No. 575 Registered Charity 271313 March 2021

OASI News

The newsletter of the Orwell Astronomical Society

Perseverance's First Full-Colour Look at Mars
This is the first high-resolution, colour image to be sent back by the Hazard Cameras (Hazcams) on the underside of NASA's Perseverance Mars rover after its landing on Feb. 18, 2021.

Credit: NASA/JPL-Caltech

Table of Contents

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/UCHgxe3QAeRVWf7vkjKkCl2Q

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, rtfd, 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 Wilshere	Librarian
	Avtar Nagra	OASI @ Newbourne
Assistants	Martin Richmond-Hardy	Newsletter, OASI @ Newbourne

Committee Meeting

This will be held via Zoom at 8pm on Friday 21 May. 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/1jhs9db71ncki4sojo7092vfvc%40group.calendar.google.com/public/basic.ics

For other astronomy news and astro pictures try our

Twitter feed https://twitter.com/OASIpswich

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.
Saturday, 06 March	https://britastro.org/meetings/2021	BAA Deep Sky Section Annual Meeting - Webinar
Monday 8 March login 19:30 talk 20:00	Paul Whiting treasurer@oasi.org.uk	OASI@Newbourne Zoom "The Milankovitch Cycles" a talk by Peter Richards
Wednesday 17 March 19:00	https://britastro.org/node/25421	Webinar "Two Eyes are better than one - Binocular Observing" -by Steve Tonkin
Monday 22 March login 19:30 Bill 19:45 talk 20:0	Paul Whiting treasurer@oasi.org.uk	OASI@Newbourne Zoom Sky Notes with Bill Barton followed by "Video Meteor Detection" (recorded)
Wednesday, 31 March 19:00	https://britastro.org/node/22282	BAA Special General Meeting and BAA Meeting
Saturday, 10 April	https://britastro.org/winchester2021	BAA Winchester Webinar
Monday 12 April login 19:30 talk 20:00	Paul Whiting treasurer@oasi.org.uk	OASI@Newbourne Zoom "Exploring the Dark Universe with XENON" a talk by Prof Marc Schumann (recorded)
Wednesday 14 April 19:00	https://britastro.org/node/25422	BAA Webinar: "The Great Debate," by Dr Nick Hewitt

Date, Time & Location	Contact	Event
Thursday 22 April login 19:45 talk 20:00	Paul Whiting treasurer@oasi.org.uk	Live online talk "The Appley Bridge meteorite – the space rock that hit Lancashire" a talk by Russell Parry
Monday 26 April login 19:30 talk 20:00	Paul Whiting treasurer@oasi.org.uk	OASI@Newbourne Zoom "The Weirdest Stars in the Universe" a talk by Dr Emily Levesque (recorded)

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

Martin Richmond-Hardy newbourne@oasi.org.uk

We normally meet at Newbourne Village Hall, Mill Lane, IP12 4NP on the 2nd and 4th Mondays (with a few exceptions). BUT In view of the COVID-19 situation **all meetings at Newbourne are suspended.** 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.

Mar 8	Mar 22 (S, T)	April 12 (T)	April 26 (S, T)
May 10	May 24 (S)	June 14	June 28 (S)

We open up for all meetings at 7:30pm. Star Guide (S) 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 during lock-down.

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!

- Monday March 8th "The Milankovitch Cycles" a talk by Peter Richards
- Monday March 22nd – OASI@Newbourne Zoom
  Sky Notes with Bill Barton followed by "Video Meteor Detection" (recorded)
- Monday April 12th - OASI@Newbourne Zoom
  "Exploring the Dark Universe with XENON" a talk by Prof Marc Schumann (recorded)

- Monday April 26th - OASI@Newbourne Zoom
  "The Weirdest Stars in the Universe" a talk by Dr Emily Levesque (recorded)

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

We are arranging an exciting and interesting set of online lectures by guest speakers for this year

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

- Thursday April 22nd – live online talk
  "The Appley Bridge meteorite - the space rock that hit Lancashire" a talk by Russell Parry

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

Other local astronomy society meetings

Athaneum Astro Society

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

Meetings suspended during the Covid-19 situation.

We normally meet fortnightly on Thursdays, from 7.30pm, at our dark-sky site in the Walled Garden at Nowton Park, just outside Bury St Edmunds. If you're planning on joining us for the first time, please contact us in advance, just to make sure the meeting is going ahead. We recommend that you wear warm clothing (even summer nights can be chilly, especially when the skies are clear!) and bring a flask, or insulated mug, for a warm drink. We have tea and coffee-making facilities on-site. Events are listed here http://www.3a.org.uk/events.htm

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

Saturday, 06 March	Deep Sky Section Annual Meeting – Webinar
Wednesday, 17 March 17 - 19:00	Webinar "Two Eyes are better than one - Binocular Observing" -by Steve Tonkin
Wednesday, 31 March	Special General Meeting and BAA Meeting
Saturday, 10 April	BAA Winchester Webinar
Wednesday, 14 April 14 - 19:00	"The Great Debate", by Dr Nick Hewitt.
Saturday, 24 April – 11:00	1-day webinar Cosmology, Galaxies & Exo-planets.
Wednesday, 27 October	BAA Annual General Meeting and BAA Meeting,
Saturday, 04 December	BAA Christmas Meeting

BAA Tutorials

Using a polarscope by David Arditti

https://britastro.org/node/25399

Wide-field astrophotography by Tony Morris

https://britastro.org/node/25545

From the interweb

'Was there life on Mars?'

UK scientists play key part in NASA mission to Red Planet

https://www.gov.uk/government/news/was-there-life-on-mars-uk-scientists-play-key-part-in-nasa-mission-to-red-planet?fbclid=IwAR0yjXhL7ZiCdotoO3wCn8PHTuUTIeH9MfwZ30L1VpLxtY5hcrjffTLR6s0

UK Space Agency Mars involvement

https://www.gov.uk/government/organisations/uk-space-agency

Nasa have uploaded 145 new RAW images to the internet.

These are all engineering camera images and most will be related to actually getting the rover up and running rather than making pretty photos but there should still be some fascinating stuff to look at.

The pretty stuff and videos is still to come!

But for now, let's get stuck in! https://mars.nasa.gov/mars2020/multimedia/raw-images/

Astronomy Photographer of the Year 13 is open for entries!

The world's greatest astrophotography competition is now open for entries!

Please encourage your members to enter up to ten images for a chance to win...

- Cash prizes up to £10,000
- Their image included in our annual publication
- Their image on display in a major exhibition
- A year's supply of BBC Sky at Night Magazines

The Young Competition winner will also receive a Celestron Astromaster 130EQ MD telescope in addition to their cash prize, so encourage under-16s to enter! It's easy to win a free copy of the 2020 publication for your society: just ask your members to enter your society name under 'How did you hear about this competition?' when they register. All societies listed will be entered into a draw to win a copy of Astronomy Photographer of the Year: Collection 9 when the competition closes in March.

Deadline for entries is midday (GMT) on 5 March 2021.

We have had to introduce competition charging this year to defray our costs due to the impact of the pandemic on our finances. Entrants will be charged a £10 fee to enter the competition, with exemptions for the Young Competition and the special prizes. Please note this is per entrant, rather than per entry, so we hope it isn't too onerous. Get in touch at astrophotocomp@rmg.co.uk if you have any questions about the competition.

Best wishes,

Alysia Calderwood Exhibitions Project Manager: Astronomy Photographer of the Year

Answers to Astro 1 Crossword

***Across*:**

2: Wavelength
3: Centripetal
4: Pleiades
7: Firstcontact
9: Supernova
13: Pulsar
14: Reddwarf
15: Io
16: Schedar
18: Hertzsprung
19: Redshift.
20: Binary.
21: Meteor.

Down:

1: Neutrino
3: Cepheid
5: Astrometry
6: Supergiant
8: Torus
10: Nucleon
11: Asteroid
12: Parallax
17: Hercules.

The Night Sky in March 2021

Martin RH

All event times (GMT/UTC) are for the location of Orwell Park Observatory 52.0096°N, 1.2305°E. **BST starts 02:00 on 28 March**

Sun, Moon and planets

Sources: http://heavens-above.com/PlanetSummary.aspx

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

Times UTC to 27 March, thereafter BST

Object	Date	Rise	Set	Mag.	Notes
Sun	1	06:41	17:35		Spring Equinox Mar 20, 09:37 BST starts 02:00 on 28 March
	31	06:32	19:27		
Moon	1	20:30	07:58		
	31	23:28	07:58		
Mercury	1	05:51	14:56	0.3	Max. western elongation 2021-Mar-06 Aphelion 2021-Mar-14
	31	06:23	17:35	-0.4	
Venus	1	06:43	16:48	-3.8	Superior Conjunction 2021-Mar-26
	31	06:47	19:24	-3.8	
Mars	1	09:01	00:58	0.9	
	31	08:57	01:37	1.3	
Jupiter	1	06:03	15:04	-1.8	
	31	05:19	14:43	-1.9	
Saturn	1	05:44	14:17	0.7	
	31	04:53	13:35	0.8	
Uranus	1	08:26	22:48	5.8	
	31	07:31	21:58	5.9	
Neptune	1	07:08	18:15	8	Superior conjunction 2021-Mar-11
	31	06:12	17:24	8	

Occultations during March 2021

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

https://iota-es.de/moon/grazing_descrx101.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 March 2021

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

Shower	Normal limits	Maximum	Max RA/ Dec.º	ZHR at Max	Notes
none					None visible from Ipswich

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

Visible ISS passes ≥15º max altitude

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

Times are UTC. Predictions are approximate (20 Dec) due to craft adjustments. Check the day before.

Date	Bright –ness	Start			Highest point			End		
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
01 Mar	-1.5	03:53:36	24°	E	03:53:36	24°	E	03:55:12	10°	E
01 Mar	-3.8	05:26:33	21°	W	05:28:39	85°	S	05:32:02	10°	E
02 Mar	-3.9	04:40:50	70°	SW	04:41:08	80°	S	04:44:30	10°	E
03 Mar	-1.9	03:55:05	30°	E	03:55:05	30°	E	03:56:58	10°	E
03 Mar	-3.8	05:28:02	18°	W	05:30:23	82°	S	05:33:45	10°	E
04 Mar	-3.9	04:42:17	60°	W	04:42:50	86°	S	04:46:12	10°	E
05 Mar	-2.3	03:56:32	36°	E	03:56:32	36°	E	03:58:39	10°	E
05 Mar	-3.6	05:29:29	16°	W	05:32:02	61°	SSW	05:35:21	10°	ESE
06 Mar	-3.8	04:43:45	50°	W	04:44:29	73°	SSW	04:47:51	10°	ESE
07 Mar	-2.5	03:58:02	39°	ESE	03:58:02	39°	ESE	04:00:17	10°	E
07 Mar	-2.9	05:31:00	14°	W	05:33:32	36°	SSW	05:36:40	10°	SE
08 Mar	-3.4	04:45:21	40°	WSW	04:46:02	48°	SSW	04:49:17	10°	SE
09 Mar	-2.4	03:59:45	33°	SE	03:59:45	33°	SE	04:01:48	10°	ESE
09 Mar	-2.1	05:32:43	12°	W	05:34:51	19°	SW	05:37:21	10°	SSE
10 Mar	-2.6	04:47:13	27°	SW	04:47:24	27°	SSW	04:50:17	10°	SSE
11 Mar	-1.7	04:01:49	19°	SSE	04:01:49	19°	SSE	04:03:01	10°	SE
18 Mar	-1.6	19:59:30	10°	SSW	20:00:30	16°	S	20:00:30	16°	S
19 Mar	-2.1	19:12:27	10°	S	19:14:45	17°	SE	19:15:26	16°	SE

Date	Bright –ness (mag)	Start			Highest point			End		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
19 Mar	-1.2	20:47:45	10°	WSW	20:48:25	15°	WSW	20:48:25	15°	WSW
20 Mar	-3.3	20:00:11	10°	SW	20:03:09	42°	S	20:03:09	42°	S
21 Mar	-2.9	19:12:42	10°	SW	19:15:45	32°	SSE	19:17:43	18°	E
21 Mar	-2	20:48:57	10°	WSW	20:50:41	28°	WSW	20:50:41	28°	WSW
22 Mar	-3.8	20:01:14	10°	WSW	20:04:35	69°	SSE	20:05:07	56°	ESE
23 Mar	-3.6	19:13:34	10°	WSW	19:16:52	56°	SSE	19:19:26	16°	E
23 Mar	-2.4	20:50:13	10°	W	20:52:23	37°	W	20:52:23	37°	W
24 Mar	-3.9	20:02:27	10°	W	20:05:49	85°	S	20:06:38	49°	E
25 Mar	-3.8	19:14:40	10°	WSW	19:18:02	79°	S	19:20:49	14°	E
25 Mar	-2.6	20:51:27	10°	W	20:53:45	40°	W	20:53:45	40°	W
26 Mar	-3.9	20:03:39	10°	W	20:07:02	83°	S	20:07:54	47°	ESE
27 Mar	-3.8	19:15:51	10°	W	19:19:14	86°	S	19:22:00	15°	E
27 Mar	-2.5	20:52:39	10°	W	20:54:57	35°	WSW	20:54:57	35°	WSW
28 Mar	-3.6	21:04:49	10°	W	21:08:09	62°	SSW	21:09:02	43°	SE
29 Mar	-3.7	20:17:00	10°	W	20:20:22	75°	SSW	20:23:08	14°	ESE
29 Mar	-2	21:53:56	10°	W	21:56:04	25°	WSW	21:56:04	25°	WSW
30 Mar	-2.8	21:06:00	10°	W	21:09:10	38°	SSW	21:10:10	30°	SSE
31 Mar	-3.2	20:18:07	10°	W	20:21:24	50°	SSW	20:24:17	13°	SE

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.

None this period.

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 – now digital (channel 10c) and FM 103.9 (Ipswich), 104.6 (west Suffolk), 95.5 (Lowestoft), 95.9 (Aldeburgh) and the internet. https://www.bbc.co.uk/radiosuffolk

Tianwen-1 (Quest for Heavenly Truth)

China National Space Administration, an Interplanetary Mission to Mars

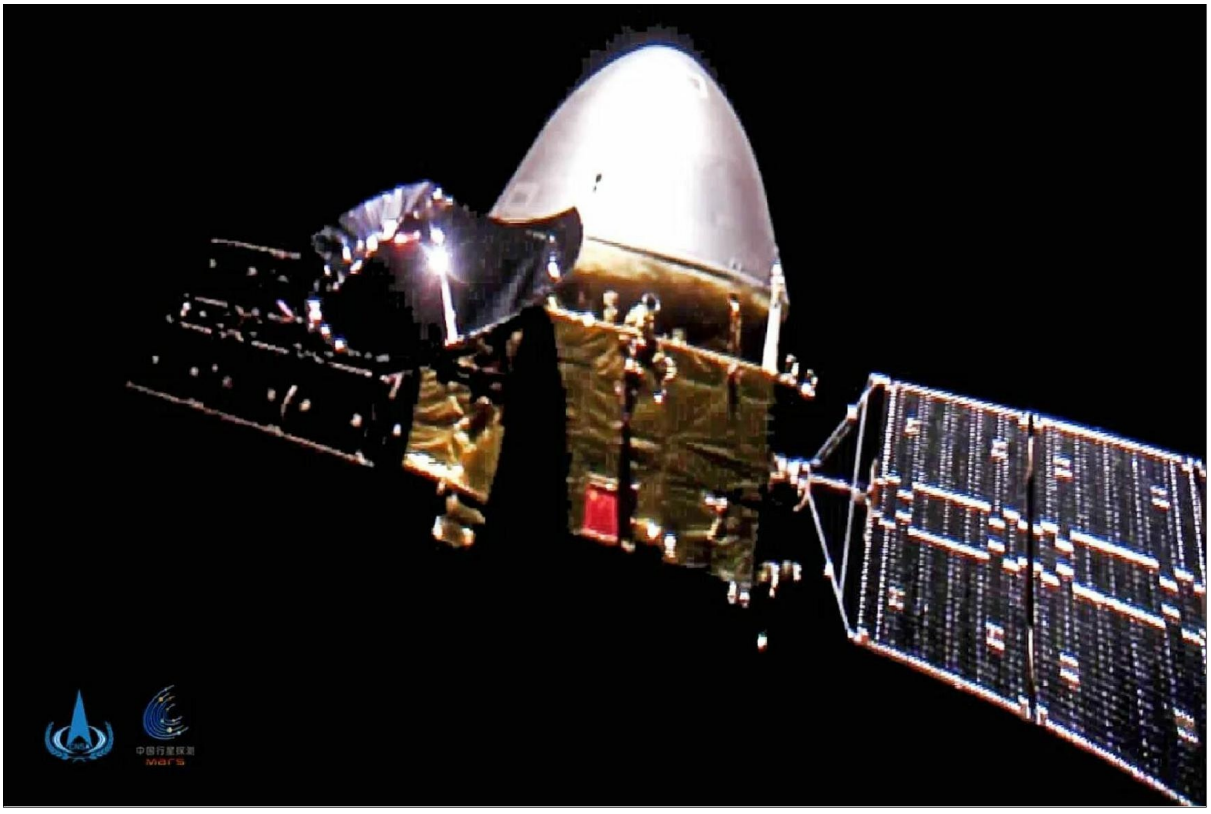
Short Article from the Library.

China successfully launched its Tianwen-1 spacecraft heading to Mars, from the Wenchang Spacecraft launch site on the 23rd July 2020, which is one of the two spacecraft launch sites of the Xichang Satellite Launch Centre. It was selected because it is 19° north of the equator, and at this latitude, it will allow a greater payload to be launched. It is also competent to launch China's very powerful rocket, the Long March 5. One problem was the delivery of the rockets new 5-meter core boosters. The rail network was unsatisfactory; however, as the launch site is close by a port, delivery by sea was the best option. The rocket's maiden flight was on 3rd November 2016.

Tianwen-1 is a Chinese (CNSA) interplanetary mission to dispatch a robotic spacecraft to Mars. The mission incorporates a lander, rover and orbiter.

The rocket can be described as a heavy lift launch vehicle, which was designed by the China Academy of Launch Vehicle Technology (CALT), from the ground up. This allowed the consideration of non-hypergolic liquid rocket propellants. (Hypergolic propellants spontaneously ignite when placed in contact with each other. This can be considered somewhat dangerous in spacecraft propulsion). At present CALT have two versions, CZ-5 and CZ-5B, and are considered the most powerful of the Long March rockets, which are comparable with the NASA heavy lift vehicle the Delta IV Heavy.

The CZ-5 comprises three 5.2 m diameter modular core stages, with a total vehicle length of 60.5 m. It has a thrust of 833.8 tons and a launch weight of 643 tons. There are two choices of engines used by the first stage and boosters. These use different fuels, 1200kN thrust LOX/kerosene, or 500kN thrust LOX/LH2. The orbiter mass is 3175kg, and rover mass of 240kg.



(image credit: CNSA)

The missions aims are:

i Searching for life, both present and past.
ii Detailing soil composition and water ice diffusion, and to analyse surface material structure.
iii Production of surface maps.
iv Analysis of the atmosphere, specifically the ionosphere.
v To cache rock and soil samples on the planet surface for retrieval at a later date. (proposed 2030s).
vi Investigate electromagnetic and physical fields within the internal structure of Mars.

Tianwen-1 arrived in orbit around the red Planet on February 10th 2021. It will now spend two to three months observing possible landing sites using its high- resolution camera. If these are found satisfactory, an attempt will be made in May 2021 to land the rover.

In September of 2019, proposed landing sites were presented at a joint meeting of the European Planetary Science Congress-division for Planetary Science. These were to be on the Utopia Planitia region of Mars. The co-ordinates of these sites were provided in July of 2020.These are 110.318° east longitude and 24.748° north latitude. Utopia is the largest recognized impact basin on Mars with a diameter estimated at 3300 km. Viking 2 touched down in this area in 1976. In order for the landing section to proceed to the surface, deceleration using a 70 degree angle heat shield will be operated. At this point a disk-gap-band parachute will be employed to further reduce speed and then jettisoned. Retropropulsion will then provide the final section of speed reduction. Having touched down, the landing platform will elongate a ramp section that will allow the rover to carefully run down to the Martian surface. The rover is able to transmit directly to earth as well as the Tianwen-1 orbiter. Power is provided by solar panels, with an operational expectancy of 90 Martian days. (sidereal day: 24hrs 37mins 22s). The main assignment of the Tianwen-1 is to examine the complete planet with the orbiter, and to send out the rover on the surface for scientific interest. With the electronic equipment on board this can be done with high precision.

The Orbiter has the following instruments on board:

- Medium –Resolution camera.
- High-Resolution camera.
- Magnetometer.
- Mineralogy Spectrometer.
- Orbiter Subsurface radar.
- Mars Ion and Neutral particle analyser.
- Mars Energetic particle analyser.

The Rover's instruments are:

- Ground Penetrating radar.
- Mars Surface Magnetic Field detector.
- Mars meteorological measurement instrument.
- Mars Surface Compound detector.
- Multi-Spectrum camera.
- Navigation and Topography camera.

Tianwen-1 is predominantly a Chinese-led enterprise, but other countries have offered help in this mission. France with scientists from the *Institute de Recherche en Astrophysique et Planetologie* provided a spectroscopy instrument, and guidance in its use. Situated in Argentina is the Chinese owned base of a tracking antenna which will be used to talk to the Tianwen-1 after launch. ESA has also agreed to use its deep space network of tracking stations.

References:

Tianwen-1 - eoPortal Directory - Satellite Missions

Tianwen-1 - Wikipedia

Tianwen-1: China's first Mars mission | Space

Neutral Hydrogen (HI) Line Astronomy

Paul Whiting

The neutral hydrogen atom, composed of a proton and an electron, will very occasionally emit a quantum of energy caused by a random flip in the spin direction of the electron (figure 1). This happens very rarely, roughly once in 10^5 – 10^6 years. However, given the huge amount of hydrogen to be found in the Universe, this 21cm[1] wavelength radio emission line is widely found.

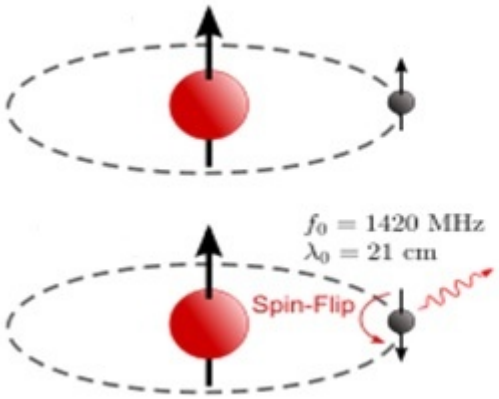


Figure 1: Neutral Hydrogen Spin-Flip, producing a quantum of energy at 21cm.

The major use that astronomers make of this phenomenon is in the detection of neutral hydrogen clouds, such as those located in the spiral arms of the Milky Way. By scanning across the Milky Way at regular intervals, say every 15 degrees of galactic longitude, the structure of the spiral arms may be ascertained. An example of such a scan may be found in figure 2.

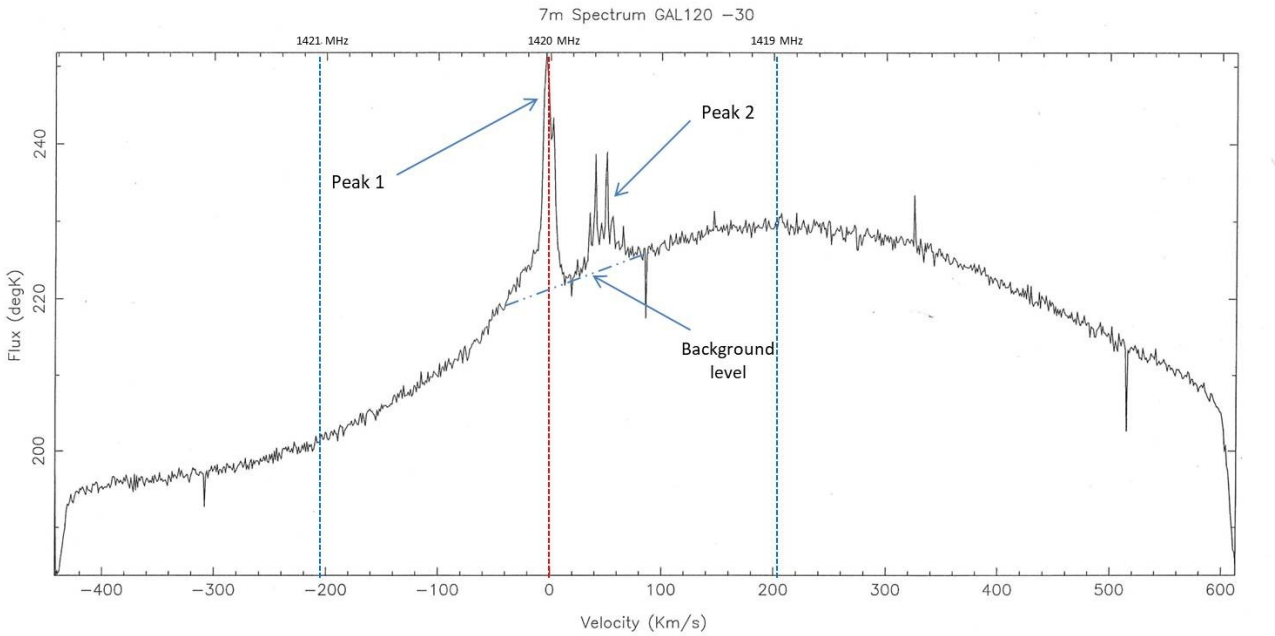


Figure 2: 21cm scan of Milky Way at ℓ = -30 degrees, using the 7m dish at Jodrell Bank.

Figure 2 shows two peaks indicating two distinct clouds of neutral hydrogen, the higher is at 1420 MHz, showing the cloud has zero or non-red-shifted equivalent radial velocity. A smaller peak is found around 1419.75 MHz, showing a

1 the exact frequency of the HI emission line is 1,420,405,751.7667±0.0009 Hz

redshift equivalent to a 50 kms^{-1} radial velocity, i.e. this gas cloud is receding from us at this velocity. Here 1 MHz of red shift is roughly equivalent to 200 kms^{-1}.

By repeating these scans around the entire Milky Way we can build up a three-dimensional map of the spiral arm structure. This relies on the fact that as the Galaxy revolves, from our point of view on Earth, different spiral arms will have different rotational velocities, and will demonstrate different radial velocity components (see figure 3).

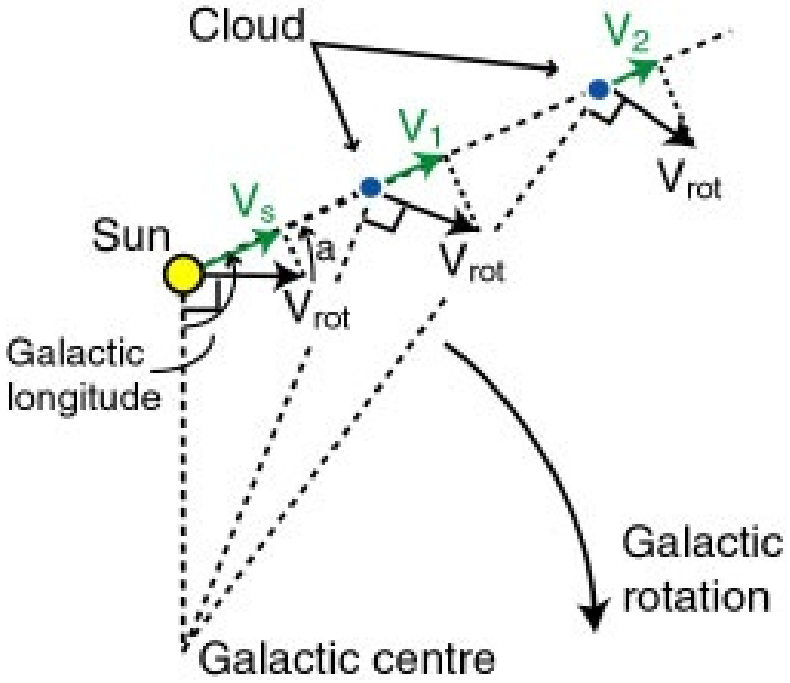


Figure 3: Relative motion of two gas clouds in a given direction.

The relative radial velocity of the nearer cloud will be $V_1 - V_S$, and that of the second cloud is $V_2 - V_S$. We know V_{rot}, the rotational velocity of our galaxy, and we can calculate V_1 and V_2 from our measurements, so we can now calculate the distance of each of the gas clouds in that given direction. Combining these calculations for the entire Milky Way, gives the image shown in figure 4.

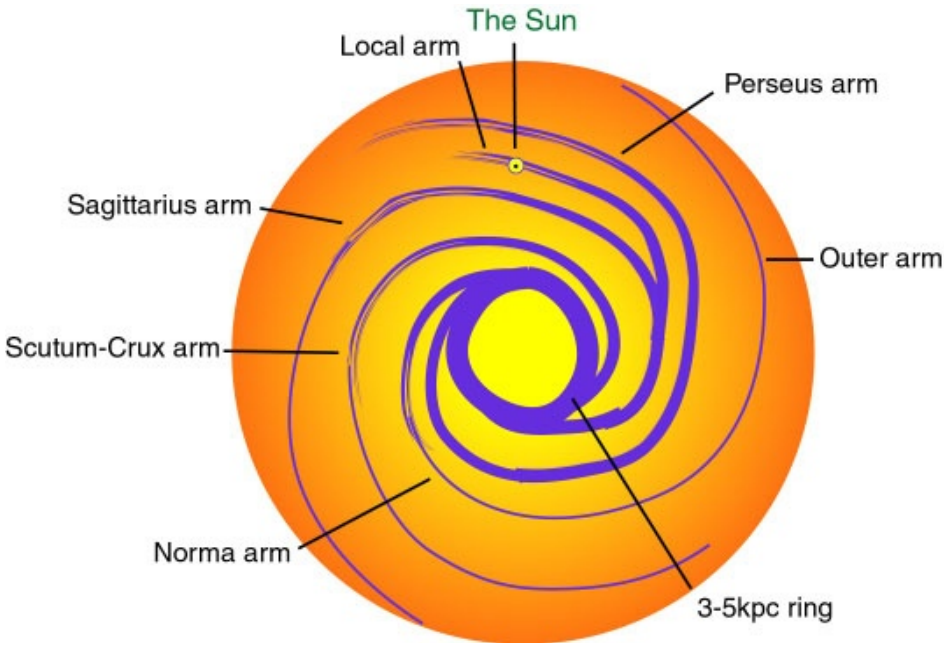


Figure 4: Resulting image of the Milky Way spiral arms.

What else can we derive from these spectral scans? If we calculate the area under each of the peaks, measured from the background level (see figure 2), this is proportional to the mass of hydrogen in the line of sight. Secondly, the

radial thickness (or depth) of the gas cloud is proportional to the FWHM of the peak. FWHM stands for "full width half maximum"; this is the width of the peak at the halfway point from the background level to its maximum value. So we can now add thickness and density information to our plots, resulting in figure 4.

So that is the science behind what I did at Jodrell Bank using the 7m dish there. I thought it would be fun to try to repeat the experiment from home. For years I thought that it would be totally impractical to even try this, but then I found an article that described a relatively cheap radio telescope setup, designed to receive the 1420MHz HI line. Figure 5 shows this setup.

Figure 5: The HI Backyard Radio Telescope.

This comprises a parabolic grid dish antenna (originally designed for 2.4 GHz Wi-Fi), a narrow-band HI line low-noise pre-amplifier, and an RTL-SDR Blog V3 USB receiver. The amplifier and receiver are shown in figure 6.

Figure 6: The HI line pre-amplifier and RTL-SDR Blog V3 USB Receiver.

The required software is free to download. You need a planetarium program, such as Stellarium, to keep track of where you are pointing the antenna, and SDRSharp to control the radio receiver. There are a couple plug-ins to SDRSharp, that may also be downloaded for free, that perform background receiver noise measurement and subtraction, and also to integrate the received signal to produce a user-friendly trace. You also need a mechanism to take a screenshot every so often – I use a package called Chronolapse with an interval of 10 minutes. Figure 7 shows a typical screenshot.

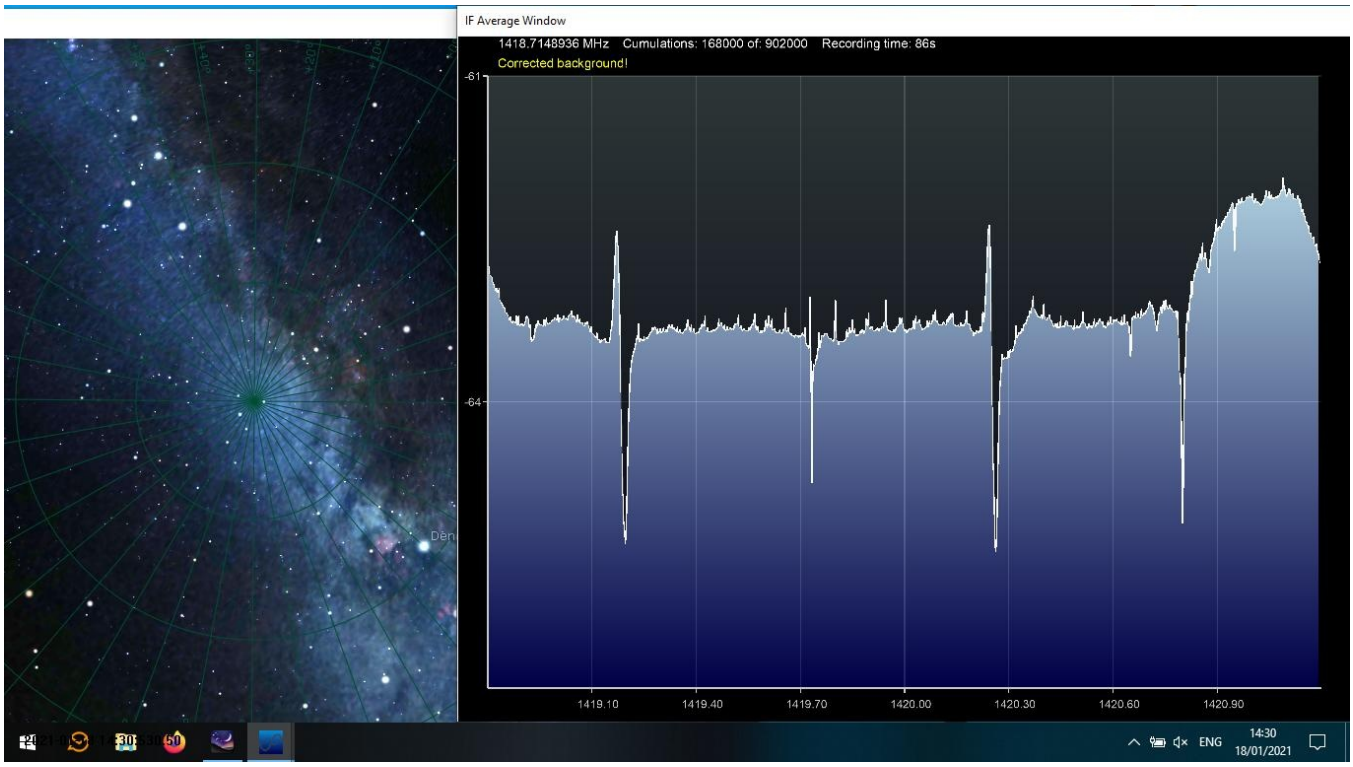


Figure 7: A typical screenshot via Chronolapse.

Before discussing what we are seeing here, first we need to consider antenna beam width or the resolution (θ, in radians). There is a simple formula that allows us to calculate this:

$$\theta = 1.22\frac{\lambda}{D}$$ note[1]

where λ is the wavelength being received (21cm in our case) and D is the maximum dimension of the dish. My first antenna had D = 40cm, which gives a resolution of 36.7 degrees. This compares to the resolution of the 7m dish at Jodrell Bank, which is 2.1 degrees. The higher the resolution (the smaller the angle), the better, as you are putting all your receive capability to work on a very narrow part of the sky. So, in figure 7, we are looking at pretty much all the hydrogen in nearly all of the sky image on the left, which dilutes the receive capability, or more technically it reduces the overall gain of the antenna.

So what are we actually seeing here? For a start each of the spikes is interference, most likely from mobile phones or Wi-Fi. But are we seeing any HI lines? To be sure, we need to compare this trace with one derived from a sky devoid of hydrogen clouds, as in figure 8. Comparing figures 7 and 8 it needs a very active imagination to see any peaks in one trace that are not present in the other. I concluded that I needed a larger antenna, and hence a higher resolution (higher gain) to actually see anything. An observing site where there is less interference would also be an advantage.

1 Ed: For those not happy with radians, the 3dB beamwidth of a dish in degrees can be expressed as 70λ/D, where λ is the wavelength in cm and D is the diameter in cm.
For those contemplating trying this for yourselves and want to know a bit more, may I commend *The W1GHZ Online Microwave Antenna Book* by Paul Wade W1GHZ http://www.w1ghz.org/antbook/preface.htm

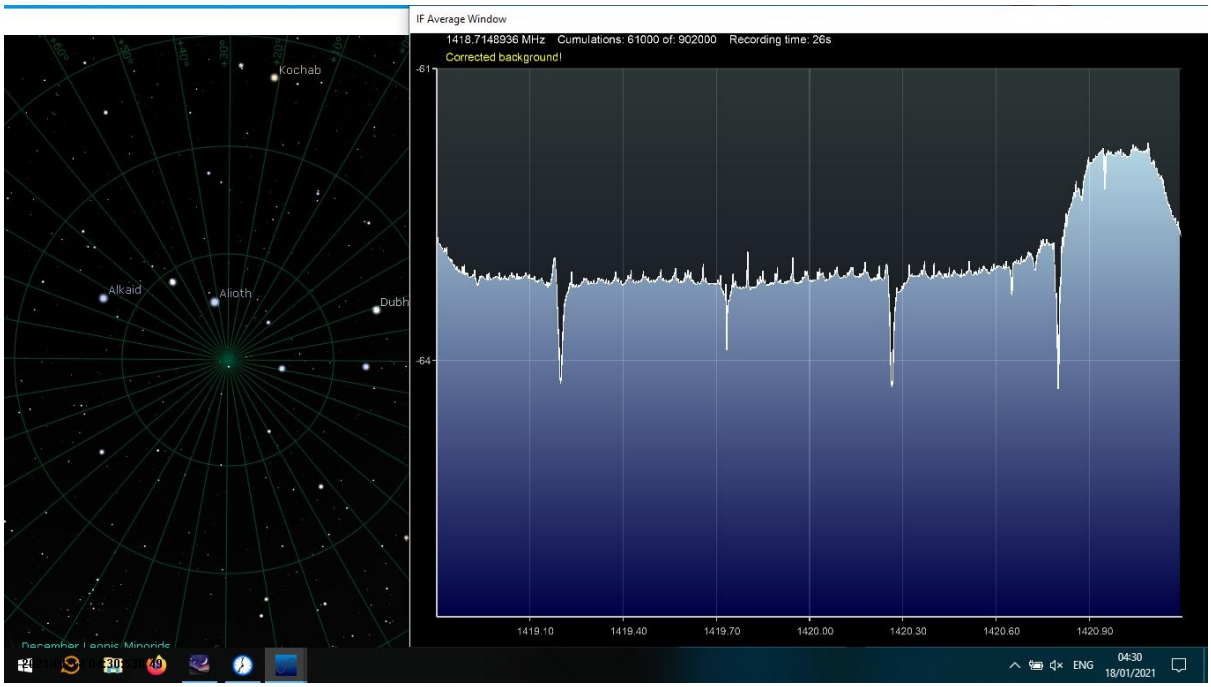


Figure 8: Screenshot of hydrogen void scan, using Mk 1 antenna.

Accordingly, I invested in the Mark 2 antenna (borrowing from the naming convention used at Jodrell Bank). It is the same design as the Mark 1, but larger. This time the diameter (D) is 103cm, giving a resolution of 14.3 degrees. Not quite the resolution of the 7m dish in Cheshire, but the best I could get hold of during Covid-19 lockdown!

So, having spent more on the Mark 2 antenna than all the other kit put together, it duly arrived and was assembled (figure 9).

Figure 9: The Mark 2 antenna with its smaller brother.

Following a brief test of about 7 hours, things look to have improved significantly. Although the interference peaks are still manifest, two distinct peaks appeared moving from void sky to central Milky Way – figures 10a and 10b.

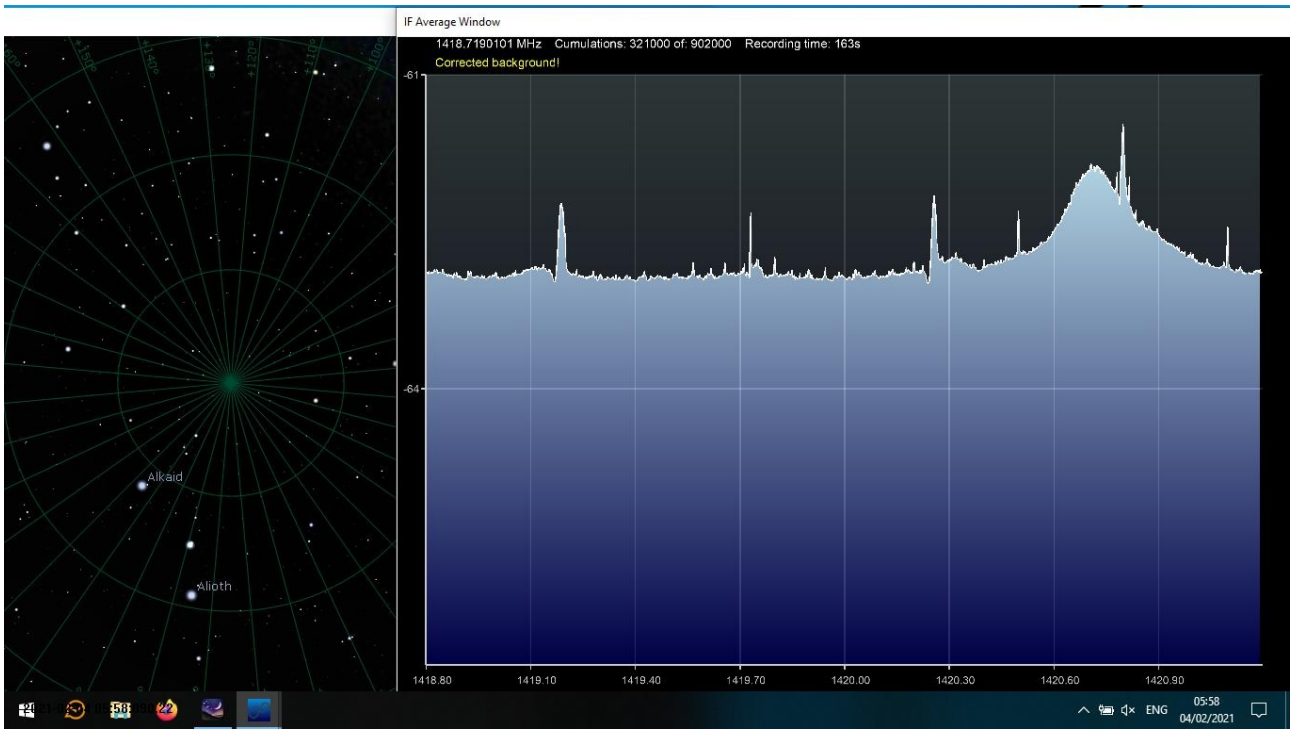


Figure 10a: Void sky trace using Mk2 antenna.

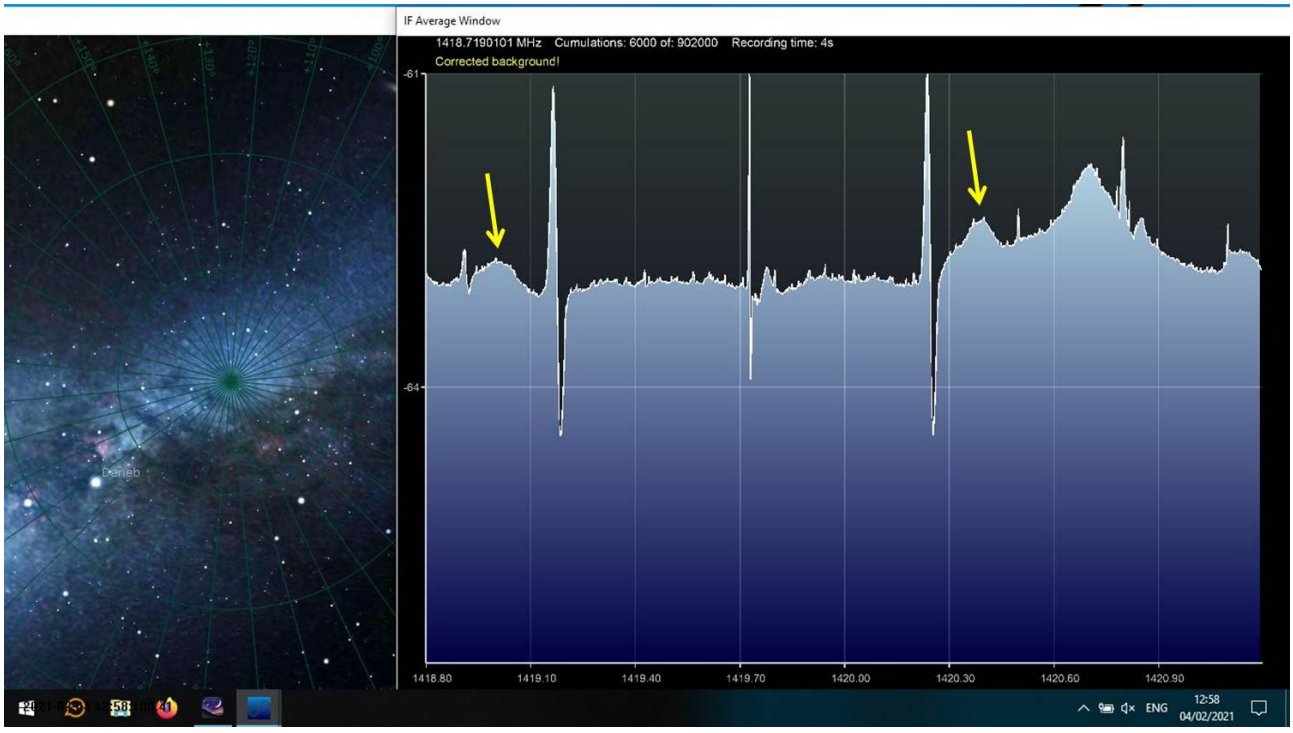


Figure 10b: Milky Way trace using Mk2 antenna, showing 2 HI responses

These peaks centre around 1419.0 MHz and 1420.4 MHz, which correspond to a recessional velocity of 200 kms^{-1} and an approaching velocity of 80 kms^{-1} respectively.

Checking with Starry night, we can find that the peak shown in figure 10b was seen at galactic longitude 100°. From figure 11, we can see that in this direction we can see two galactic arms and corresponding gas clouds (cloud A and cloud B).

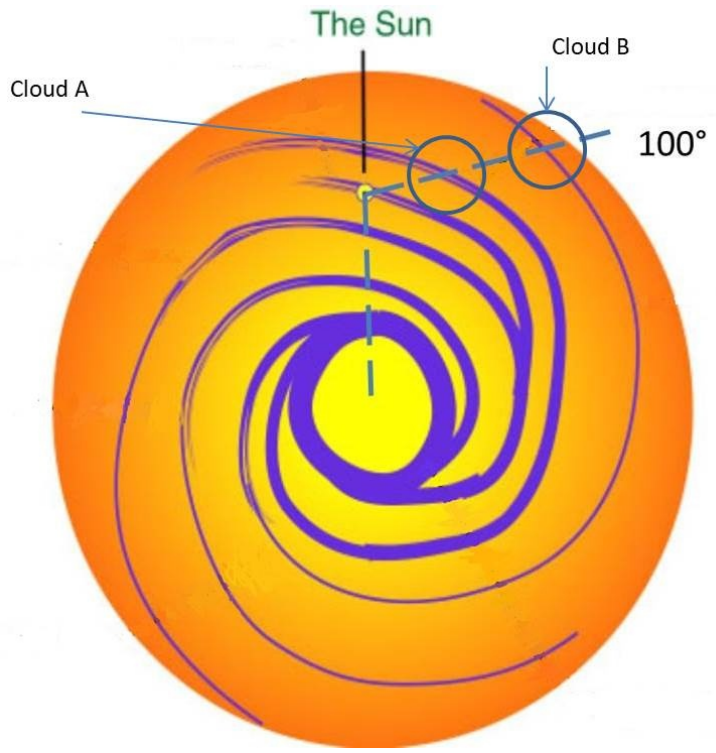


Figure 11: Gas clouds encountered at $l = 100°$

Using our observations, a little mathematics shows that cloud A is approximately 5.5 kiloparsecs from the Sun and cloud B approximately 12.0 kpc, which agrees nicely with the relative positions of the clouds in figure 11. This is quite pleasing and suggests that this radio telescope setup (admittedly with the Mk 2 antenna) is working and could be used to map out the structure of the Milky Way by repeating the observation along the entire Milky Way.

So what next? The experiment needs to be re-run in a very radio quiet site, away from Wi-Fi, mobile phones and other source of interference. Perhaps Newbourne when we are allowed out. Watch this space!

Gyulbudaghian's nebula in 2020

Mike Harlow March 2021

I've been imaging Gyulbudaghian's variable nebula in Cepheus since 2008 **[1]** but in 2020 I began to image it much more frequently. As a result I was able to follow the fade of the nebula in some detail. Figure 1 shows the evolution of the nebula in 2020. Unfortunately, I had some telescope down time in January and February but from March onwards I got reasonable images each month. Letters in each image indicate the month but note that I didn't image it from home in June as the sky doesn't get completely dark.

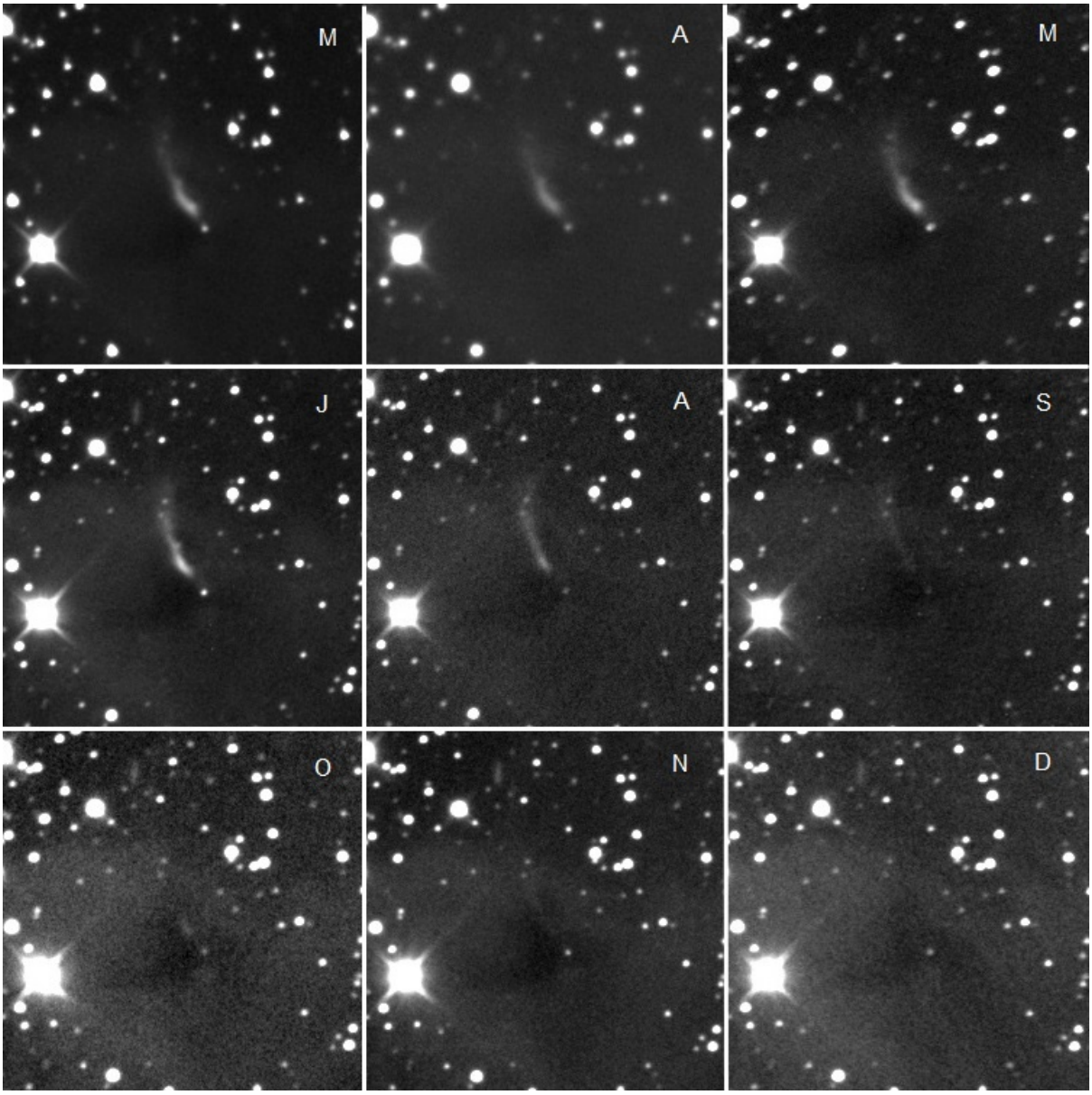


Figure 1: The fade of Gyulbudaghian's nebula in 2020.
Each image is just 6 x 6 arc minutes with north up.

The fade of the nebula was accompanied by a dramatic fade of PV Cephei, the star that illuminates the nebula, from about magnitude 15 to below magnitude 19 **[2]**. By the end of the year, the nebula had completely faded from view with only the background interstellar nebula remaining. This background nebulosity is the north eastern tip of LBN468 **[3]**.

2021: The story so far

Imaging continues in 2021 on every clear night. Even when the Moon is up it is possible to get usable results by imaging through a red filter to cut out the blue sky background. Figure 2 shows the nebula brightening in February. Only time will tell what happens next but the signs are encouraging for a revival.

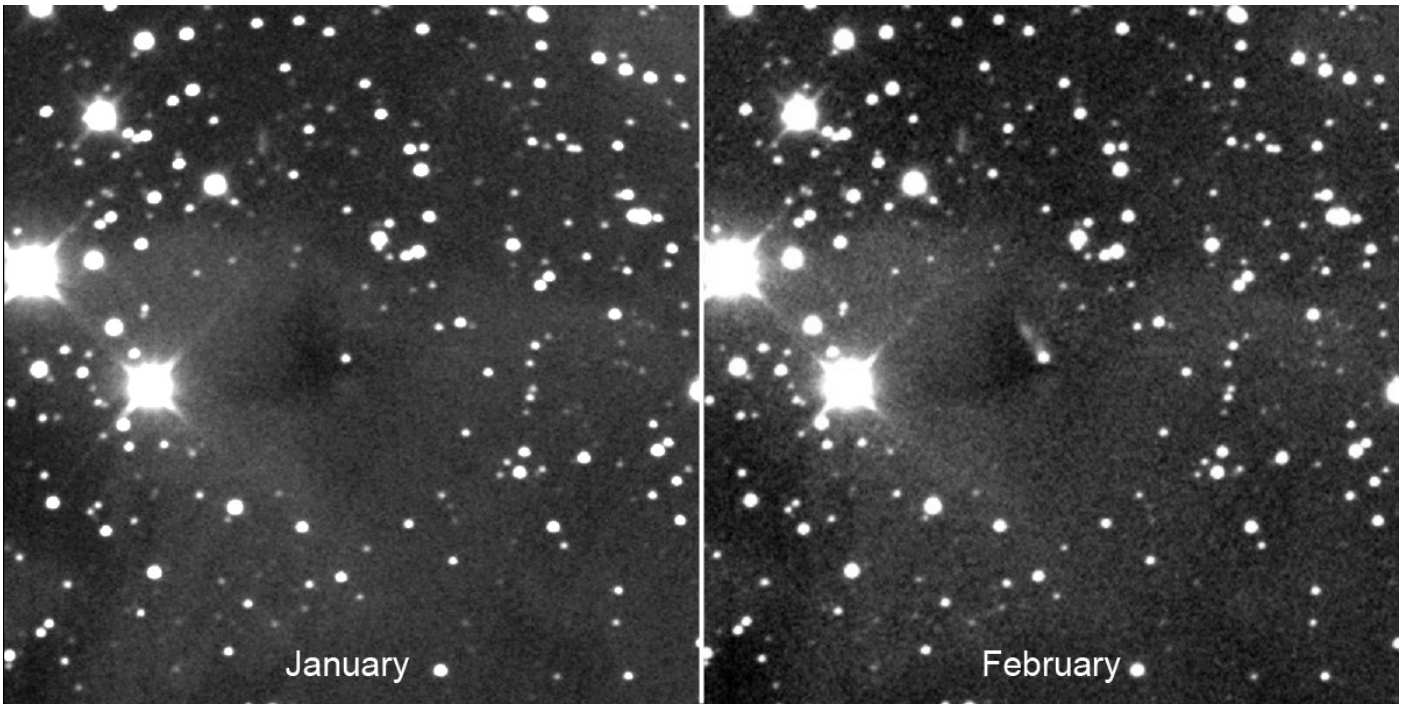


Figure 2: Start of a revival? Gyulbudaghian's nebula in January and February 2021. Each image is 9 x 9 arc minutes with north up

Comments

Gyulbudaghian's nebula is the most variable object of its class showing changes in shape and brightness on time scales from years to months and sometimes even in just a few days.

I'm planning to image the nebula throughout this year and upload results to my BAA members page as I get them **[4]**.

For more information on variable nebulae, see Nick Hewitt's recently updated web pages on the BAA site **[5]**. Also, a paper on the changes in Gyulbudaghian's nebula between 2009 and 2015 has been published by Grant Privett in the BAA Journal **[6]**.

References

[1] Many images are on the OASI variable nebula web pages maintained by James Appleton: http://www.oasi.org.uk/Obsvns/20210201_VN/20210201_VN.php

[2] David Boyd's observations of PV Cep on the BAA forum: https://britastro.org/node/24244

[3] Some very nice images of LBN468 can be found on the internet. For example: https://jthommes.com/Astro/LBN468_Gyul.htm

[4] Mike Harlow's BAA members page: https://britastro.org/observations/user.php?user=1252

[5] BAA variable nebula web pages: https://britastro.org/node/4928

[6] 'The many faces of Gyulbudaghian's nebula', G. Privett et al. J. Br. Astron. Assoc. **129**(5), 2019, p273-278.

Making an Objective Prism

Mike Harlow, March 2021

Almost 10 years ago Paul Whiting turned up at our house with a large, battered cardboard box. A friend had been clearing out their loft and thought the contents of the box might be of interest to Paul. In turn, Paul thought the contents of the box might be of interest to me! And what was so interesting?...two 12 inch diameter plano-convex lenses. Large lumps of optical glass are potentially useful, but at the time, I wasn't sure what to do with them, so they went in my loft!

A couple of years later, at the very first Newbourne observing meeting, Mike O'Mahony asked me if I had ever done any spectroscopy. I hadn't, but that got me thinking about how I could do it with my existing telescope. The simplest way was to put a prism on the front of the telescope so I contacted Bob Marriott at the BAA and asked him if their instrument collection had anything I could use. A few months later, Bob turned up at my house with a large, battered cardboard box containing a 23cm, 12 degree prism**[1]**. After trying out the prism**[2]** and getting some nice results**[3],** I had a thought. I could make an even bigger prism from the lenses that Paul had given me. The larger prism would have a shallower wedge angle but could reach fainter objects, ideal for supernovae, novae, quasars, planetary nebulae and all sorts of other interesting objects. So fabrication started...

Cutting the blanks

The first job was to cut out a disc from each lens. By making the cut off-centre, one side is thicker than the other providing the wedge needed for the prism. The size of the prism is a trade-off between the diameter and wedge angle. With a 3 degree wedge, it was possible to cut a 26cm diameter disc, coincidently, the same size as the lens of the Tomline refractor.

Figure one shows the two lenses and the metal 'biscuit cutter' used to cut out the discs. Rotating the cutter by hand and using 80 grade carborundum powder cuts about 5 mm per hour, so it took a couple of hours' effort for each disc.

Figure 1: Two 12 inch diameter lenses and the 26cm diameter metal cutter

Figure 2 shows the result of the offset cutting.

Figure 2: The completed cut on the first prism blank

Note that the plano-convex lens is fixed to an old mirror blank for support as the cut breaks through the thin side first and needs extra glass to preserve the even cutting action. The discs are glued together with Evostick which can be softened with a hot air gun (carefully!) after cutting is complete to release the prism blank from the support disc.

Grinding

I now had two skew, plano-convex lenses which were the starting point for the prism grinding process. Having two was an advantage as they could be ground against each other to cut grinding time in half. Figure three shows the two discs back to back on the grinding stand at the start and part way through the rough grinding.

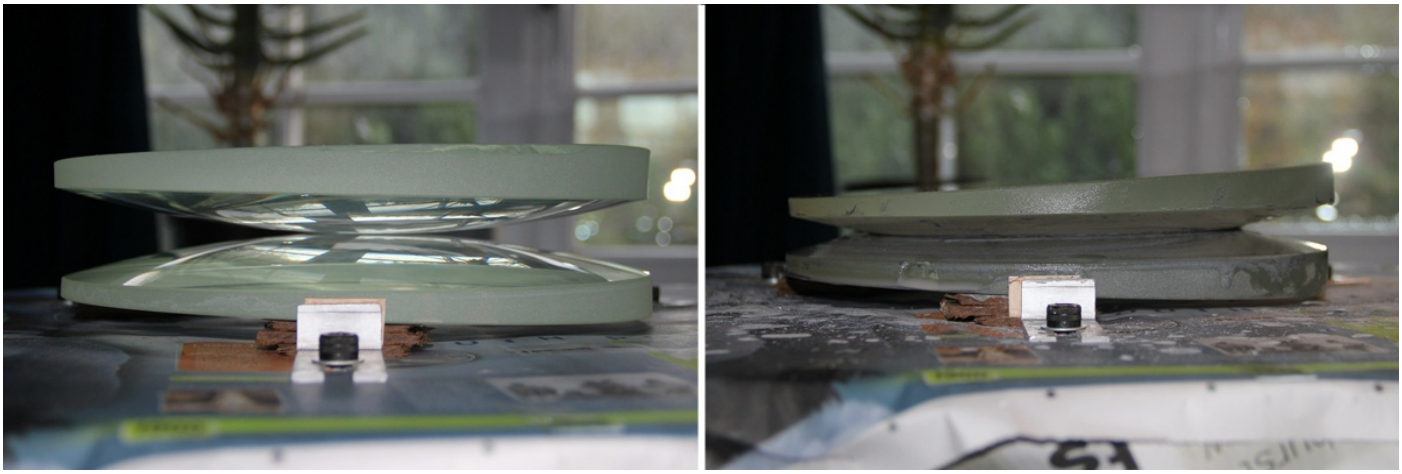


Figure 3: The two blanks back-to-back.
Left: Before grinding starts showing the convex curve.
Right: Part way through rough grinding with flats beginning to form.

Using 80 grade carborundum, the standard rough grinding grit, it took 21 hours to remove the curve from both discs. Some additional pressure was applied to the thin sides during grinding to increase the prism angle slightly to the desired 3 degrees.

Then followed the standard finer grinding stage to make the glass surfaces smooth enough for polishing. After the rough 80 grade, I used 180, 280, 400, 600 and 1000 grades before the discs were ready for polishing. The standard technique for making optical flats was used, grinding three discs together in alternating pairs to ensure that all surfaces become flat**[4]**.

Polishing

A polisher was made using pitch on a flat glass disc a bit smaller than the prisms. The faceted surface and random scratched grooves to give a smooth polish are shown in figure 4. The two prism blanks were mounted back to back at 180 degrees to give a level surface during polishing.

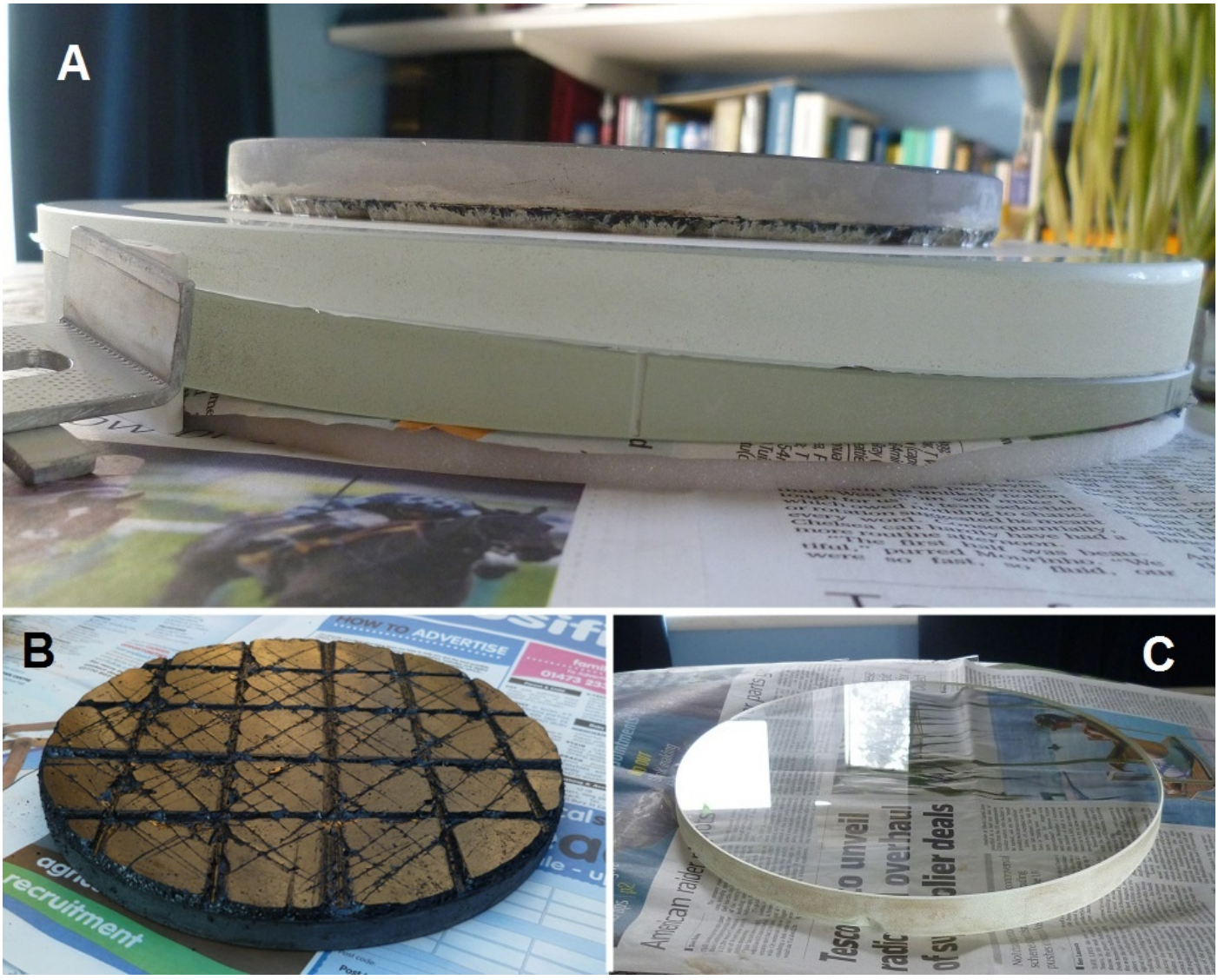


Figure 4 – A: Polisher on top of the two prisms,
B: The sub-diameter pitch polisher, C: the fully polished prism.

At this stage, I just polished one of the discs so the other fine-ground blank still needs to be finished. Polishing itself is a slow process and each surface took over three hours to polish out fully the grinding pits. I used cerium oxide powder to start and rouge (iron oxide) to finish off.

Testing

I should have said that the first thing I did, before any cutting or grinding of glass, was to test the lenses for internal stress. By mounting each lens between two polaroid sheets, any stresses in the glass can be revealed. The first sheet polarises the light and the second, mounted at 90 degrees, blocks the light completely so the lens should appear dark. Any stress in the glass rotates the polarisation slightly so some light leaks through and the lens can show bright, coloured areas. Both the lenses appeared dark in this test and appeared to be of good optical quality. The test was repeated after the prism was polished with the same result.

Some optical testing has been carried out to check on the surface quality but the final figuring is still to be done. A prism is just two optical flats back to back with a wedge between them so an interference test against a known optical flat gives a contour map of each surface under test. In the past I have used a monochromatic light source, either a helium-neon laser (632.8nm red light) or more recently a green laser pointer (532nm). For the prism testing I tried a different approach by using a white light source, an LED light bulb, but with a narrowband filter on the camera lens, namely an OIII filter centred at 501nm. Figure 5 shows an interferogram of one of the surfaces against a λ/8, 6 inch diameter optical flat. The test set-up is described in reference **[4]**.

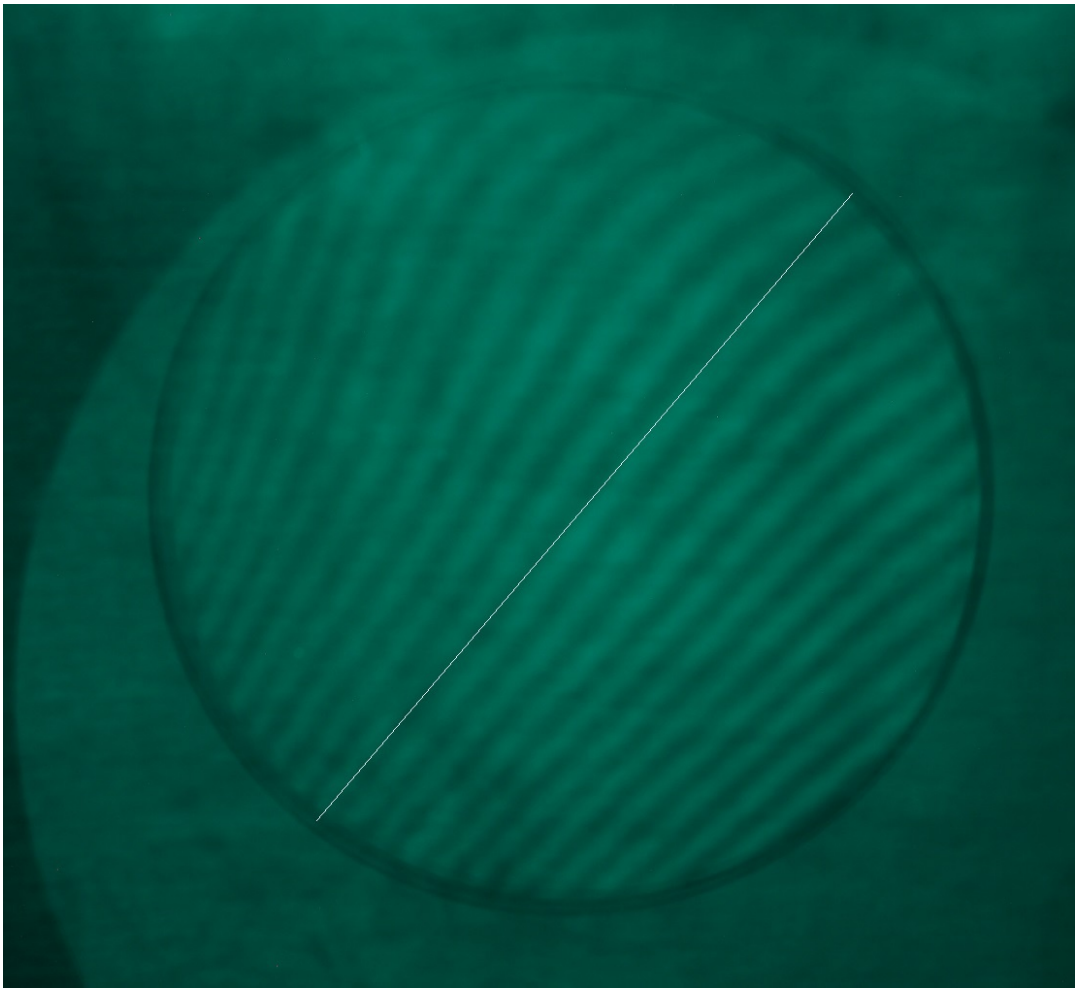


Figure 5: Prism in contact with an optical flat,
illuminated with white light and viewed through a narrowband filter at 501nm.

Clearly the interference fringes are not straight, as they would be for a perfectly flat surface, but the surface is good enough to give usable spectra.

Some results

My telescope has a focal length of 1100mm and, when combined with the 3 degree prism, gives spectra that are just 220 pixels long. But these low resolution spectra can still reveal the main features of many interesting objects down to fainter than magnitude 14. Figures 6 and 7 illustrate what the prism can reveal.

Figure 6 shows the field containing the cataclysmic variable SS Cygni. The variable shows emission lines due to hydrogen on a continuum background. Note that an 'ordinary' A-type star shows the same hydrogen lines but in absorption, i.e. dark lines on the continuum. Also in the field is a very red M-type star showing the characteristic dark bands due to titanium oxide in the star's atmosphere.

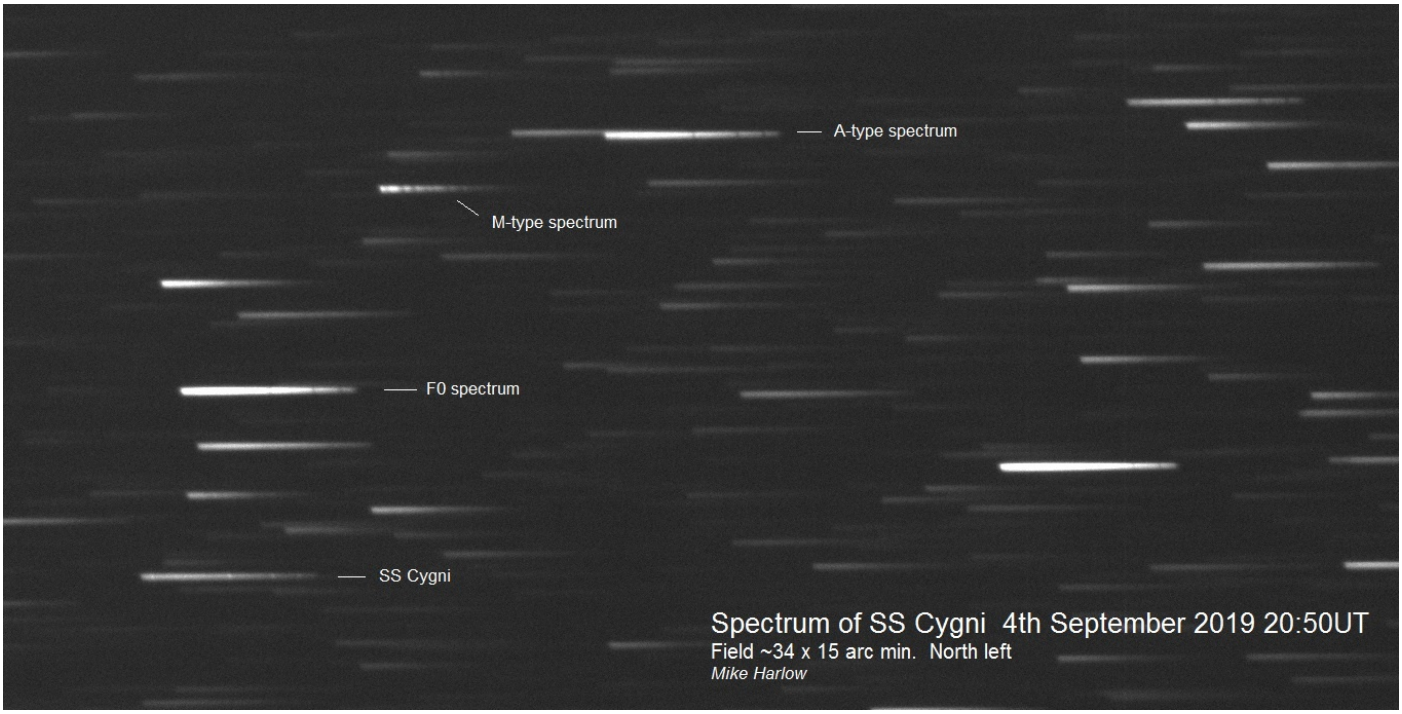


Figure 6: The field containing cataclysmic variable SS Cygni.

Figure 7 shows a crowded star field in Cygnus containing the very small planetary nebula NGC6881. The planetary is just 4 arc seconds across with a visual magnitude of 14.3. Visually, it is almost indistinguishable from the stars but, through the prism, the hydrogen alpha and oxygen III emission from the nebula gives two discrete images of the object making it stand out from the background.

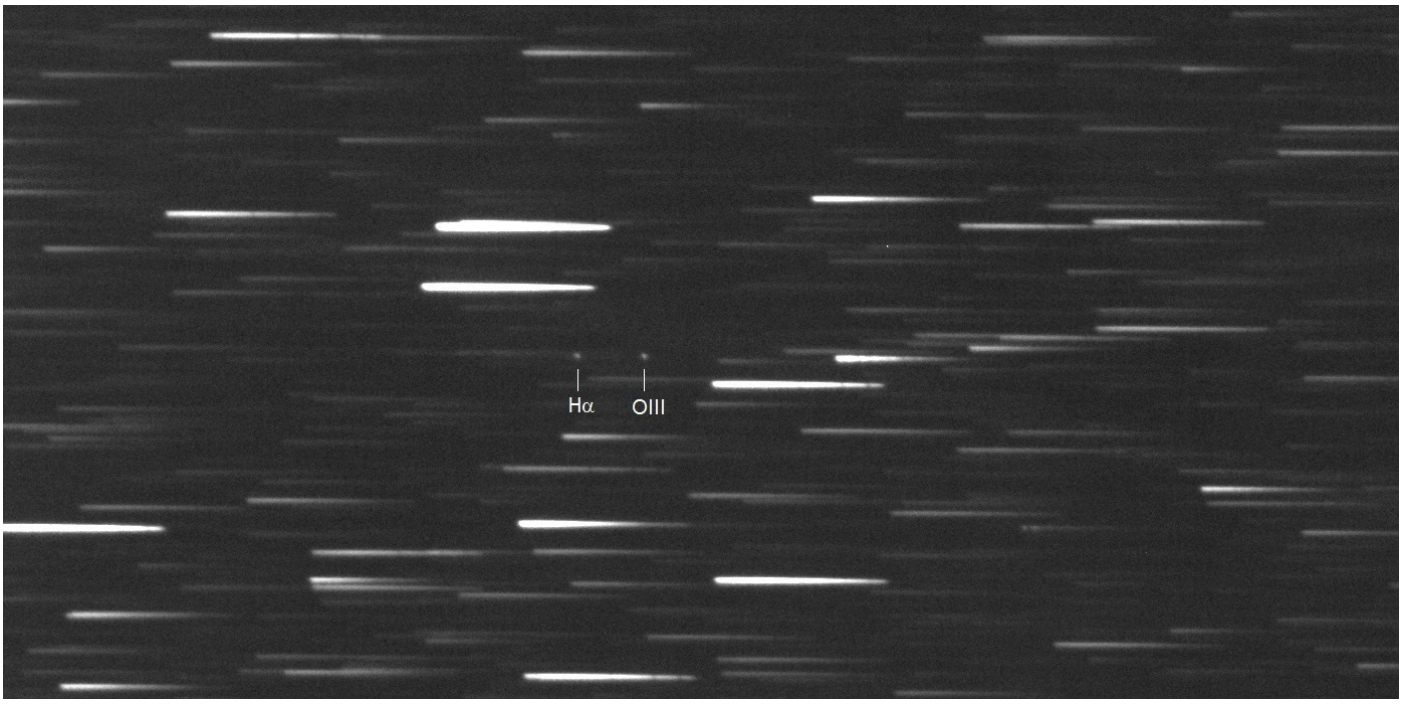


Figure 7: Planetary nebula NGC6881 in Cygnus. Field of view 35 x 14 arc minutes with north left.

Other spectra, including of nova Persei 2020 and nova Casseiopeia 2020, can be found on my BAA members' page amongst all the variable nebula images**[5]**.

Conclusion

Objective prisms were extensively used by professional astronomers in the second half of the 20th C for surveys to look for unusual objects with great success **[6]**. An objective prism offers a simple way to convert an existing imaging telescope into a spectrograph where every object in the field of view has its spectrum taken at the same time. For my homemade equipment this avoids the requirement of very accurately aligning the object of interest on a slit used in grating based spectrographs.

Most amateurs now use grating systems like the Lhires or Alpy spectrographs. Many studies using these systems are reported on the ARAS web site**[7]**.

References

[1] This prism was used by Maurice Gavin in the 1980s and 1990s and some of his results are published in the BAA Journal: 'Stellar spectroscopy with CCDs-some preliminary results'. J. Br. Astron. Assoc. **106**(1) 1996, p11-15.

[2] OASI web site: http://www.oasi.org.uk/Obsvns/novae+SN/20130906_obj_prism.jpg

[3] OASI web site: http://www.oasi.org.uk/Obsvns/novae+SN/CCDvsDSLR_2.jpg

[4] 'Optical Flats', R. E. English, Amateur Telescope Making, Book 3, p. 156-162. Scientific American Inc. 1956.

[5] Mike Harlow's BAA members page: https://britastro.org/observations/user.php?user=1252

[6] 'Astronomy with Schmidt-type telescopes', Proceedings of the 78th colloquium of the International Astronomical Union, Asagio, Italy, August 30 to September 2, 1983. Ed. Massimo Capaccioli, D. Reidel publishing company.

[7] Astronomical Ring for Access to Spectroscopy (ARAS) web site: http://www.astrosurf.com/aras/

Fireball update

Alan Smith

Following on from my report of a fireball at 0542hrs UT yesterday, 4/2/21, it now seems that there were at least 40 sightings.

I'm not able to share any of the images from the International Meteor Organisation (IMO) owing to copyright rules.

However, if you access: Fireball event (imo.net) (Press control and click to access the IMO database and check out EVENT 677-2021).

You will see the complete list, including my image and one other, plus 2 videos taken by what appear to be 'doorbell' type cameras. It just shows what can be seen using ordinary stuff. If any of you have doorbell cameras (NEST, RING etc.) and yours happens to be pointing in the general direction of a report (in this case north) it might be worth checking them out!

Yesterdays event seems to have occurred just north of Scunthorpe, with a possible impact area close to Doncaster (see map).

The IMO do stress that the track is provisional and based upon visual reports.

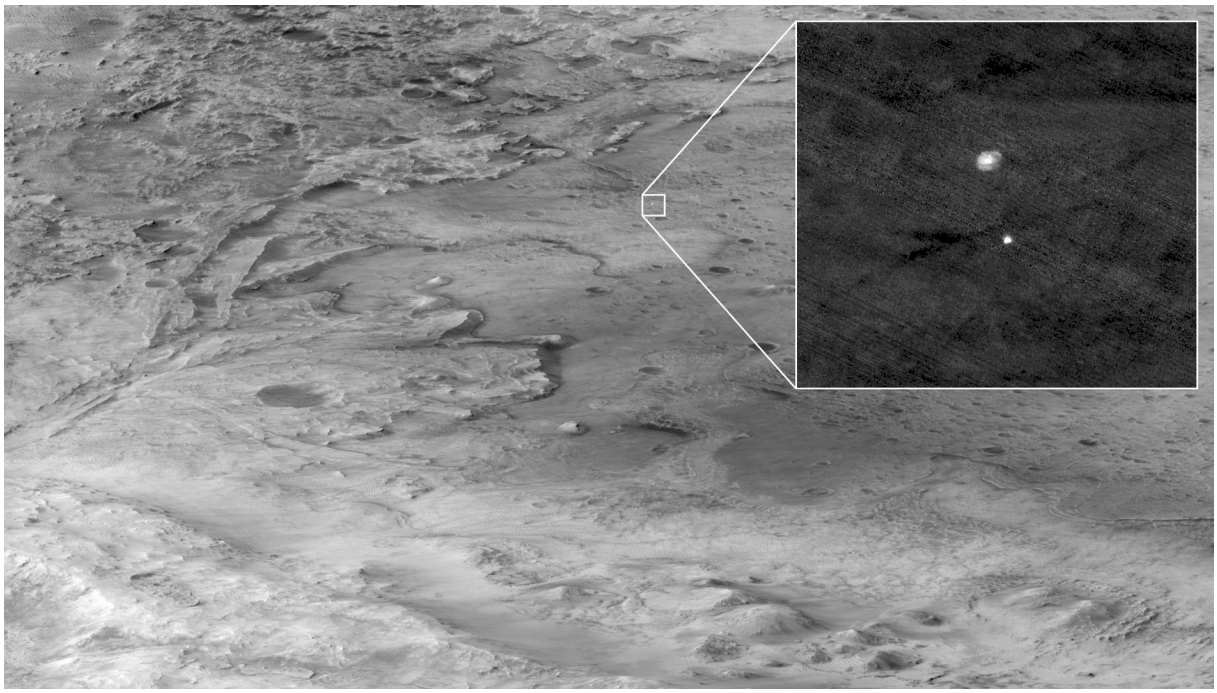
Hopefully, at least one other member of the Dutch Meteor Society (DMS), of which I am a member, will post on 'our' WhatsApp group and the DMS will reduce the images to provide a more definitive track.

Pictures from Mars

HiRISE Captured Perseverance During Descent to Mars

Credits: NASA/JPL-Caltech

The descent stage holding NASA's Perseverance rover can be seen falling through the Martian atmosphere.



More images can be found here https://www.nasa.gov/content/perseverance-mars-rovers-first-images

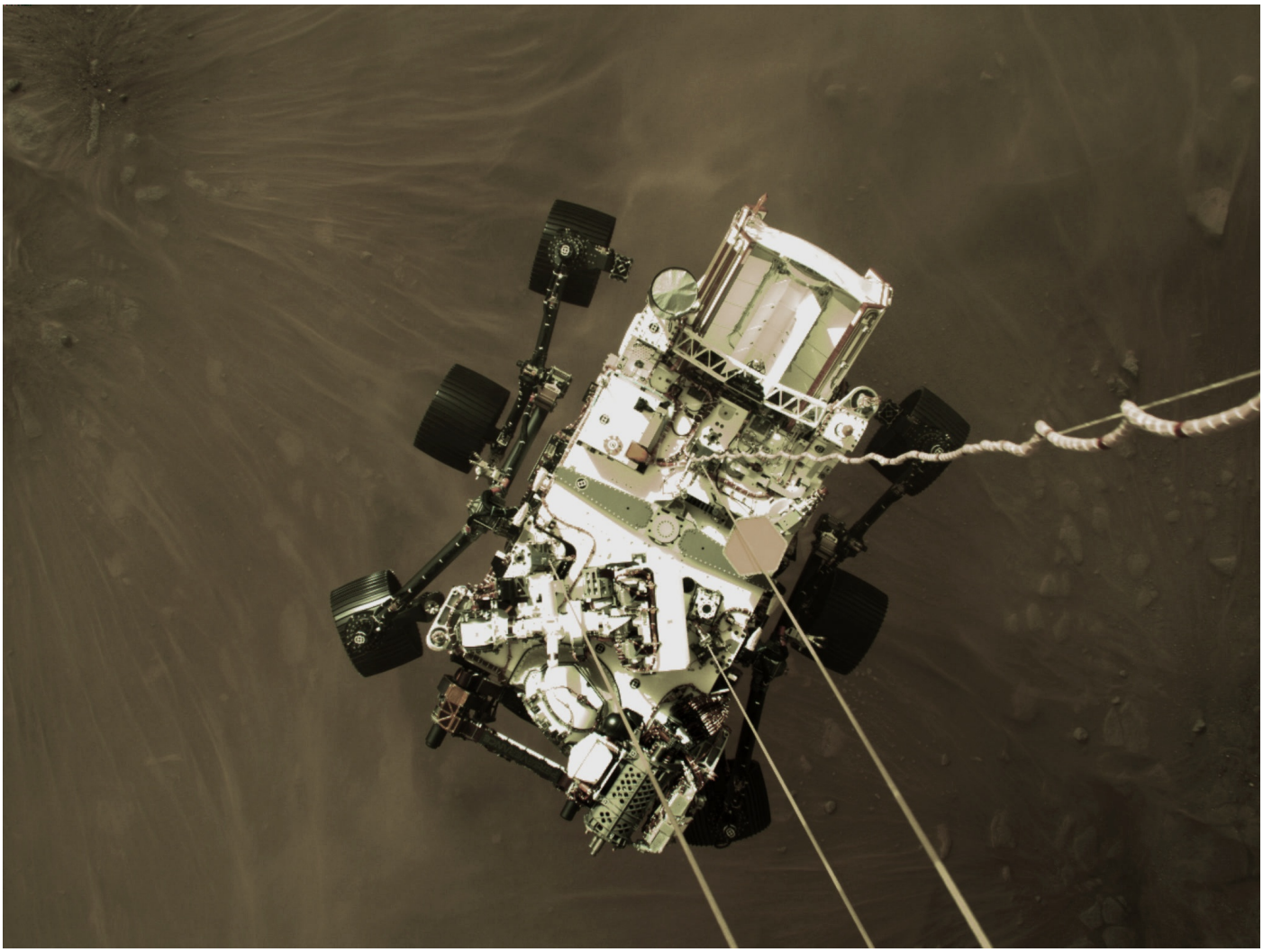
NASA's Perseverance Rover Gives High-Definition Panoramic View of Landing Site

https://mars.nasa.gov/news/8873/nasas-perseverance-rover-gives-high-definition-panoramic-view-of-landing-site/

NASA's Mars 2020 Perseverance rover got its first high-definition look around its new home in Jezero Crater on Feb. 21, after rotating its mast, or "head," 360 degrees, allowing the rover's Mastcam-Z instrument to capture its first panorama after touching down on the Red Planet on Feb 18. It was the rover's second panorama ever, as the rover's Navigation Cameras, or Navcams, also located on the mast, captured a 360-degree view on Feb. 20.

NASA's Perseverance Rover Sends Sneak Peek of Mars Landing

Credits: NASA/JPL-Caltech

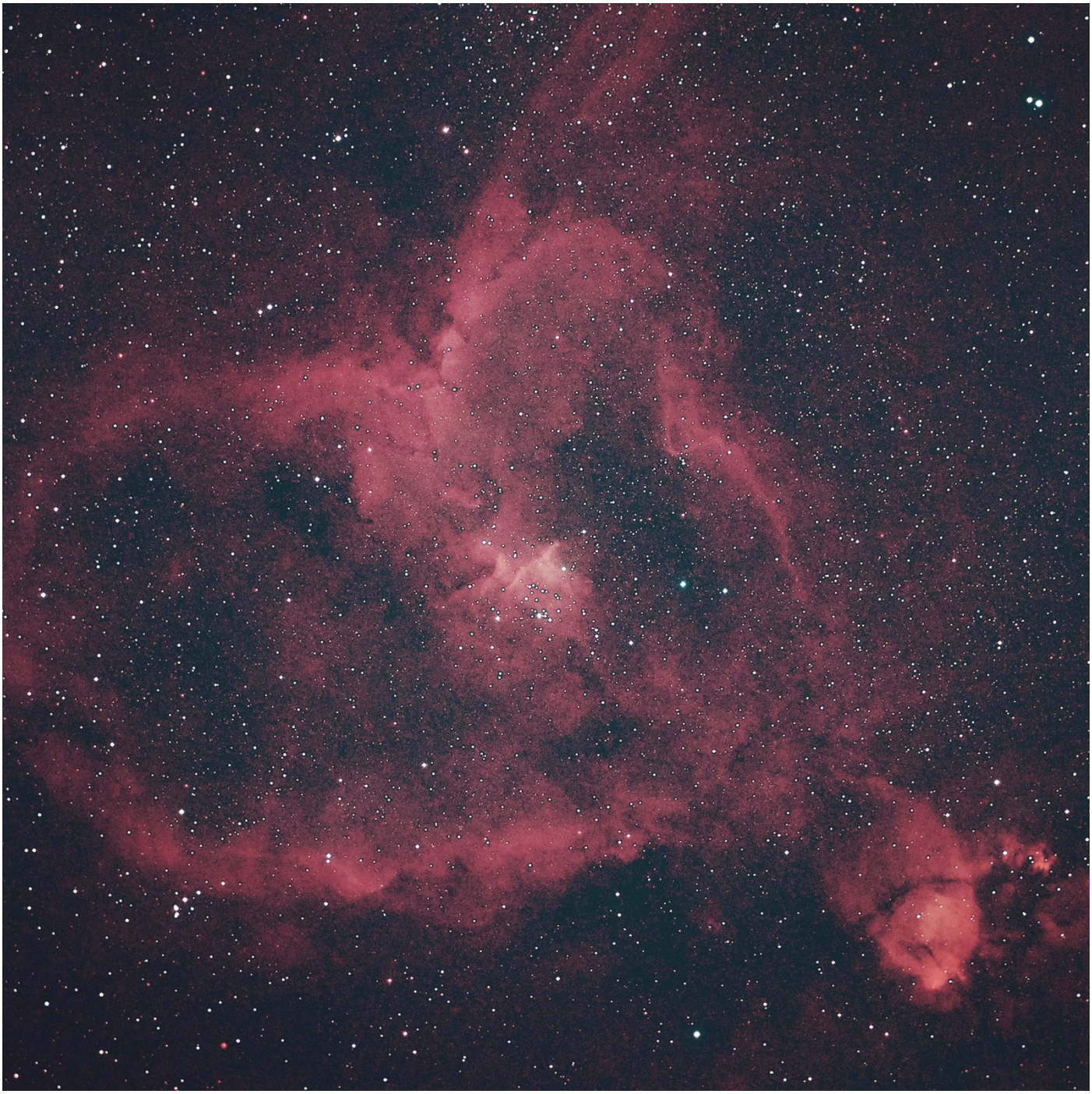


This high-resolution still image is part of a video taken by several cameras as NASA's Perseverance rover touched down on Mars on Feb. 18, 2021. A camera aboard the descent stage captured this shot. A key objective for Perseverance's mission on Mars is astrobiology, including the search for signs of ancient microbial life. The rover will characterize the planet's geology and past climate, pave the way for human exploration of the Red Planet, and be the first mission to collect and cache Martian rock and regolith (broken rock and dust). Subsequent NASA missions, in cooperation with ESA (the European Space Agency), would send spacecraft to Mars to collect these cached samples from the surface and return them to Earth for in-depth analysis. The Mars 2020 mission is part of a larger program that includes missions to the Moon as a way to prepare for human exploration of the Red Planet. JPL, which is managed for NASA by Caltech in Pasadena, California, built and manages operations of the Perseverance and Curiosity rovers.

Credits: NASA/JPL-Caltech

IC1805 Heart Nebula

Stephen Olley



IC1805 Heart Nebula. Imaged over 3 nights in February (snow included !)

Imaging

• 58 X 300 sec RGB + Calibration

Hardware:

• Telescope - Skywatcher Evostar 72ed ds pro
• StellaMira 0.8x Reducer / Field Flattener
• SkyWatcher HEQ5 Mount
• Orion starguider 60mm Guide Scope
• Altair GPCam2 224c Guide Cam
• Nikon d3400 DSLR
• Optolong L Enhance 2" Filter

Software:

• Digicam2 -- Capturing
• PHD2 -- Guiding
• Cartes du Ciel - Scope Control
• Sharpcap2 -- Polar Alignment
• Astro Pixel Processor -- Stacking and Processing
• Photoshop — Final Processing Tweaks

Strolling along the Terminator.

John Hughes

The weather prediction for last night (20 Feb) was for a few hours of clear skies but with the Moon positioned where it was I decided against bringing out my heavy gear.

Instead, I decided to take some pictures of the Moon. Having recently downloaded the free software 'Virtual Moon Atlas' I started looking for targets along the terminator. The software is great for this as you can feed in your scope focal length and camera pixel size and it will then provide a list of suitable objects.

I chose the following;

Rupes Recta - A scarp some 67 miles long and 900 feet high located in Mare Nubium.

Plato - large crater to the north
along with the mountain range bearing south west towards the Cassini crater.

Eratosthenes - another large crater with a mountain range to its north west.

Archimides - another crater north of Eratosthenes
and the continuation of the same mountain range bearing north.

Equipment

- Celestron Nexstar 6SE SCT.
- ZWO ASI174mm camera.
- 2.5x barlow.
- Celestron AVX mount.

Software

- Virtual Moon Atlas to identify targets and orientate camera.
- SharpCap for image acquisition.
- PIPP for images quality assessment.
- Autostakkert 3 to combine images into a single tif file.
- PixInsight - crop, contrast enhancement, sharpening and curve adjustment to produce final image.

Images

- 1,000 frames captured in SER video format for all targets.
- Plato – Exposure 4 ms, camera gain 300. Remaining targets were captured with the same gain but an exposure time of 6ms. Low exposure time and high gain ensured a good histogram with no clipping and a high frame rate for capturing the video footage c160 FPS.
- A review of the quality log generated by PIPP allowed me to sense check the best 20% frames and adjust this higher or low depending on the quality.