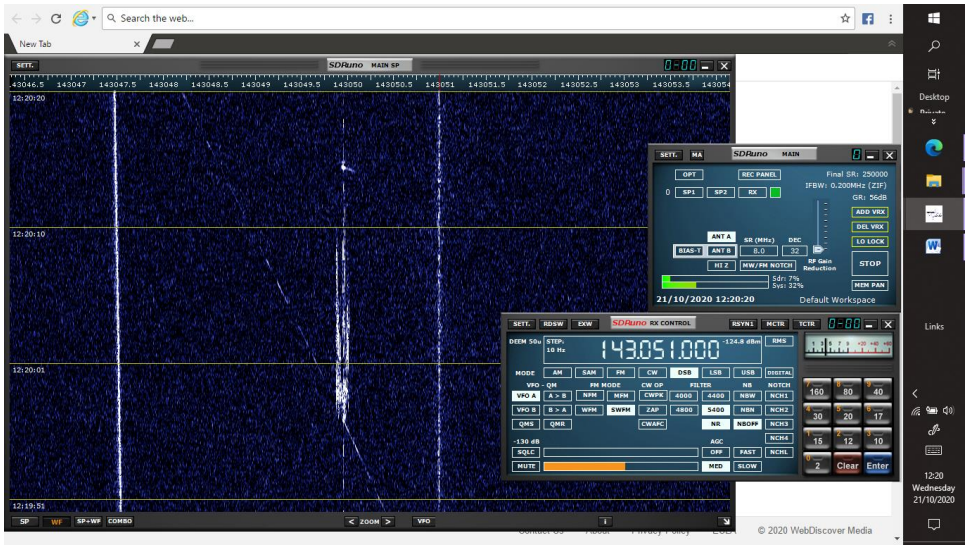
Some of the interesting displays are shown below.

From the SDR receiver (2D echoes)



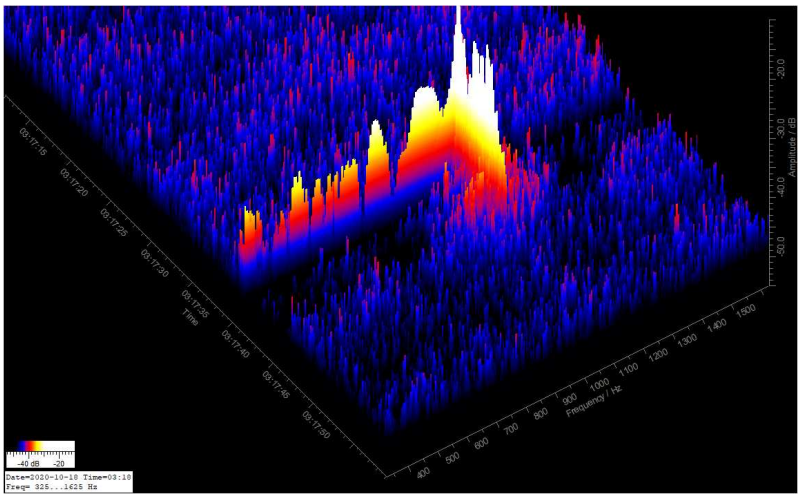
Large Doppler shift as meteor slows.

Starlink Satellites (Thanks Elton) with 2 meteor traces mixed in

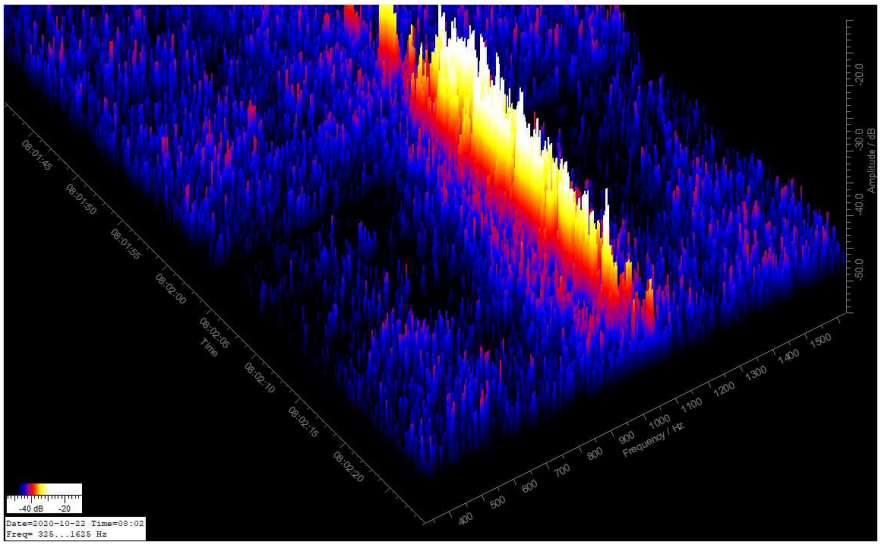


Double trace persistence (reflected due to upper atmospheric winds displacing part of the ionised trail; this is due to wind shear.)

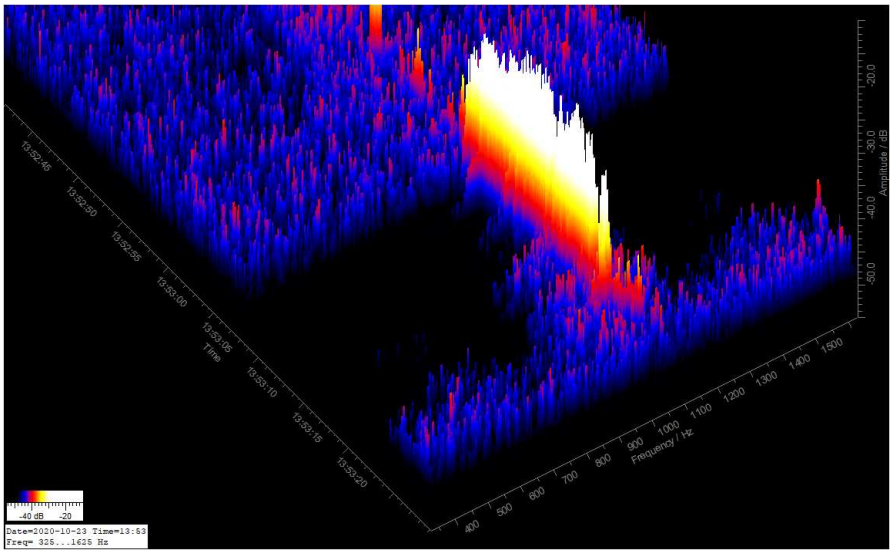
From the output of Speclab where a 3rd dimension is added for signal strength (Vertical).



Doppler shift and some persistence



Long Echo approx 12sec (This is the time taken for the ionised trail to collapse and stop reflecting the signal)



All Sky Camera

Not running, due to the weather, so of no advantage at this time. ROI cameras not used (these are DLSRs so need good weather conditions.)

Very Low Frequency observations

Although running for most of the period it was not possible for it to be at it's very quiet site so a larger amount of interference was experienced. There are several strikes that were recorded but without the Skycam it is not possible to correlate.

In conclusion, not the best shower, so await the next (Taurids and Loenids)

Chris Bailey

For Sale or Wanted

This section is for the sale of Astronomical items and any wants from members. Details of items for sale (With photographs where applicable) should be forwarded to the newsletter editor at newsletter@brecklandastro.org.uk

It is suggested that a donation of 5% of the final sale price be given to the Society to assist with funds. If sellers do not wish to make their contact details public then please make this known to me and I will field any enquiries on a box number system. Please send any sales details to me before the 26th of the month for inclusion in the next issue.

Please ensure that if any item is sold by another means prior to publication that I am advised so it can be removed to avoid confusion.

For Sale

150 dia x 750 F/L Sky-Watcher Newtonian. Complete with an EQ3 GoTo Synscan mount. Upgraded 10-1 soft focuser, 15, 25 & 28mm eyepieces finder scope, red dot finder, laser collimator and moon filter.

Hoping for £300. Plus the original box.

I've known the scope from new, with two previous owners, the last being a lady that has used it possible 3 or 4 times in the last 3 years, where it's been stored in the corner of the living room gathering dust….

In the first instance contact me at jim@slight.io.

SynScan EQ3
SynScan
Moon Filter
TELESCOPE
D=150mm F=750mm
Coated Optics
Made in China
INSTRUCTION MANUAL
SynScan

CONTACTS

Chair Dan Self
Contact **chairman@brecklandastro.org.uk**

Observatory/Visits Mick Ladner
Contact **visitors@brecklandastro.org.uk**

Webmaster Andrew Luck (temporary)
Contact webmaster@brecklandastro.org.uk

Newsletter Chris Bailey
Contact newsletter@brecklandastro.org.uk

Membership/Treasurer Andy Jones
Contact treasurer@brecklandastro.org.uk

Secretary Rebecca Greef
Contact secretary@brecklandastro.org.uk

Please check with any of the contacts in bold before visiting the observatory. Please ensure you are wearing appropriate footwear and clothing and bring a torch (preferably one showing a RED light)

Breckland Astronomical Society Events – 2021 7:30pm Great Ellingham Recreation Centre, Watton Road, Great Ellingham, Attleborough, Norfolk **Google Meet – details to follow - £free** **We may return someday! Hall entry £2.50 £1 U18s**		
Friday, December 11th 2020	**North Norfolk AONB and the Dark Skies Project Update** **+ Review of 2020 in pictures**	Kate Dougan, Norfolk Coastal Partnership Members
Monday, December 21st 2020	**Jupiter Saturn conjunction viewing 5pm**	Observatory – restricted numbers
Friday, January 8th	**The Vikings at Barsoom part 1 – orbital operations**	Paul Money (the one and only)
Friday, January 29th	**Public open night (subject to public mobility)**	Observatory
Friday, February 12th (palindrome date!)	**Cosmic Dawn and Destiny (follow up to Hawking/Edge of Physics)**	Paul Fellows, Cambridge AS
Friday, February 26th	**Public open night (subject to public mobility)**	Observatory
Friday, March 12th	**Building an Observatory** **+ The Crisis in Cosmology**	Malcolm Dent and Dan Self (BAS)
Week March 10 – 17th Main: Sat, March 13th	**Spring Star Party 2021*** **(*star walk/talk Sat eve*)**	Haw Wood Farm (see below)
Friday, March 26th	**Public open night (subject to public mobility)**	Observatory
Friday, April 9th	**The Vikings at Barsoom part 2 – the search for life**	Paul Money
Friday, April 30th	**Public open night (subject to public mobility)**	Observatory
Friday, May 14th	**Our Moon – a closer look** **+ AGM**	Jerry Workman (in person)
Friday, June 11th	**Comets past and future**	Nick James, BAA
* Haw Wood Farm Caravan Park, Hinton, Saxmundham, IP17 3QT. www.hawwoodfarm.co.uk to book: info@hawwoodfarm.co.uk 01502 359550. £12 per pitch per night subject to updates		

DASH has kindly invited us to the following great talks in early 2021 To ask to join please email **Jim** in advance on dashastro.info@gmail.com		
Sunday, January 24th	**Quasars and Their Influence on Galaxy Evolution.**	Amy Rankine, IoA Cambridge
Thursday, January 28th	**Surveying the Sky for Radio Galaxies**	Prof Martin Hardcastle Uni of Herts.
Sunday, March 28th	**The Čerenkov Telescope Array**	Prof Michael Burton, Director Armagh Obs