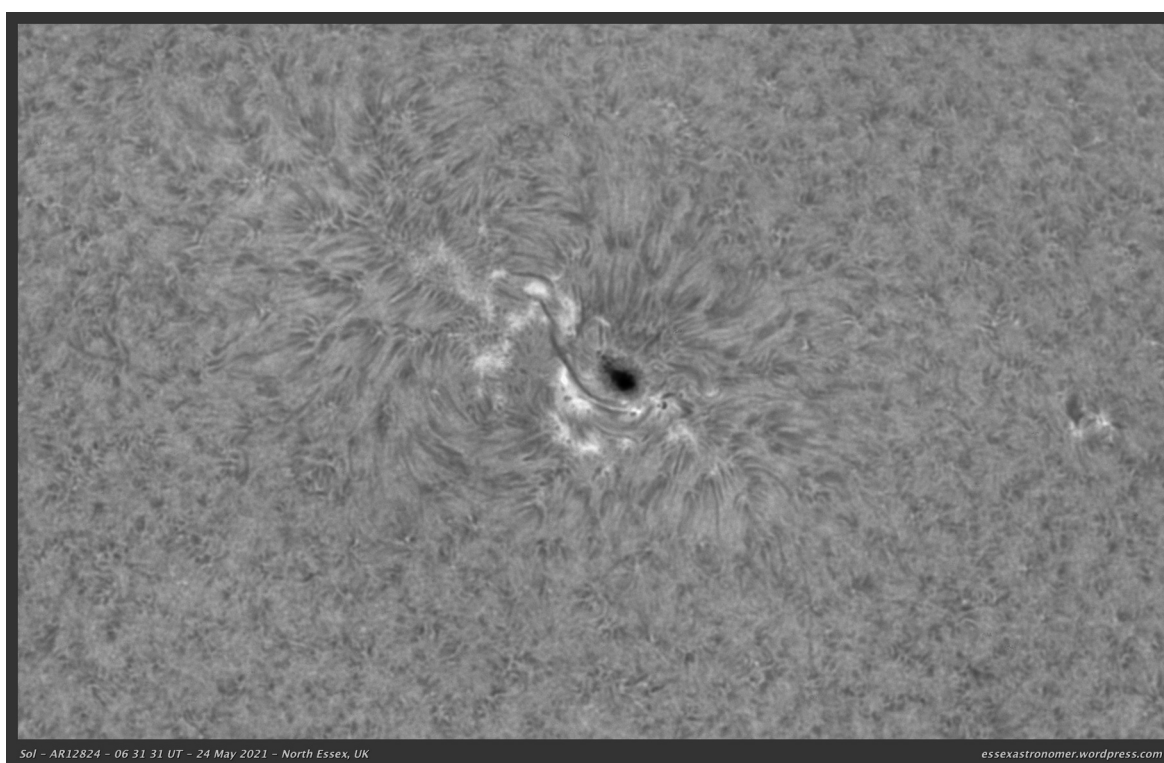




OASI News

The newsletter of the Orwell Astronomical Society



Sol - AR12824 - 06 31 31 UT - 24 May 2021 - North Essex, UK

essexastronomer.wordpress.com

Sunspot AR12824

Photo by: John Hughes

Trustees:

Mr Roy Adams

Mr Neil Morley

Mr David Payne

Honorary President:

Dr Allan Chapman D.Phil MA FRAS

Table of Contents

Society Notices.....	3
Committee Meeting.....	4
OASI and BAA Events.....	5
Meetings via Zoom.....	6
OASI @ Newbourn (only one more Zoom!).....	6
Astronomy Workshops/Informal talks.....	6
Lectures – via Zoom.....	7
Other local astronomy society meetings.....	8
Atheneum Astro Society.....	8
LYRA Lowestoft & Yarmouth Regional Astronomers.....	8
DASH Astro.....	8
BAA news & webinars.....	8
The Radio Astronomy Section.....	8
The Moon: Meet our nearest neighbour.....	9
From the Interweb.....	9
Professor Catherine Heymans appointed as Astronomer Royal for Scotland.....	9
Chinese astronomy: a guide to ancient stargazing in China.....	9
Dark Energy Survey Consortium.....	9
Stephen Hawking's papers to be saved for the nation.....	10
The International Astronomy Show – October 2021.....	10
Sun Halo.....	10
Noctilucent Cloud season.....	10
The Night Sky in June 2021.....	11
Sun, Moon and planets.....	11
Annular Solar eclipse, 10 June.....	12
Occultations during June 2021.....	12
Meteor showers during June 2021.....	12
Visible ISS passes $\geq 15^\circ$ max altitude.....	12
Starlink passes.....	13
Comets with magnitude brighter than magnitude 10.....	13
Astronomy on the radio.....	13
Baikal –GVD Neutrino Telescope.....	14
The Hunt for Astrophysical Neutrino Origins.....	14
Wartime Radar Jamming not what it seems.....	17
Radioastronomy: Area 51¾ Report.....	18
The Sun – 24 May 2021 – AR12824.....	20
An All-Sky camera using a RaspberryPi.....	22
Astro3 small crossword.....	26

Society Notices

Dear Members,

We have moved to using a Zoom Pro account. If you would like to join in, email Paul Whiting, treasurer@oasi.org.uk

In the coming months, we will be guided by advice from the Government and Public Health England, as to when we can resume some of our activities. These are likely to be very limited at first, the Committee will decide what could be done, with the health and safety of everybody being the highest priority.

I would like to wish everybody clear skies, stay safe and I hope to see you soon.

Andy Gibbs, Chairman

Society Contact details

Email queries: info@oasi.org.uk

Facebook: Orwell Astronomical

Twitter: @OASIPswich

YouTube:
<https://www.youtube.com/channel/UCHgxe3QAeRVWf7vkjKkCI2Q>

Members-only message board

<https://groups.io/g/OASI>

Observatory (meeting nights only)
07960 083714

**Please send material for the OASI
web site and newsletter
e.g. observations, notices of events,
general interest articles, to
news@oasi.org.uk**

The CLOSING date is the 15th day of the month

Access into the School Grounds and Observatory Tower

The Observatory is closed.

Articles for OASI News

News, pictures and articles for this newsletter are always welcome. Details above.

Please submit your articles in any of the following formats:-

Text: txt, rtf, rtf, doc, docx, odt, Pages, pdf
Spreadsheets: xls,xlsx, OpenOffice/LibreOffice, Numbers
Images: tiff, png, jpg
Please send tables as separate files in one of the above formats.

If you don't feel up to writing a major article, perhaps you might write a short note for OASI News along the lines of "This month I have mostly been observing/constructing/mending/reading/etc."?

Newsletter archive www.oasi.org.uk/NL/NL_form.shtml

Authors, please note that your articles will be publicly available worldwide!

Reproducing articles from OASI News

If you plan to reproduce an article exactly as per OASI News then please contact the Editor – otherwise, as a matter of courtesy, please seek permission from and credit the original source/author. You may not reproduce articles for profit or other commercial purpose.

Committee 2021

Chairman	Andy Gibbs	Set overall agenda for OASI, Chair committee meetings, Press and publicity,
Secretary	Roy Gooding	Outreach meetings (jointly with Chairman), observatory decoration.
Treasurer	Paul Whiting FRAS	Finance, Supervision of applications for grants. Visits by outside groups, Observatory tours, Public appreciation of astronomy, Outreach activities.
Committee	James Appleton	Committee meeting minutes, Web site
	Martin Cook	Membership, Tomline refractor maintenance & user testing
	Matt Leeks	Safety & security
	Peter Richards	Lecture meetings, Email distribution lists
	John Wainwright	Equipment curator
	Mike Whybray	Astronomy Workshops, Child protection officer, Orwell Park School Astronomy Club.
	Andy Wilshire	Librarian
	Avtar Nagra	OASI @ Newbourne
Assistants	Martin Richmond-Hardy	Newsletter, OASI @ Newbourne

Committee Meeting

The next Committee Meeting will be held at 8pm on Friday 3 September.

Please Contact Paul Whiting for Zoom connection details.

OASI and BAA Events

Please note that the listed events may change depending on the progress of the pandemic. For the latest event details, please see www.oasi.org.uk/Events/Events.php

There's a Google Calendar on the OASI web site with the latest dates (and corrections!). If you want to easily add OASI Events to your own computer/phone/tablet calendar application click this button on the website Events page (bottom right of the calendar) or use this address to access this calendar from other calendar applications.



<https://calendar.google.com/calendar/ical/ljhs9db7lncki4sojo7092vfvc%40group.calendar.google.com/public/basic.ics>

For other astronomy news and astro pictures try our

Twitter feed <https://twitter.com/OASlpswich>

Facebook page <https://www.facebook.com/pages/Orwell-Astronomical/158256464287623>

Date, Time & Location	Contact	Event
Weekly, every Wednesday, from 20:00	Martin Cook, Roy Gooding	OBSERVATORY CLOSED Meet via Zoom.
Mon 14 June, 19:30-21:00 Zoom	Martin R-H newbourne@oasi.org.uk	"Newbourne" meeting: 19:30 meeting opens; 19:45 Astro News by Paul Whiting, FRAS.
Thursday 10 June 10:00 – 11:00		Annular solar eclipse, partial view from the UK If not cloudy, observing from Newbourne VH car park. No access to Hall (& loos!)
Fri 25 June, 19:50-21:00 Zoom	Pete Richards lectures@oasi.org.uk	19:50 meeting opens; 20:00 <i>Anglo-Saxon Astronomy</i> , live talk by Martin Lunn, MBE.
Mon 28 June 2021, 19:30-21:00 We're back at Newbourne Village Hall!	Martin R-H newbourne@oasi.org.uk	Newbourne meeting: 19:30 meeting opens; 19:45 Sky Notes by Bill Barton, FRAS.
Saturday 10 July from 13:00 Newbourne Village Hall	Pete Richards lectures@oasi.org.uk	OASI Summer Picnic
2022		
Friday 28th January 2022	Pete Richards lectures@oasi.org.uk	Dame Jocelyn Bell Burnell will deliver a talk to OASI live on Zoom.

Meetings via Zoom

Paul Whiting has set up an OASI account on Zoom Pro which allows us to accommodate more participants.. To join, please first contact Paul, treasurer@oasi.org.uk – OASI members only. Be sure to install the latest version of Zoom – there's no need to set up an account. Go to <https://zoom.us/join> and enter the meeting ID or personal link name. You will have received a link from the meeting organiser.

We meet on Wednesday evenings from 20:00 and on Newbourne evenings (see below) from 19:30.

OASI @ Newbourne (only one more Zoom!)

Martin Richmond-Hardy newbourne@oasi.org.uk

In view of the COVID-19 situation **all meetings at Newbourne have been suspended**. We normally meet at Newbourne Village Hall, Mill Lane, IP12 4NP on the 2nd and 4th Mondays (with a few exceptions). If OASI members would like to meet up via Zoom on those evenings, please first contact Paul Whiting with your email address to receive an invitation. Members only, please. Subsequent meetings will be assessed in line with the current Government Guidelines in place at the time. Thank you for your understanding.

Zoom June 14 (A)

Newbourne June 28 (A) July 10 OASI picnic

We open up (Zoom) for all meetings at 7:30pm. Astro News/Star Guide (A) at 7:45pm followed by any Talks (T), Workshops (W) and the occasional Quiz (Q).

Stargazer's Guide

On the last meeting each month, at 19:45, Bill Barton FRAS will give a short presentation of what can be viewed in the following 4 weeks plus a reminder of OASI events. During the COVID-19 isolation period these will be available on our website.

Astronomy Workshops/Informal talks

Meetings will depend on COVID-19 situation. **Talks will be via Zoom until further notice.**

Contact Mike Whybray Monday meetings start at 7:30pm. Workshops / Talks start at 8pm

If you are a new OASI member, or haven't been to one of these informal workshops before, they are a mixture of events of different characters including beginners talks, interactive workshops, films, etc., suitable for all. They are also a chance to chat with other members over a cup of tea and a biscuit, in a venue rather warmer than the observatory dome on a winter's night!

All meetings are via Zoom. The OASI@Newbourne events are via the usual meeting ID. Contact Paul Whiting if you can't find the details.

Do you have a subject you could workshop/talk? You could do a short one, or share the effort with a partner. Drop Mike Whybray a line! workshops@oasi.org.uk

Lectures – via Zoom

Contact: Peter Richards lectures@oasi.org.uk

The start time for all talks will be 8pm and, as usual, the talks will usually be held on a Friday evening.

All meetings are currently via Zoom. Contact Paul Whiting if you can't find the details.

Friday 28th January 2022

Dame Jocelyn Bell Burnell will deliver a talk to OASI live on Zoom. The talk title will be confirmed at a later date.



Jocelyn Bell Burnell inadvertently discovered pulsars as a graduate student in radio astronomy in Cambridge, opening up a new branch of astrophysics - work recognised by the award of a Nobel Prize to her supervisor.

She has subsequently worked in many roles in many branches of astronomy, working part-time while raising a family. She is now a Visiting Academic in Oxford, and the Chancellor of the University of Dundee, Scotland. She has been President of the UK's Royal Astronomical Society, in 2008 became the first female President of the Institute of Physics for the UK and Ireland, and in 2014 the first female President of the Royal Society of Edinburgh. She was one of the small group of women scientists that set up the Athena SWAN scheme.

She has received many honours, including a \$3M Breakthrough Prize in 2018.

The public appreciation and understanding of science have always been important to her, and she is much in demand as a speaker and broadcaster. In her spare time, she gardens, listens to choral music and is active in the Quakers. She has co-edited an anthology of poetry with an astronomical theme – 'Dark Matter; Poems of Space'.

Other local astronomy society meetings

Athaneum Astro Society

www.3a.org.uk/index.htm

Meetings suspended during the Covid-19 situation.

LYRA Lowestoft & Yarmouth Regional Astronomers

www.lyra-astro.co.uk

Due to current Corona Virus outbreak all LYRA meetings are cancelled until further notice.

DASH Astro

Darsham And Surrounding Hamlets <http://dash-astro.co.uk>

Meetings are normally held at New Darsham Village Hall and all DASH Astro observing sessions will take place at Westleton Common. ASOG observing sessions and locations may be arranged at the time of observation. Unless stated all group meetings will take place from 7:30 pm. on Sundays.

Meetings will be assessed in line with the current Government Guidelines in place at the time.

BAA news & webinars

For full details of all meetings or cancellations, please go to <https://britastro.org/meetings/2021>.

2021

Wednesday 9 June	19:00	Sketching Deep Sky Objects	Howard Banich
Friday, 25 June	19:15	Radio Astronomy Section Zoom 7	
		On the tricky question of Pulsars - Peter East OBE FEng	
Saturday, 26 June	11:00	BAA Summer Webinar	
Friday, 3 September	19:30	BAA Autumn Weekend Meeting, Leeds	
to Sunday, 5 September	13:00	School of Music, University of Leeds, Leeds LS2 9JT	
Wednesday, 27 October		BAA Annual General Meeting and BAA Meeting,	
Saturday, 4 December	14:00	BAA Christmas Meeting	

The Radio Astronomy Section

Thanks to an initiative by Paul Hearn, the Radio Astronomy Section have been enjoying talks, seminars and tutorials via Zoom.

These are/will be available on the BAA YouTube channel.

<https://www.youtube.com/user/britishastronomical/playlists>

Radio Astronomy Python¹

Rupert Powell

1 <https://www.youtube.com/watch?v=3m87wpPATjc>

2 <https://www.youtube.com/watch?v=aBzePb9OG4g>

3 <https://www.youtube.com/watch?v=FKCHQzCEMLg>

¹ There is a really good free Python course from the OU on Openlearn, *Learn to code for Data Analysis*, <https://www.open.edu/openlearn/science-maths-technology/learn-code-data-analysis/content-section-overview?active-tab=content-tab>

Part II - SDR and GPS	Rupert Powell 5th June 2021 - 09:30 - 12:30
Hydrogen Line Observing	Brian Coleman G4NNS https://www.youtube.com/watch?v=uzcvbGzKp8E
SpectrumLab workshop	Paul Hyde G4CSD https://www.youtube.com/watch?v=x0PnyxEzmZ0
On the tricky question of Pulsars	Peter East OBE FREng, 28 May
Current Observations from Astropheiler Stockert	Wolfgang Herrmann, June 25th.
GNU Radio for Radio Astronomers	Marcus Leech, (Science Radio Laboratories, Inc.) will be leading a training seminar to unpack the mysteries of GNU Radio. Marcus is a leading GNU guru for Radio Astronomy applications Due Saturday Sept. 18th 15:00 – 18:00 BST

The Moon: Meet our nearest neighbour

Ipswich Art Gallery

31 July – 10 October

Ipswich Art Gallery is re-opening this summer.

The Moon: Meet our nearest neighbour is a touring exhibition and features fascinating objects such as a large inflatable Moon, scientific instruments, and actual Moon rock on loan from Be-spoke Scientific, giving you the chance to discover what the Moon is made of, how it has influenced our history, culture and natural world, and how we have explored it from ancient times to the present and future.

Subscribe to the Ipswich Museum's mailing list to keep up to date with all the news about the exhibition. <https://www.ipswich.gov.uk/content/keep-touch-ipswich-museums>

From the Interweb

Professor Catherine Heymans appointed as Astronomer Royal for Scotland

<https://ras.ac.uk/news-and-press/news/prof-catherine-heymans-becomes-astronomer-royal-scotland>

[Professor Catherine Heymans](#) is an astrophysicist at the University of Edinburgh and Ruhr University Bochum. Professor Heymans is the eleventh scientist and the first woman to hold the role since its establishment in 1834.

Chinese astronomy: a guide to ancient stargazing in China

<https://www.skyatnightmagazine.com/space-science/chinese-astronomy/>

Dark Energy Survey Consortium

<https://www.facebook.com/darkenergysurvey/>

The results are IN!! We are proud to present our main results from our analysis of gravitational lensing and galaxy clustering using the first three years of DES observations.

Here is a press release of our results, including a great 7-minute video featuring DEScientists!

<https://news.fnal.gov/.../dark-energy-survey-releases.../>

We have now released 26 of our 30 papers related to this analysis, including our main results! They can all be found here, with the main results at the bottom of the page:

<https://www.darkenergysurvey.org/des-year-3-cosmology.../>

Stephen Hawking's papers to be saved for the nation

<https://www.bbc.co.uk/news/science-environment-57088148>

The International Astronomy Show – October 2021

<https://www.ukastroshow.com>

Sun Halo

Andy Gibbs

Whilst drinking coffee outside the Suffolk Food Hall this morning (28 May), I observed a 22° Sun Halo. Taken with an iPhone SE.



Noctilucent Cloud season

Sandra Brantingham, BAA Director Aurora & Noctilucent Cloud Section

It looks like the NLC season is starting, with the first signs showing on the "Polar Daisy" dated May 20th. Although it's small, I expect it to expand rapidly and soon provide sightings. NLC was spotted 26 May (most of us were under cloud) so keep your eyes skinned and looking north as the season is now under way.

The Night Sky in June 2021

Martin RH

All event times (BST) are for the location of Orwell Park Observatory 52.0096°N, 1.2305°E.

Sun, Moon and planets

Sources:

<http://heavens-above.com/PlanetSummary.asp>

<http://heavens-above.com/moon.aspx>



Object	Date	Rise	Set	Mag.	Notes
Sun	1	04:41	21:06		Jun 10 Annular solar eclipse, partially (30%) visible from the UK.
	30	04:39	21:18		Summer solstice Jun 21, 04:32 Sunrise 04:35; Sunset 21:19
Moon	1	01:52	11:05		Full 24 June 2021 19:40 Last Q 02 June 2021 08:24
	30	00:34	11:18		New 10 June 2021 11:53 First Q 18 June 2021 04:54
Mercury	1	05:40	21:57	2.9	Aphelion 10 June
	30	03:45	19:15	1.2	Inferior conjunction 11 June
Venus	1	05:46	22:30	-3.8	Perihelion 12 June
	30	06:48	22:42	-3.8	
Mars	1	07:47	00:08	1.7	
	30	07:35	22:58	1.8	
Jupiter	1	01:33	11:27	-2.3	1 June: The Moon and Jupiter will make a close approach, passing within 4°21' of each other. The Moon will be 21 days old. From Ipswich, the pair will be visible in the dawn sky, rising at 01:30 (BST) – 3 hours and 11 minutes before the Sun – and reaching an altitude of 19° above the south-eastern horizon before fading from view as dawn breaks around 04:13. Source: https://in-the-sky.org/news.php?id=20210601_15_100
	30	23:37	09:35	-2.5	
Saturn	1	00:55	09:43	0.6	
	30	22:55	07:43	0.4	
Uranus	1	03:34	18:14	5.9	
	30	01:43	16:27	5.8	
Neptune	1	02:11	13:29	7.9	
	30	00:18	11:36	7.9	

Annular Solar eclipse, 10 June.

Source: <http://www.eclipsewise.com/oh/ec2021.html#LE2021May26T>

We will be Observing from Newbourne Village Hall.

First contact is at 10.11 BST, with the aim to be on-site at 09.45, to set up equipment.

Due to Covid, the sharing of equipment will not be permitted, so OASI members must bring their own equipment to view the eclipse. HMG rules state that the maximum number of people meeting outside must not exceed thirty, (we would be unlikely to exceed this figure), but I would ask that those members who are interested in attending to email me at chairman@oasi.org.uk We will just be meeting outside, Newbourne Village Hall will not be open.

If the weather looks unfavourable, we will make a go/no go decision at our meeting on Wednesday June 9.

The link below simulates the view of the eclipse from Newbourne.

<https://www.timeanddate.com/eclipse/in/@2641703>

From Ipswich we may be able to see ~30% cover.

Local Circumstances Outside the Path of Annularity

CITY	Eclipse Begins	Maximum Eclipse	Eclipse Ends	Sun Alt. Alt. **	Ecl. Obsc. Obsc	Ecl. Mag
London	09:08:43	10:13:12	11:22:26	55	0.316	0.200

Occultations during June 2021

If you would like to know more about lunar occultations, please see:-

https://iota-es.de/moon/grazing_descr%101.html and <http://www.lunar-occultations.com/iota/bstar/bstar.htm>

Observers are encouraged to download and install the [Occult](#) software program [Windows only] to generate predictions for their own particular site coordinates.

Meteor showers during June 2021

Source: BAA Handbook 2021 p26-27 and <https://in-the-sky.org/newsindex.php?feed=meteors>

Shower	Normal limits	Maximum	Max RA/Dec.°	ZHR at Max	Notes
Daytime Arietids	May 22 – July 2	June 7	02:56 (044°) +24°	30?	Most active of the daytime showers. Good for radio observers. ZHR and radiant location uncertain.
Daytime ζ-Perseids	May 20 – July 5	June 9	04:16(064°) +27°	20?	Peak overlaps with that of Daytime Arietids. Good for radio observers. ZHR and radiant location uncertain.

For radio observation, use reflections from Graves radar on 143.050MHz or the Brams transmitter in Belgium on 49.97MHz.

Visible ISS passes ≥15° max altitude

Source: <http://heavens-above.com/PassSummary.aspx?satid=25544>

Times are BST. Predictions are approximate (29 Apr) due to craft adjustments. Check the day before.

Date	Bright-ness (mag)	Start			Highest point			End		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
No visible passes this month										

Starlink passes

<https://heavens-above.com/AllPassesFromLaunch.aspx>

For a dynamic 3-D display, see <https://heavens-above.com/StarLink.aspx>

Comets with magnitude brighter than magnitude 10

Source: <https://heavens-above.com/Comets.aspx> and BAA Handbook p95.

Comet	Brightness	Date of last reported observation	Angular separation from Sun	Altitude	Azimuth	Constellation
None this month						

Astronomy on the radio

Bill Barton's Radio Broadcast

ICRFM (Ipswich Community Radio) 105.7 MHz at about 08:25 in the morning of the first Wednesday of each month. I aim to cover what there is to see in the sky and then a little bit on something topical. ICRFM is also available to listen to over the Internet and there is a listen again option on their website. <http://www.icrfm.com>

David Murton's Radio Broadcast

On 1st Tuesday of the month, 2.40pm on the Lesley Dolphin show on BBC Radio Suffolk and the internet. <https://www.bbc.co.uk/radiosuffolk>

Baikal –GVD Neutrino Telescope.

The Hunt for Astrophysical Neutrino Origins.

A short article from the library.

Andy Willshire

It would seem in the hunt for the illusive neutrino, scientific articles about the subject appear like the renowned London bus. One article appears and two more follow along. The first article was about KM3NeT, which is a detector situated in the Mediterranean Sea, and the second, IceCube situated at the South Pole in Antarctica.

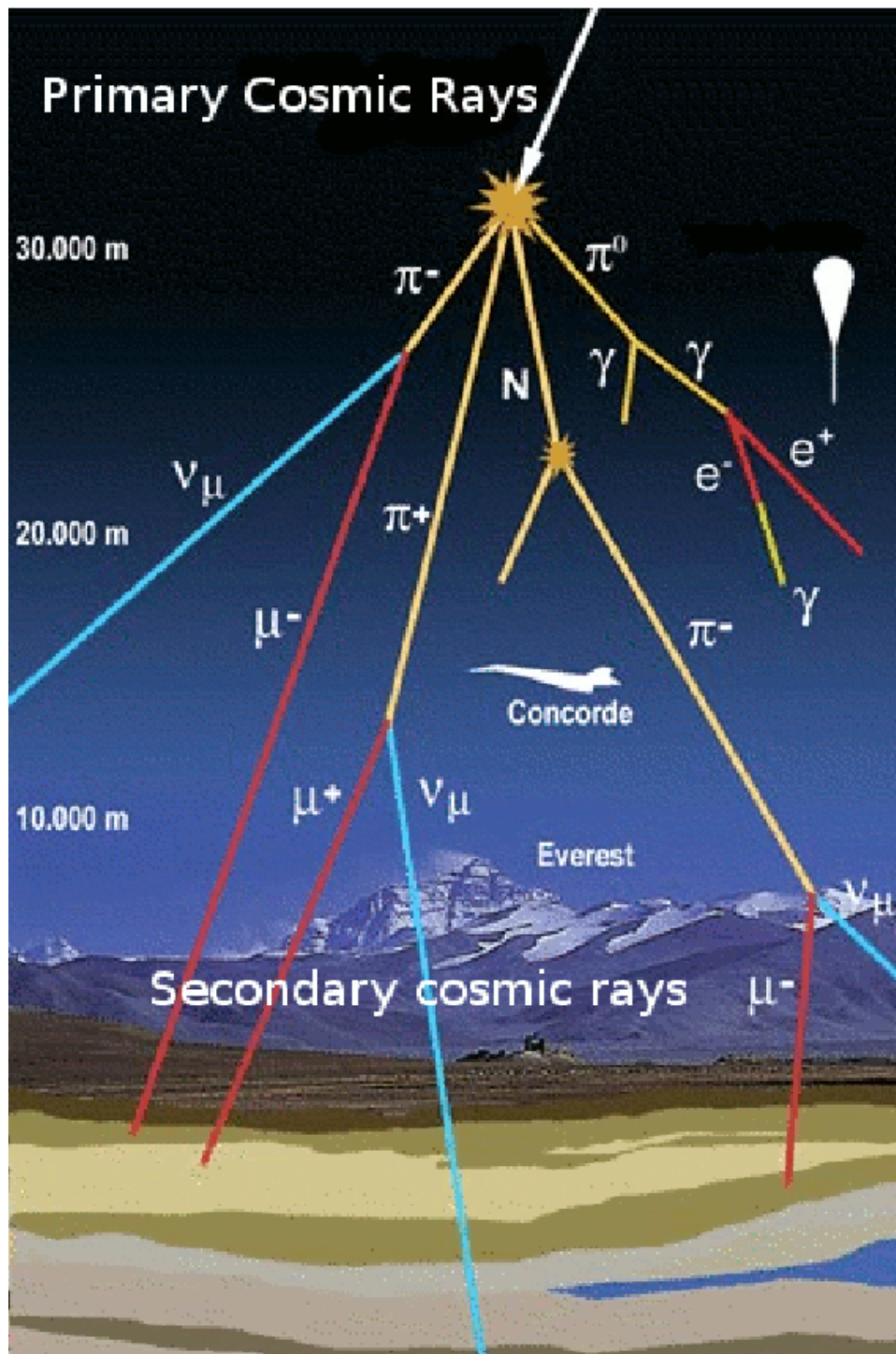
KM3NeT is considered one of the next generation of neutrino telescopes, and will take the place of the ANTARES scope in the deepest area of the Mediterranean Sea. It will provide facility to examine a major section of the Galactic Plane, which incorporates the Galactic Centre. This system supplements the coverage of the IceCube telescope, and will spend its time searching for neutrinos generated from gamma ray bursts, supernovae sources and perhaps dark matter. Its angular resolution will be 0.1° for neutrinos with an energy of 100TeV.

The IceCube neutrino observatory has been erected at the Amundsen-Scott South Pole base. It is the first gigaton neutrino monitor to be constructed and stretches down 1500m in the South Pole's ice. The cost for building the neutrino search equipment at the Pole is \$279 million U.S. An article about this particular telescope appears in the OASI magazine February 2021.

Recently the SuperNemo neutron demonstrator model was produced at the *Laboratoire Souterrain de Modena* (LSM). The Modena underground laboratory is 1700m below the Frejus mountain and is the deepest in Europe, and analysed its first data in 2018. It is designed to research the double-beta decay process, a type of radioactive decay. Two neutrons are concurrently converted into two protons or conversely, two protons into two neutrons, inside an atomic nucleus. This has been theoretically predicted but never observed.

So, why have the Russians decided upon Lake Baikal to search for the ghost particle. This is the neutrino which has virtually no mass and no electrical charge, and is sub-atomic. The main reason is that in order for neutrinos to be detected, the detection apparatus has to be well shielded from all sources of interference, for example, cosmic rays. With this in mind, Lake Baikal with its covering of thick ice and fresh water is an ideal candidate. The plan for the telescope is completion in two stages, with the first being completed between 2020 and 2021. This will incorporate 2304 optical elements, producing a volume of 0.4km^3 . The following step will be to increase this volume to 1.5km^3

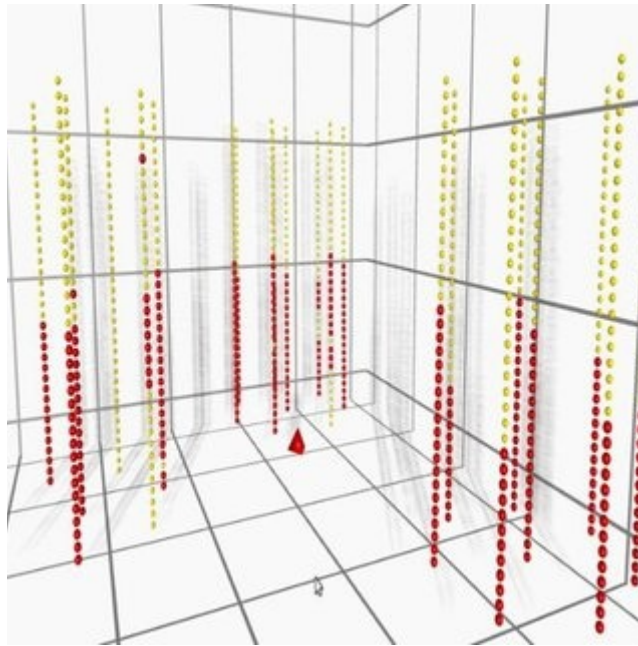
The GVD (Gigaton Volume detector) neutrino telescope has been in operation since April 2015 at the point when the first module was laid down. Decisions were then made at this point to decide which tasks would become priority. Ultra-high energy neutrino flows originating in deep space leading to muon neutrinos and high-energy cascades are to be analysed in order to hunt for astrophysical neutrino origins. The Baikal –GVD looks Southward to muon neutrinos coming in from the lower hemisphere of the Earth, with approximately one neutrino incident occurring and being detected by each cluster. Neutrinos were the first to indicate when the supernova 1987A exploded in the Large Magellanic Cloud. (23 February 1987). A total of 19 neutrinos were recorded within 6 seconds, whilst it was not optical until 3 hours later. Electrons and protons are not used because while traveling on their way to Earth their paths are radically changed due to magnetic fields. This makes it impossible to ascertain their source.



Picture credit: Francisco Barradas Solas [1]

The Biakal Gigaton Volume Detector (GVD) is a spatial configuration comprising optical modules, assembled in groups, with each group consisting of 288 optical elements, located on eight 525m long vertical strings. The distance between the strings is 60m and between elements 300m. It takes 3-4 days to position one of these strings including all the evaluation checks. When all of the strings have been completed, they are connected to a central control centre situated about 30 m deep and from here via an opto-electrical cable to the shore control centre.

The primary phase of the telescope was finished on 13th March 2021 comprising the first 8 clusters of 288 optical elements. The cost of the build to this point has been some 34 million U.S.Dollars.



Example of laser flash detection, used for inter-cluster calibration. Triangle shows position of laser.

Picture credit: Shutterstock.com

The operating principle of the detector has been established on Cherenkov radiation. This radiation is created when a charged particle such as an electron travels through materials with a high polarization, speeding faster than light through the same medium. In this case, neutrino interactions giving rise to secondary muons and cascade showers. The light sensitive systems of the optical modules are photomultiplier tubes (PMT) which have a photocathode diameter of 10 inches. In order to obtain high signal capability, the tubes are required to be sensitive to low light levels and low dark noise rates. Once the signals have been received by the PMT, they are amplified and conveyed to the analogue to digital converter (ADC), the sampling rate of these is 200MHz, which is timed using quartz oscillators. This results in the fusion and synchronisation of all timed events. Twelve operational modules are controlled by each ADC. The data recorded will indicate the direction and energy of the cascade showers and muons. Secondary muons created in high-energy neutrino relationships are capable of transmitting for more than 1 kilometre. This allows for muon neutrinos to be recorded.

The analysis of data obtained during 2015-2017 enabled the singling out of a sample of muons to represent contenders for neutrino events leading to the recognition of two high-energy cascades, which may have initiated from astrophysical neutrinos. The concluding ambition of the Baikal-GVD enterprise is the building of a km^3 – scale neutrino telescope formed of approximately 10^3 light sensors.

References:

1. https://www.researchgate.net/publication/264310353_Bringing_particle_physics_to_life_build_your_own_cloud_chamber
2. [\(PDF\) Status of the Baikal-GVD Neutrino Telescope \(researchgate.net\)](#)
3. [High energy neutrinos from the cosmos \(nobelprize.org\)](#)
4. [Why Russian scientists just deployed a giant telescope beneath Lake Baikal | Live Science](#)

Wartime Radar Jamming not what it seems

Paul Whiting FRAS

James Stanley Hey (1909 – 2000) was a physicist and teacher, who, at the outbreak of war, joined the Army Operational Research Group (AORG) specifically to work on countering the radar jamming methods the Germans had been using since 1941.

Over the two days 27th and 28th February 1942, Hey was told of severe noise jamming of anti-aircraft radars in the 4–6m (50–70MHz) range. This was quite worrying, as it was assumed that the Germans had come up with a new, highly-effective method to thwart the Allied radar defence system.

In a paper¹ published after the war, in January 1946, Hey revealed that the source of this jamming was actually a little further away than Europe, namely the Sun. Hey and his colleagues had quickly realised that the jamming signal was highly directional, the source of which moved with the Sun during daylight and which disappeared at night. The bearing and elevation of the source was measured independently by stations around the UK - Hey cites Hull, Bristol, Southampton and Yarmouth as some of these receiving stations.

The signal itself had all the characteristics of regular background radio noise that was normally received by the radar receivers, except that the level or amount of signal was far greater. The signal was seen across the whole of the 4–6m band, starting in the afternoon of the 27th. The signal disappeared overnight and then re-appeared the next day. It was not seen again for the duration.

Although precise measurements of the intensity of the increase in this solar radiation were not made (there was a war on!), Hey estimates that the solar radiation over this two-day period was around 100,000 times greater than normal. The cause of this massive radiation event was identified as an unusually large active solar region, which produced a massive flare event that happened to be pointing directly towards the Earth. This was later confirmed by Sir Edward Appleton², the Nobel laureate in atmospheric and radio physics.

These massive flare events have occurred both before and since the war. Prior to industrialisation these events have largely gone unnoticed, except for the occasional report of northern lights in southern latitudes. But with the greater reliance on electricity and electronic devices, the magnetic effects of these flares in the Earth's atmosphere can have severe effects on communications, power distribution and satellites. Fortunately these events are quite rare.

As for Hey, he continued to work with problems with radar reception. In 1945, he was working on using radar to track the paths of V2 rockets and their high altitude approach path. His team noticed issues from random sporadic radar echoes at heights of about 50-70 miles, arriving every 5-10 minutes. When the war ended, the echoes continued. Hey realised that these echoes were caused by the ionised trails left by meteors or pieces of material the size of a grain of sand crashing into the atmosphere and burning up because of friction. Another scientist working on this phenomenon was Bernard Lovell, who went on to build the telescope at Jodrell Bank. Lovell incidentally, was sent on a course on radar at RAF Bawdsey in late August 1939, two years after becoming an assistant lecturer at Manchester University.

1 Nature, **157**, 47-48 (1946)

2 Nature, **156**, 534 (1945)

Radioastronomy: Area 51^¾ Report

Martin RH & Paul Whiting, with assistance from Dr Laurence Newell

This month we have been testing a horn antenna.



Paul Whiting, Laurence Newell, Nicky Richards

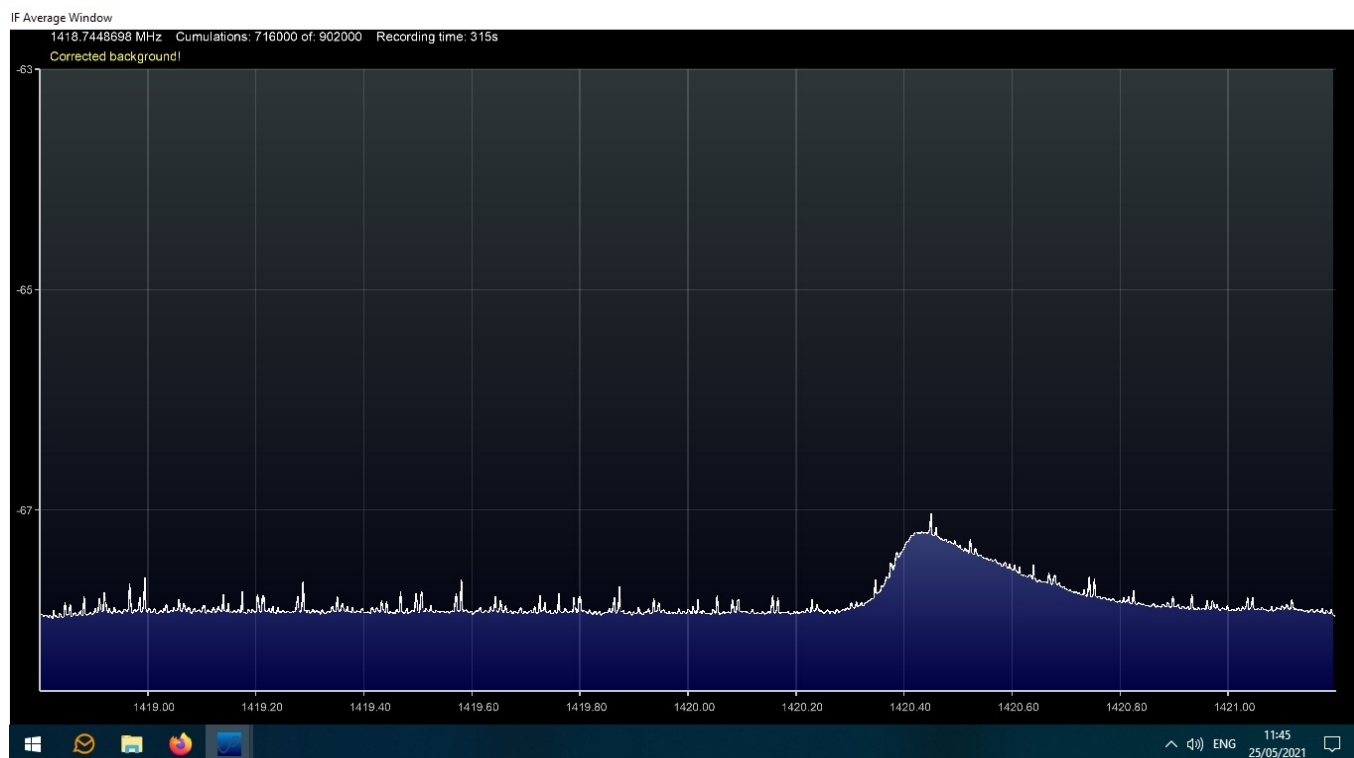


Probe

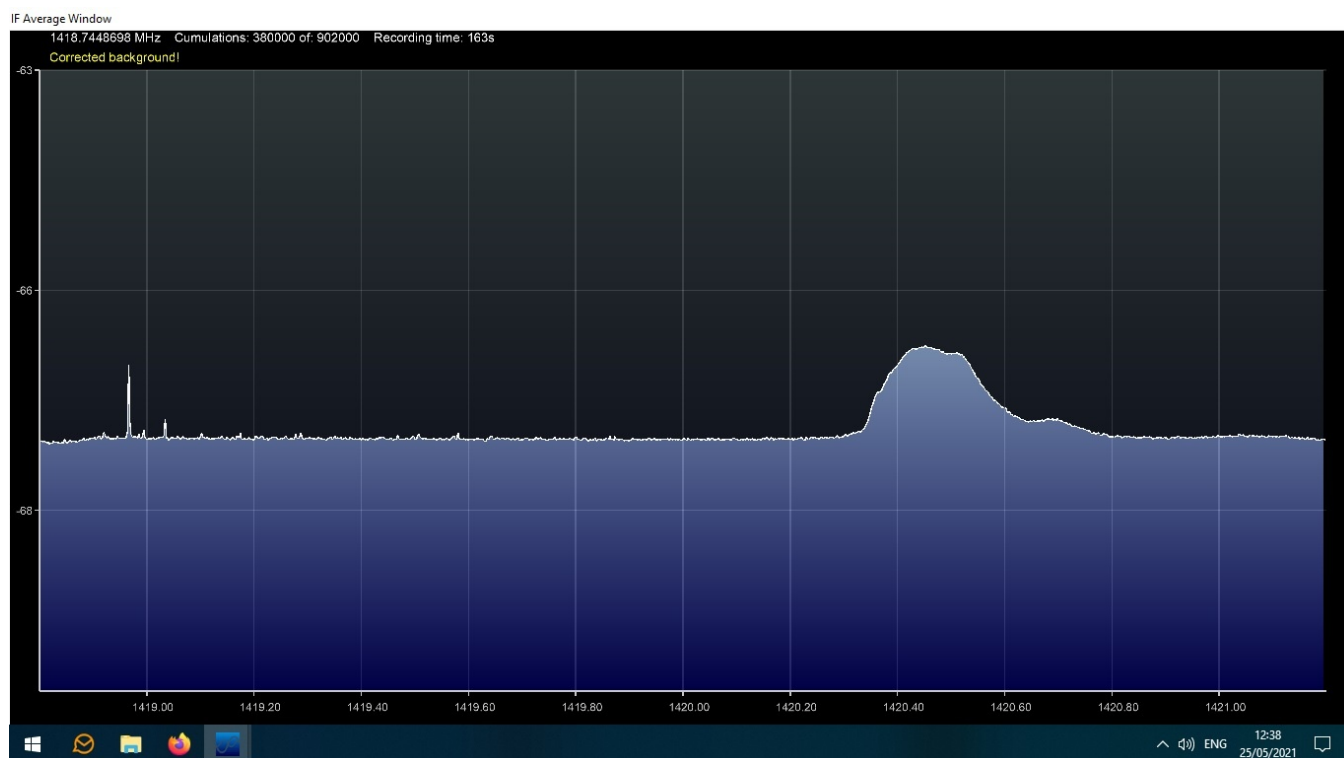
Inside the horn feed



On Tuesday 25 May we obtained the following results:



Spectrum received using horn antenna



Spectrum received using the 3m dish

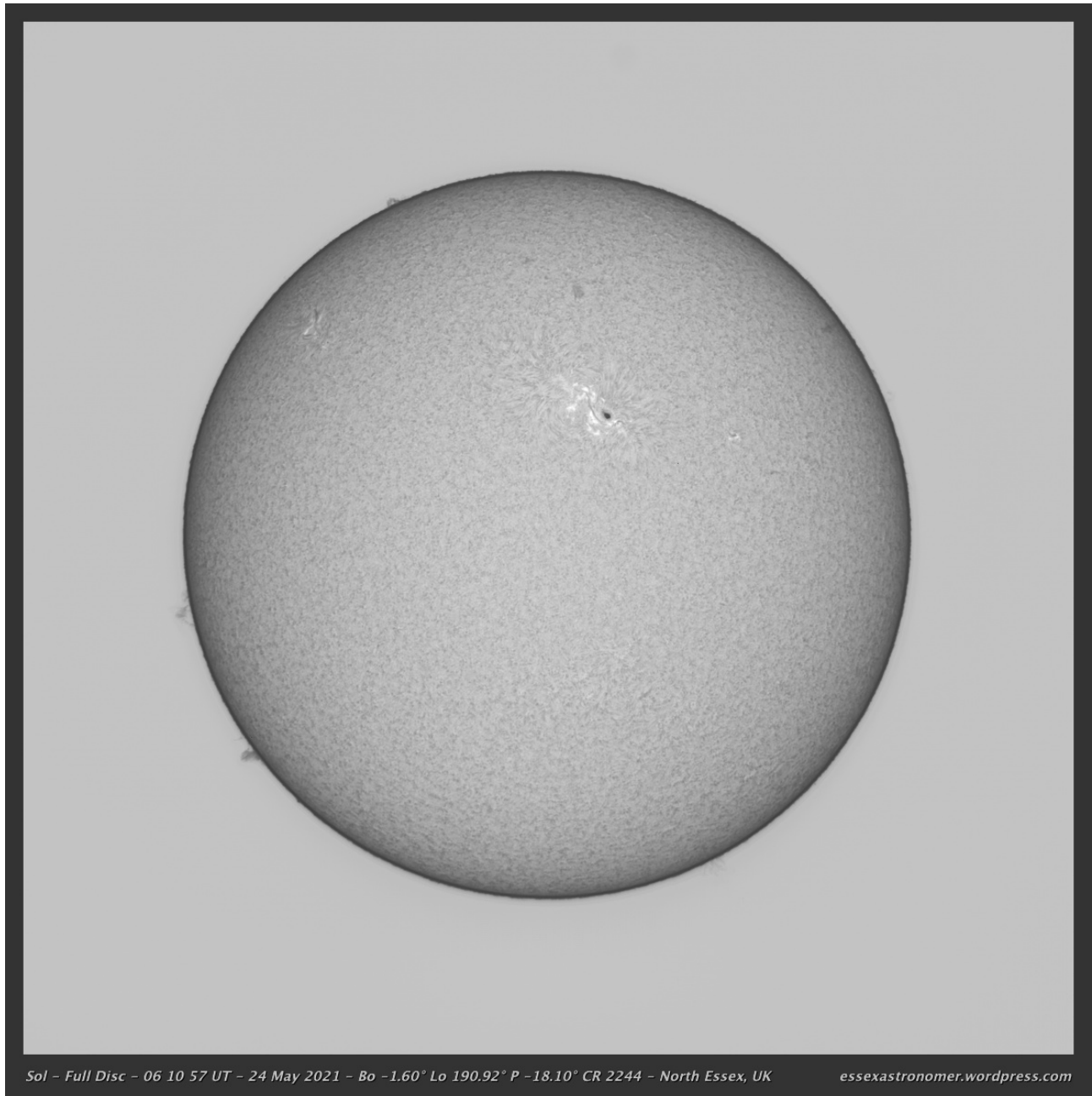
Although our mobile phones were switched off, the spikes around 1419MHz are probably interference from local electronic equipment. The Doppler-shifted signals around 1420.5MHz are from the Milky Way.

More analysis next month.

The Sun – 24 May 2021 – AR12824

John Hughes

A selection of solar images is attached taken yesterday morning (24 May);



**Image 1 Full disc with AR12824 very well placed and active
with a quieter AR12825 coming off the eastern limb.
Exposure time 2.5 ms, zero gain 50% of the best 1,000 frames stacked**

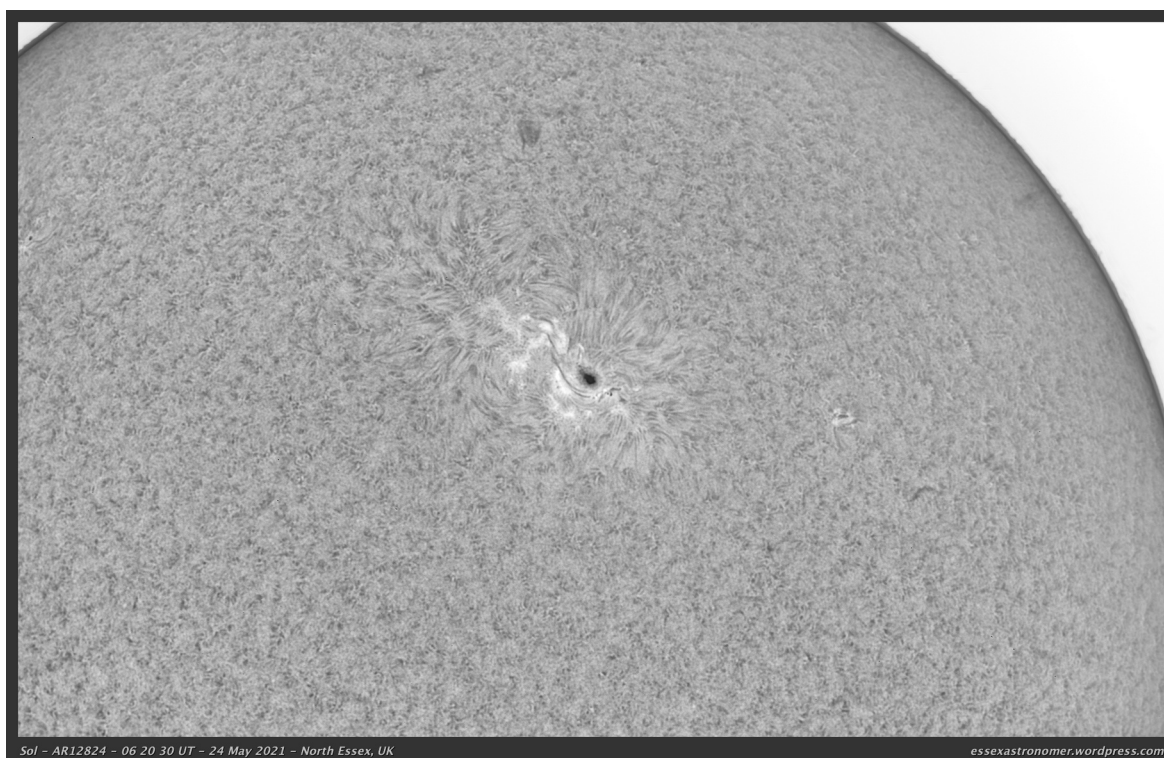


Image 2 AR12824 captured with an Altair Astro x3 barlow.
Exposure time 20 ms, Gain = 20 25% of the best 1,000 frames stacked

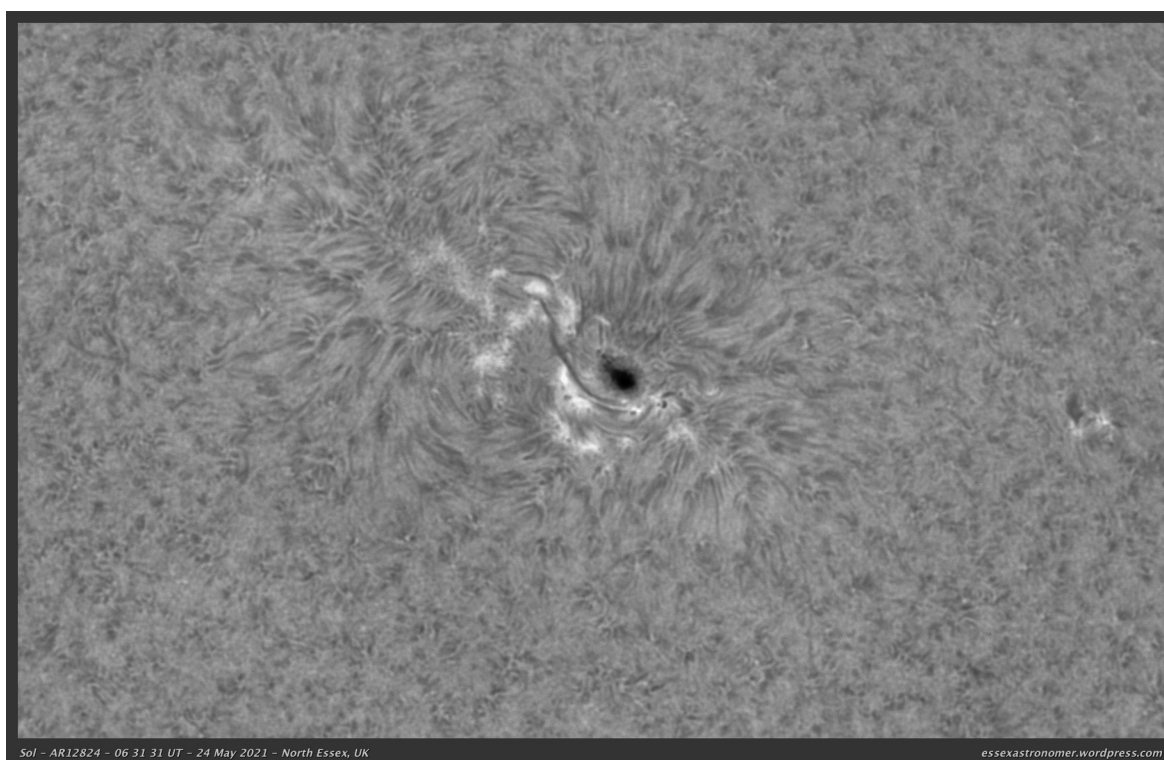


Image 3 AR12824 captured with a Tele Vue x5 Powermate.
Exposure time 30 ms, Gain = 79 25% of the best 1,000 frames stacked

Flat frames acquired by applying a scrunched up plastic sandwich bag over the front of the scope. Focus position maintained as for the main images and exposure time and gain adjusted to produce a histogram at 60% (in line with all three images).

Equipment (plus Barlow/Powermate)

Lunt 60mm THa/CPT1200 solar scope.

ZWO ASI174mm camera

SkyWatcher EQ6R Pro mount

Images acquired using SharpCap Pro

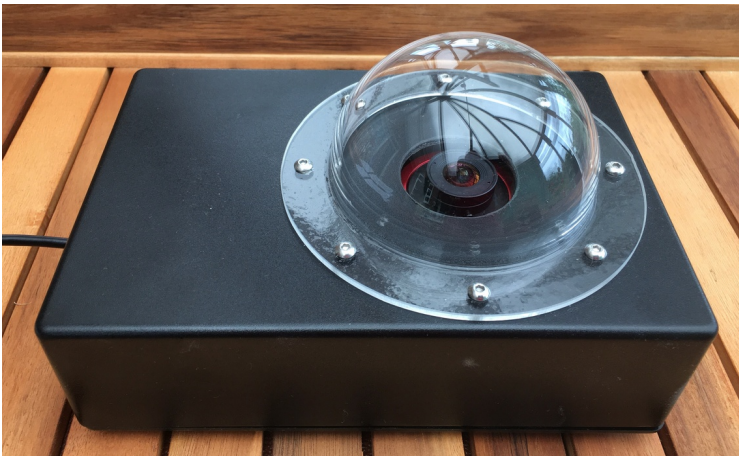
Processed using AutoStakkert 3 (stacking); ImPPG (curve adjustment, no sharpening); Registax 6 (Sharpening using wavelets) and PixInsight (final sharpening using restoration filter and s-curve applied to boost contrast).

An All-Sky camera using a RaspberryPi

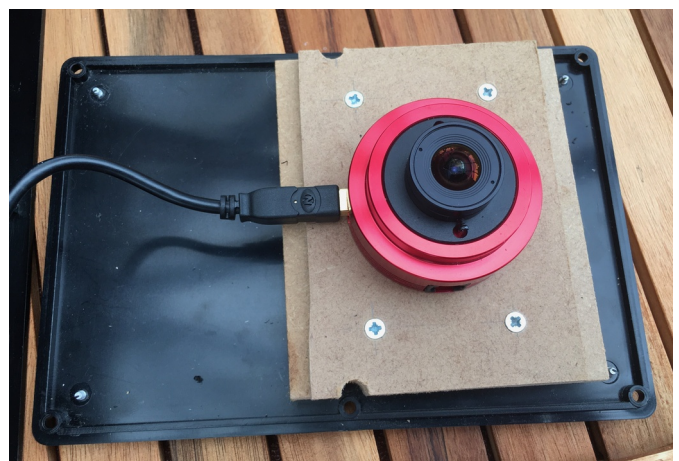
Martin R-H

Getting started

Having been inspired by Messrs Smith & Appleton's all-sky cameras, I decided to experiment. The UKMON <https://ukmeteonetwork.co.uk/> arrangement requires a networked camera¹, which I don't have. I did, however, purchase a ZWO ASI 120MM camera as a scope guide camera some while ago. This came with a wide-angle lens. A bit of DIY with a plastic box and an acrylic dome² and a few bits of MDF and I had a housing for the camera.



Camera enclosed in case



Camera on mounting block

The plan is to connect the usb camera to a RaspberryPi which I could then access remotely from the house. Thomas Jacquin has produced software for a RaspberryPi to run a ZWO camera as an all-sky camera. The project is described here <http://www.thomasjacquin.com/all-sky-camera/> and details of the software are on github <https://github.com/thomasjacquin/allsky>

I'm using a Pi 3 but a Pi 2, 4 or zero can be used.

As the images will be captured on the Pi, the advice is to get a 64GB microSD card, though a 32GB one seems sufficient for a few day's captures.

If you've never played with a Raspberry Pi then there are a few things to do before you start.

1 <https://docs.google.com/document/d/18TT-Jm7z9kYskl5ua07jQWD9lOiyBemBnOosiNdW6nY/edit#heading=h.ni7cpe4q6q9e>

2 100mm acrylic domes <https://www.projectplastics.co.uk/acrylic-domes.html> Item number 163332659704. Their E-Bay shop is at <https://www.ebay.co.uk/str/projectplastics>

1. You can buy a Pi with the operating system already installed on the microSD card. You'll have to do some set-up activities, like connect it to your wifi network.
2. If you already have a Pi, you probably know what to do. If you haven't used it for a while, blow the dust off and update.
3. Now to install **allsky**. Be brave and use Terminal. You will be writing a little bit of unix shell script.
4. Install git (it may already be installed on your pi.).
`sudo apt-get install git`
5. Now fetch the allsky software from Thomas Jacquin's GitHub page.

```
git clone --recursive https://github.com/thomasjacquin/allsky.git
```

6. Navigate to the allsky directory and run the install script

```
cd allsky
```

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

It takes a while so make a beverage of choice. When it's done, it will ask if you want to reboot. Answer y.

I found that it was necessary to remove the camera before rebooting or the screen froze with three dots.

7. There's a bit of configuring to do. You can use **nano** (the Pi's text editor) or just install the GUI (Graphical User Interface) and do it from whatever computer you normally use, using the AllSky Admin Panel. To install the GUI do:

```
cd allsky
```

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

If you don't want to use the default name **allsky** use

```
sudo gui/install.sh piname      (I used allskypi3 as I have several Pi-s)
```

8. On your main computer in the browser go to

```
http://allsky.local or http://piname.local
```

9. The browser will ask you for a username [admin] and password [secret] and will then display the GUI (Fig. 1).
10. Before you change anything, read the instructions on github <https://github.com/thomasjacquin/allsky> . Some settings interact!
11. Set your location (Lat. & Long.) in the camera settings. This ensures AllSky knows when dawn and dusk occur at your location. Don't forget to Save (scroll down to the button at the bottom of the window).
12. There are instructions on how to enable dark frame subtraction; worth doing as I found that my camera had a slightly snowy background of white pixels.

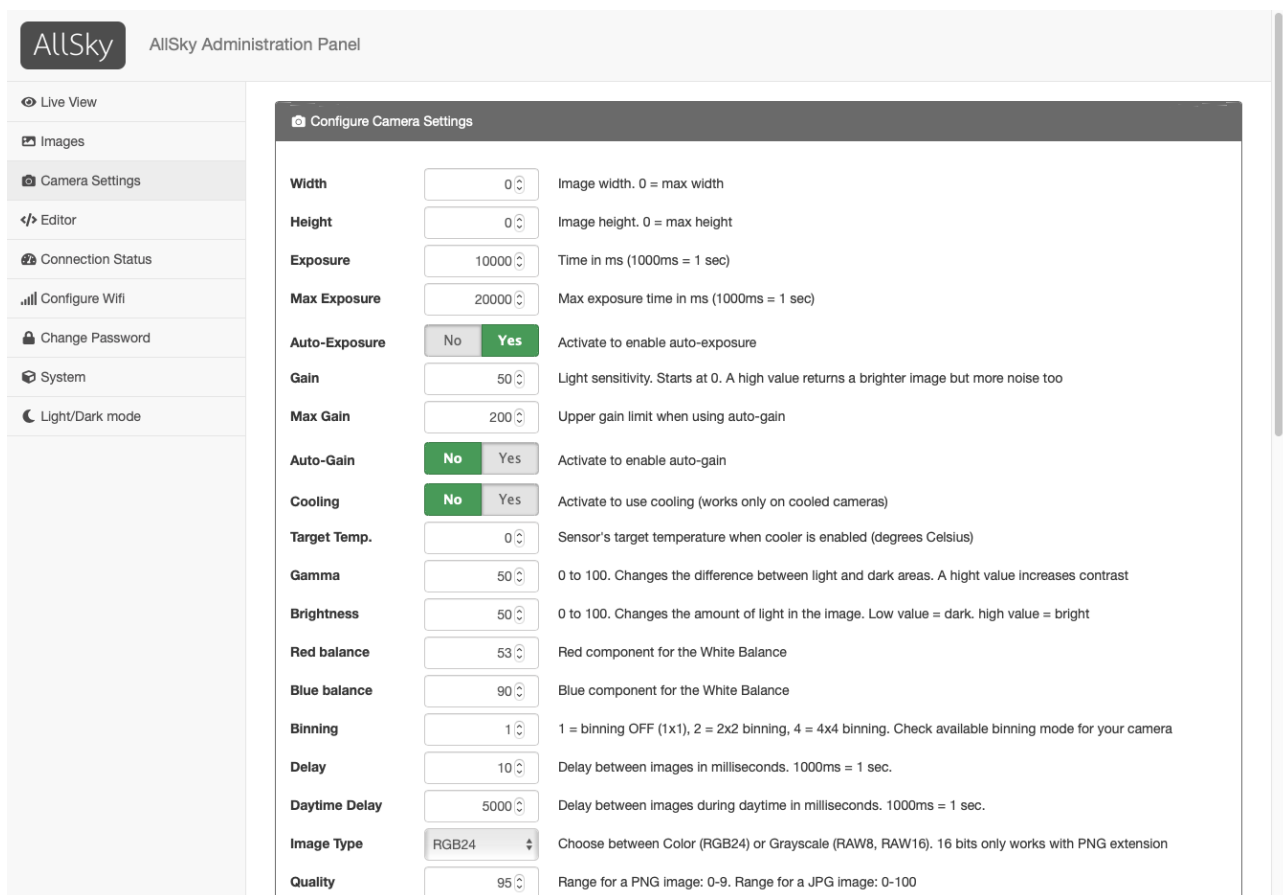


Fig. 1 The AllSky Admin Panel showing part of the camera settings window.

Other features

Video:

At the end of each night, the software will generate a video of the good frames. You can download this via the Admin Panel and open it in your favourite video viewer.

Keogram:

This is an image giving a quick view of the night activity. For each image, a central vertical column one pixel wide is extracted. All these are then stitched together resulting in a timeline that reads from dusk to dawn.

Startrails:

This is generated by stacking all the images from the night.

Website:

There is the facility to upload images to your own website.

Power issue with the Raspberry Pi

Remember that you are powering the camera via the Pi. I found that all my micro usb leads (including the RaspberryPi-supplied leads) were of sufficient electrical resistance such that the Pi gave a screen warning that the supply voltage was low. It did, however, continue to work. Choose a short lead or wire directly to the Pi power pins on the multi-pin header (see Fig. 2)

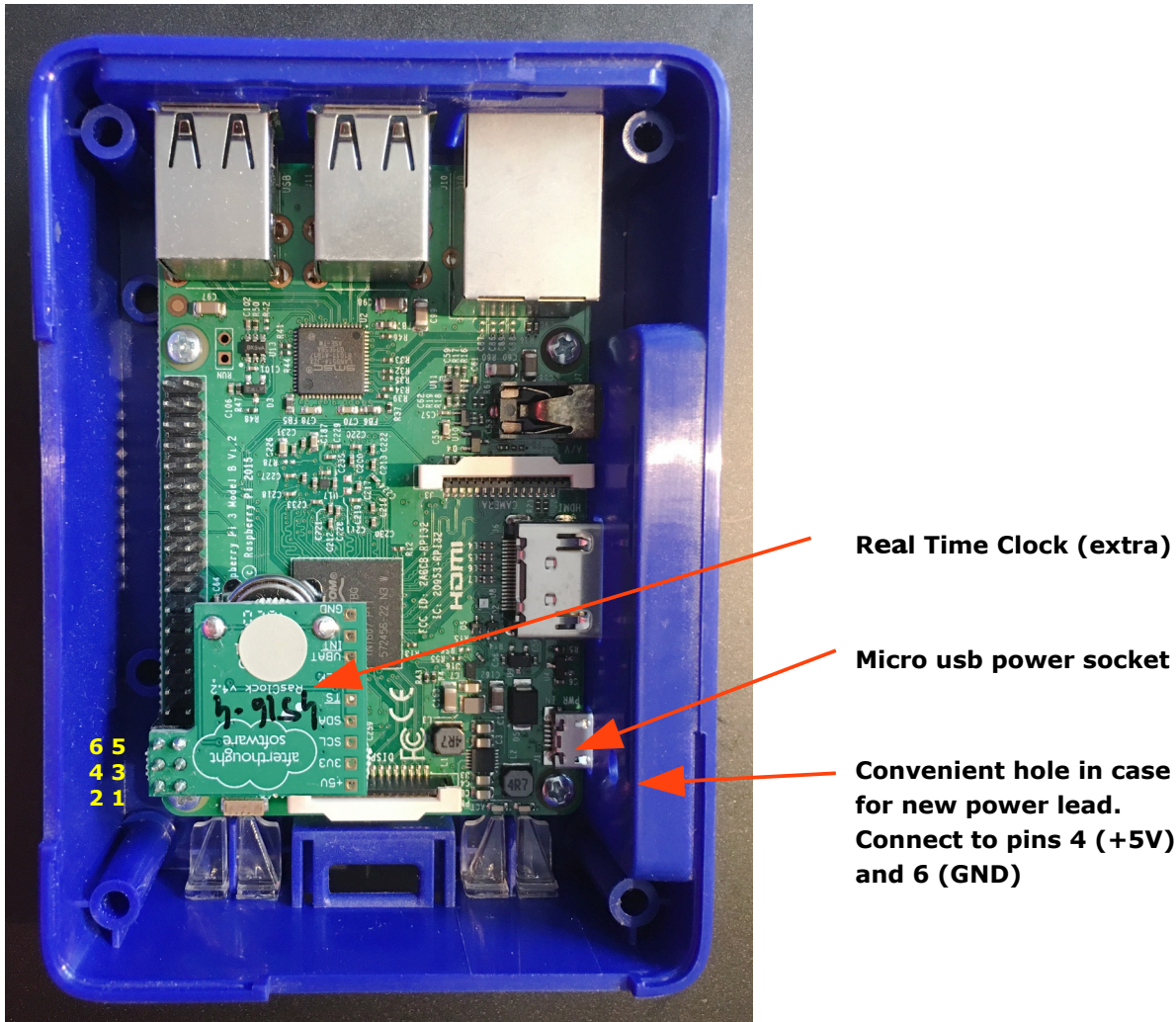


Fig. 2 Internals of the Raspberry Pi 3

The Real Time Clock “hat” provides a stable time and date to the Pi in the event of loss of internet – not essential if you can have your Pi permanently connected via Ethernet/wifi. There are several models of RTC hats (cost ~£10), each with their own instructions.

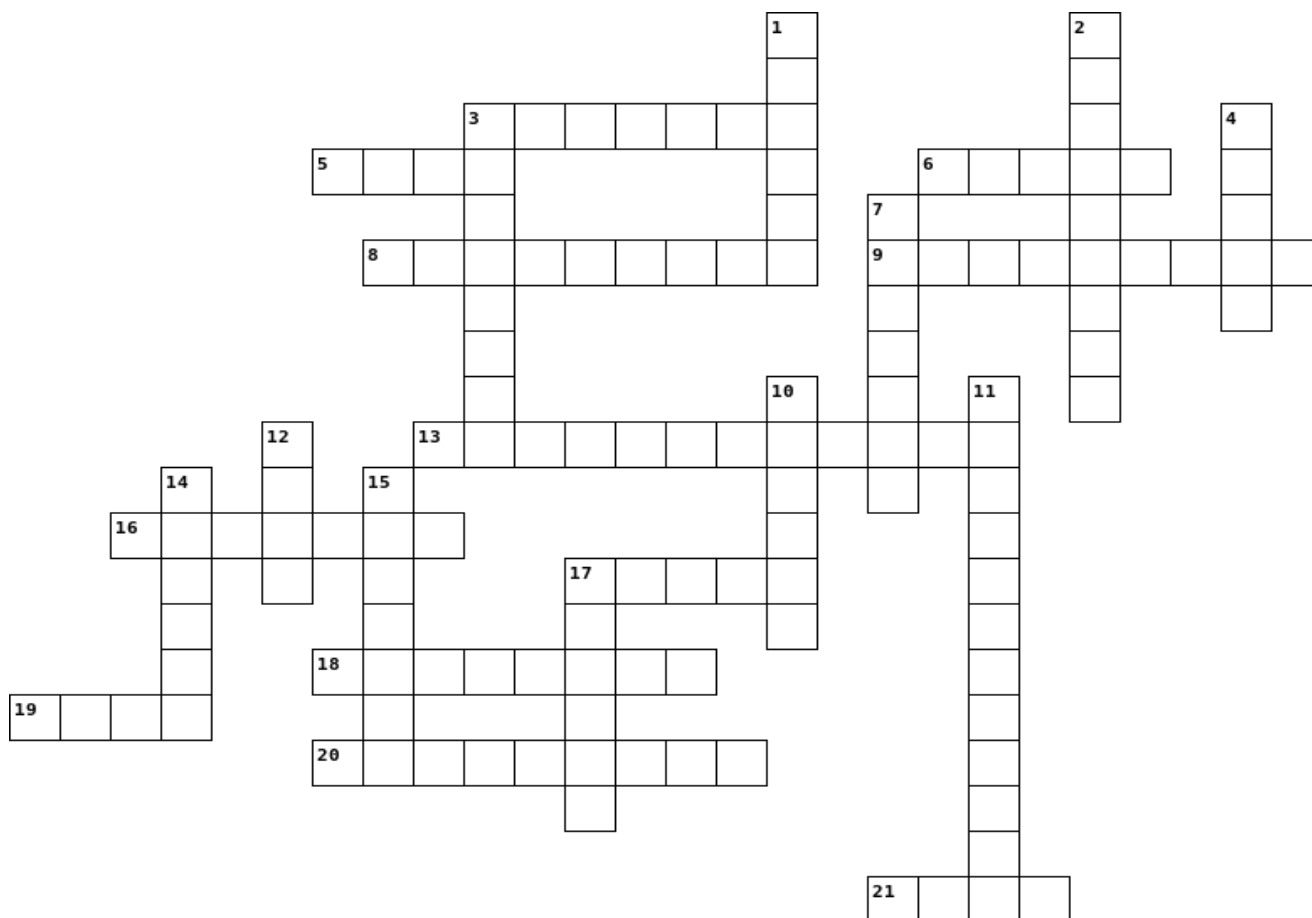
Remote operation

My all-sky camera will be mounted on the roof of one of my sheds (the “EME shack/Radio Astronomy Observatory”). The Raspberry Pi lives in the shed and with the usb lead to the camera unit fed through a rain-proof tube. Internal plumbing fittings are a good source of conduit. Internet is available via a pair of powerline networking devices whenever I connect mains to the shed.

First pictures next month...

Astro3 small crossword

Andy Willshire



Across

3. Solid or liquid airborne particle
5. Weakly interacting massive particle
6. ? Fisher relation
8. ate that wavelengths pass a fixed point
9. One of Hubble's galaxy classes
13. Interaction between particle and antiparticle
16. Accumulation of galaxies in area of space
17. Region around the centre of a spiral galaxy
18. Deuterium nucleus
19. Contains mainly Population II stars
20. Same in all direction
21. Structured component of spiral galaxies

Down

1. Spiral or irregular?
2. Accelerating expansion in the early universe
3. Point of orbit furthest from the Sun
4. Series of electronic transitions in hydrogen atom
7. Star used as a standard candle
10. Distance to a celestial body, parallax of 1 arc.s
11. Intensity variation of the GMB
12. Small solid particles found with interstellar gas
14. Incoming solar radiation reflected from surface
15. Strata of reddish sedimentary rocks
17. Elementary particle formed from 3 Quarks