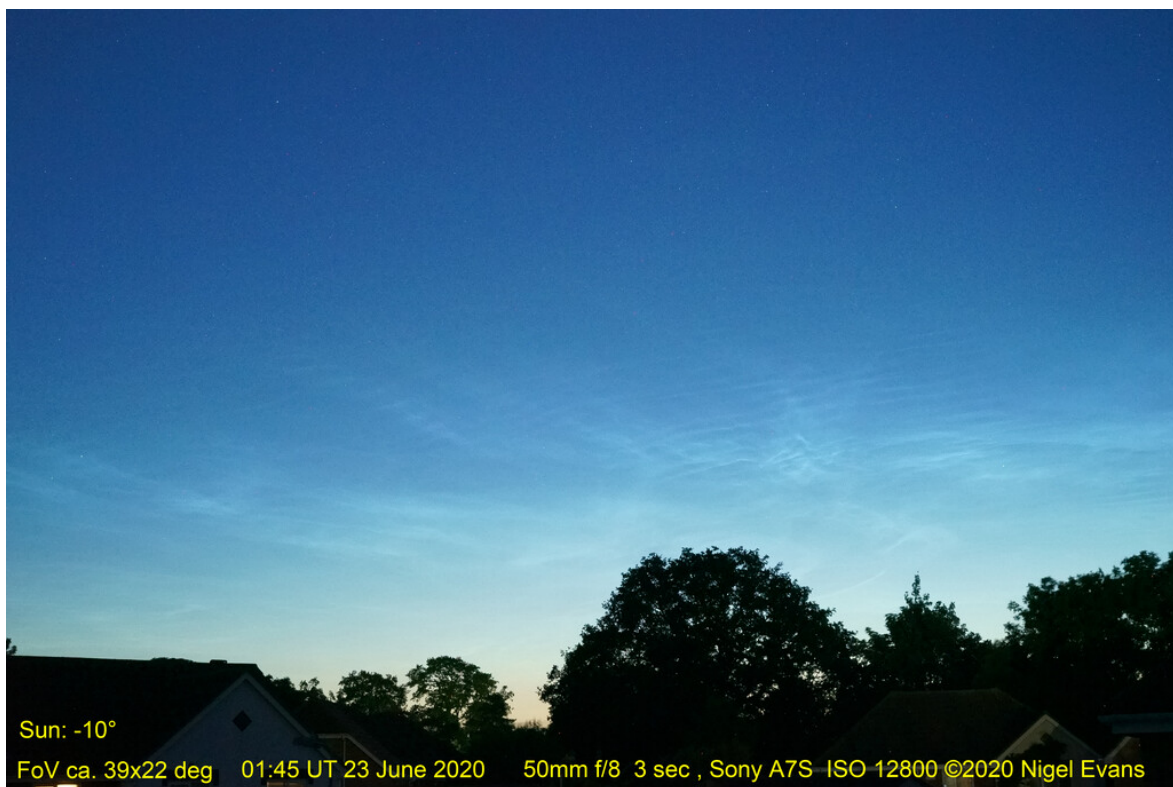




OASI News

The newsletter of the Orwell Astronomical Society



Sun: -10°
FoV ca. 39x22 deg 01:45 UT 23 June 2020 50mm f/8 3 sec , Sony A7S ISO 12800 ©2020 Nigel Evans

Noctilucent clouds

Photo by Nigel Evans

Trustees: Mr Roy Adams Mr Neil Morley Mr David Payne
Honorary President: Dr Allan Chapman D.Phil MA FRAS

Contents

Cover picture: Image of a prominence on the solar limb in H α light	
Society Notices	3
Society Contact details	3
Committee Meeting	4
Welcome new & returning members	4
OASI and BAA Events	5
Meetings via Skype.....	6
OASI @ Newbourne	6
Stargazer's Guide	7
Astronomy Workshops/Informal talks	7
Lecture Meetings	7
Other local astronomy society meetings	8
Atheneum Astro Society	8
LYRA Lowestoft & Yarmouth Regional Astronomers	8
DASH Astro	8
BAA news	8
BAA meetings in July–August	8
BAA Wednesday Webinars	9
GoSpaceWatch July Zoom Online Meeting:.....	9
Marsquake!: NASA's InSight Mission to Mars	9
The SPA have a number of online events	10
Joint webinar with the BAA	10
SPA online webinar on Saturday 25 July	10
A night with Hercules	11
Dates of solstices and equinoxes for the current epoch.....	13
I don't see many pictures of Mercury!.....	14
The Night Sky in July 2020	15
Moon	15
Sun, Moon and planets	15
Occultations during July 2020	16
Meteor showers during July 2020	16
Visible ISS passes $\geq 15^\circ$ max altitude	17
Starlink passes	18
Comets with magnitude brighter than magnitude 10	19
Astronomy on the radio	19
FOR SALE	19
Noctilucent clouds	20
Action on the Sun	21
First light with the Lunt LS60THa/B1200CPT	22
Venus	24
All-sky camera picture	26
A satellite	26
The Megaconstellation Threat	26
Welcome to IMAP	27

Society Notices

Dear Members,

Since all OASI gatherings were suspended on 16 March, due to the COVID 19 Pandemic, I have been heartened by OASI members efforts to keep the Society functioning during the lockdown.

Our Skype meetings on Wednesday's and Newbourne Monday's have proved popular. On Wednesday evenings, we have watched a live SpaceX launch, had impromptu astro imaging tutorials and have watched the ISS live on Alan Smith's all sky camera. On our Newbourne Monday's, we still have our monthly "Sky Notes", plus we have presented two talks. We have 27 members in our Skype group, if you would like to join in, email your Skype id to Martin Cook. membership@oasi.org.uk

As a result of staying at home, plus many clear days and nights during the last three months, we have had many observations and astro images submitted.

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

Observatory (meeting nights only)

07960 083714

Email queries: info@oasi.org.uk

Facebook: Orwell Astronomical

Twitter: @OASIpswich

Members-only message board

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

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

news@oasi.org.uk

Other contact details will be issued to members on a separate printed list.

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. Please send them to

news@oasi.org.uk

The CLOSING date is the 15th day of the month

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](http://www.oasi.org.uk/NL/NL_form.shtml)

Authors, please note that your articles will now 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 2020

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

Signing in and out

Please ensure you sign in and out when visiting the Observatory and/or Newbourne.
This is for fire safety precautions and also provides an historic record.

Committee Meeting

This will be held on **Friday 4 September**, 8pm by Skype. Please join the **OASImembers** Skype group to attend. Contact **Martin Cook** for details.

Welcome new & returning members

*We wish all our readers and their families good health during this difficult time.
Clear skies!*

OASI and BAA Events

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>

Subscribe to the OASI Yahoo group by emailing oasi-subscribe@yahoogroups.com

Key:

OASI public events

BAA & SPA events

Other events

Date, Time & Location	Contact	Event
Weekly, every Wednesday, 20:15–22:00 Orwell Park Observatory	Martin Cook, Roy Gooding	OBSERVATORY CLOSED Meet via Skype.
Wed, July 1 19:00	<i>Jeremy Shears, BAA Variable Star Section Director</i>	<i>BAA webinar: Is SS Cygni losing the plot? Observing unusual outbursts in a well-known dwarf nova - Webinar</i>
4 July	https://britastro.org/node/22096	<i>BAA Summer Webinar</i> <i>11:00 Sandra Brantingham Aurora, STEVE and Notilucent Clouds</i> <i>Sandra is the Director of the BAA Aurora & NLC Section.</i> <i>14:30 Dr Colin Snodgrass - Latest news in spacecraft exploration of comets and asteroids</i>
Wed 8 July 19:00	<i>Stewart Coulter</i>	<i>BAA webinar: Cook, the Transit of Venus, Aftermath and Legacy</i>
Mon 13 July from 19:30 Skype	Martin Richmond-Hardy newbourne@oasi.org.uk	OASI@Newbourne. Meet via Skype.
Wednesday 15 July 19:00	<i>Dr John Rogers, BAA Jupiter Section Director</i> <i>Greg Smye-Rumsby, designer and illustrator with Astronomy Now</i>	<i>BAA/SPA Joint Webinar</i> <i>Jupiter at opposition</i> <i>Myths and Illusions</i>

Date, Time & Location	Contact	Event
Wednesday 22 July 19:00	<i>Owen Brazell, President of the Webb Deep-Sky Society</i>	<i>BAA webinar: Observing Planetary Nebulae</i>
25 July 2pm		<i>SPA meeting</i>
Mon 27 July from 19:30 via Skype	Martin Richmond-Hardy newbourne@oasi.org.uk	OASI@Newbourne . Meet via Skype. Talks by: Bill Barton on the night sky.
Wednesday 29 July 19:00	<i>Dr Mark Kidger of the European Space Agency European Space Astronomy Centre</i>	<i>BAA webinar: Supernova Betelgeuse? What we learnt from the recent fade of this red giant</i>
Mon 10 August from 19:30 via Skype	Martin Richmond-Hardy newbourne@oasi.org.uk	OASI@Newbourne . Meet via Skype.
Mon 24 August from 19:30 via Skype	Martin Richmond-Hardy newbourne@oasi.org.uk	OASI@Newbourne . Meet via Skype. Talks by: Bill Barton on the night sky.

Please note that the listed events may change depending on the progress of the pandemic.

Meetings via Skype

Martin RH

I've set up an OASImembers group on Skype. To join, please first contact **Martin Cook** with your Skype name. OASI members only. Be sure to [download the latest version of Skype](#).

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

The Committee are considering moving to using Zoom or another videoconferencing service in order to accommodate more participants. We'll let you know if and when this happens.

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 Skype on those evenings, please first contact Martin Cook with your Skype name to receive an invitation. Members only, please.**

OASI@Newbourne Meetings

Subsequent meetings will be assessed in line with the current Government Guidelines in place at the time. Thank you for your understanding.

July 13
Sept 14
Nov 9

July 27 (S)
Sept 28 (S)
Nov 23 (S)

Aug 10
Oct 12
Dec 14

Aug 24 (S)
Oct 26 (S)
Dec 28 (S)

We open up for all meetings at 7:30pm. Star Guide (S) at 7:30pm and Workshops (W) at 7:45pm.

Stargazer's Guide

On the last meeting each month 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 and in OASI News.

Astronomy Workshops/Informal talks

Meetings will depend on COVID-19 situation. Talks will be via Skype during lock-down..

Contact Mike Whybray

Location: Newbourne Village Hall IP12 4NP

Doors open at 7:00pm.

Workshops start at 7:45pm

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!

Given a clear night, we can make use of the field for a workshop or continue afterwards with some observing.

Paul Whiting, Bill Barton and James Appleton have offered to lead workshops as follows:

- Paul Whiting: *Galaxy Collisions*, date TBA.
- Bill Barton: *Celestial Coordinates*, date TBA. New members at Newbourne have requested this workshop; Bill is willing to lead it but will defer if anyone else would rather do so.
- James Appleton: *Update on OASI All-Sky Meteor Cameras*, date TBA.

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

Lecture Meetings

Contact: Peter Richards lectures@oasi.org.uk

We have an exciting and interesting set of lectures by guest speakers for the Autumn.

There is a new venue for lectures this year which is:

St Augustine's Church Hall
Bucklesham Road
Ipswich IP3 8TH.

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

Friday 25th September

Nik Szymanek

"Adventures in Deep Sky Astrophotography"

Friday 23rd October

Sonali Shukla

"Brown dwarfs: Linking stars and planets"

Stars and planets are fundamentally different astronomical object yet the formation processes for each of these types of objects are heavily intertwined. Brown dwarfs straddle the realm of both stars and planets,



exhibiting characteristics of both but not fully fitting into either category. I will explore the history, discovery and latest results from our study of brown dwarfs and relate them to our lowest mass dwarf stars and biggest known planets. Understanding brown dwarfs can lead us to better understand how stars and planets form in tandem, both in our solar system and beyond.

Friday 20th November

Matt Bothwell:

"Big bangs to big rips: a history of 20th century cosmology".

Other local astronomy society meetings

Athaneum Astro Society

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

We 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 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. Thank you for your understanding at this time. Stay Safe.

Note * Guest Speaker Evenings - Admission Fees:- Members Free, Non Members £ 2:00

Meetings are now on Sundays.

06 Sept Meeting:- Ian Lomas - Quantum Mechanics for Beginners

13 Sept Dash Observing Session (Sunset 19:14 Moonset 17:46 21.5% Moon)

19&20 Sept Outreach:- Henham Steam Rally. Solar Observing and Displays

04 Oct* Meeting:- Stewart Moore – Globular Clusters

18 Oct Dash Observing Session (Sunset 17:50 Moonset 18:57 4.7% Moon)

01 Nov Meeting:- Talk T.B.C.

15 Nov Dash Observing Session (Sunset 15:59 Moonset 16.21 0.2% Moon)

29 Nov Meeting:- Talk T.B.C.

12- Dec (Saturday) DASH Christmas Social (Members and Guests only)

BAA news

BAA meetings in July–August

Sat., 4 July all day BAA Summer webinar <https://britastro.org/node/22096>

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

BAA Wednesday Webinars

<https://britastro.org/node/21142> These are listed in the OASI Events list on pages 5–6.

GoSpaceWatch: Publishers of CAPCOM Magazine

GoSpaceWatch July Zoom Online Meeting:

Wednesday 15th July 2020 19:30 BST

Marsquake!: NASA's InSight Mission to Mars

Dr Anna Horleston (University of Bristol)



About the Lecture:

NASA's InSight lander is the first dedicated geophysical lander sent to Mars. It arrived on the red planet in November 2018 and has been collecting all sorts of geophysical data ever since. The primary mission aims are to determine the interior structure of the red planet and to determine the level of seismicity. These two things will tell us about how Mars formed and will help with general models of planetary formation and evolution – why is Mars so different from Earth? In this talk, Anna will give an overview of the mission, the instruments involved and the results so far including records of marsquakes and the sound of the wind on Mars.

About the Speaker:

Anna is a seismologist with several years experience in broadband seismology managing deployments in locations all over the world. She has performed passive and controlled source field work and been involved with projects monitoring features including glaciers, volcanoes, subduction zones, passive basins and oil and gas drilling. Anna's interests lie in seismic instrumentation, network management and data interpretation.

Having recently worked on the BEIS-funded, BGS-led Environmental Monitoring Project for the Vale of Pickering and Lancashire, Anna turned her focus off-world and works on the NASA InSight Mission to Mars.



In order to access this meeting you must purchase a ticket through Eventbrite via our website below.

Joining Instructions will be sent two days before the meeting.

Tickets at Just £3.00 each at www.gospacewatch.co.uk

The SPA have a number of online events

Joint webinar with the BAA

On Wednesday 15 July at 7 pm there will be the first-ever joint meeting of the SPA and the BAA via Zoom.

Speakers will be John Rogers, Director of the BAA Jupiter Section, on the current opposition of Jupiter; and Greg Smye-Rumsby, specialist lecturer for the Royal Observatory, Greenwich, on Myths and Illusions – a talk that he was due to give at the cancelled April SPA meeting.

The Zoom link for the webinar is <https://us04web.zoom.us/j/548739039>. If you have not used Zoom before, please click on the link in advance to install the software. Alternatively, you can view the meeting on the BAA's YouTube channel. For more information about the meeting please visit our website: www.popastro.com/main_spa1/meetings-and-events/forthcoming-meetings/

SPA online webinar on Saturday 25 July

Rovers and landers on Mars: an astrobiology perspective

We are pleased that our intended speaker for the London meeting originally planned for this date, Dr Susanne Schwenzer of the Open University, will now give her talk online using Zoom. The meeting will start at 2 pm and further speakers will be announced nearer the time.

Instructions will be emailed to all members on the SPA mailing list in advance of the meeting..

A night with Hercules

John Hughes

Lockdown has touched us all in different ways and we now find ourselves using new technologies for entertainment and socialising outside of the traditional TV, books and movies. Zoom, Skype and Teamster have now entered our vocabulary and have kept us in contact with family, friends and colleagues. YouTube has become another source of education and/or entertainment and in the world of Astronomy it allows us to keep in touch with missed BAA presentations and similar offerings from amateur and professional contributors. Who would have thought the day would come when part of your evening entertainment would be to catch up on a recording on music relating to astronomy "Herschel to Hawkwind"!

Recently I was inspired by such a Zoom presentation, not to take up the trumpet (though playing it under the stars at 2am to the annoyance of my neighbour and his bright security light did cross my mind) no, this was two excellent presentations on splitting doubles and a guide to observing. On this occasion the host was The Stargazers Lounge, an astronomy forum which now produces weekly presentations on all manner of astronomy related subjects. For more information see <https://stargazerslounge.com>

The first presentation on doubles concentrated on five easy targets which anyone with a good pair of binoculars or a small scope would have no problem splitting. This was followed by a really interesting guide on observing in which the presenter walked through his approach to equipment, set up, target acquisition and the actual session itself. The video presented by Ian and Mark can be found here <https://www.youtube.com/watch?v=qcHaTnrLaJw&t=0s>

Astronomy can be as simple or as complicated as you want it to be and my garage is a testament to this with GOTO mounts, GPS, cables, cameras and the plethora of technology that never seems to end. Sometimes, the Mark I eyeball is good enough, though maybe on this occasion we will stretch to a small scope.

Back to basics

So, duly inspired to return to visual astronomy I broke out my Celestron Nexstar 6SE (F/L 1500mm) and SkyWatcher AZ5 mount. No GOTO, no electronics or gizmos unless you count my red dot finder. I also grabbed four eyepieces; 25mm, 15mm and 12mm BST StarGuiders with a 60 apparent field of view and a 40mm Vixen NPL with a 40° apparent field of view. Each offered 60x, 100x, 125x and 37.5x magnification respectively and fields of view ranging from 1° to 0.48°.

In addition, I dusted off my copy of the Illustrated Guide to Astronomical Wonders, Sky & Telescope's Pocket Sky Atlas and Interstellarium Deep Sky Atlas. Tonight, planetarium software would be left on the shelf and play no part.

Using the techniques described in the video I sat down in the evening with the Sky & Telescope Pocket Sky Atlas and determined that my target that night would be the constellation Hercules. Just after 11pm it would be visible high in the South where I would have a good clear view of it.

I then turned to the Illustrated Guide to Astronomical Wonders which provides details of targets to view in each constellation. Looking up Hercules I decided to keep the session light touch and just concentrate on five targets. On this occasion I chose;

- | | | |
|-----------------|---|--|
| 64 (Rasalgethi) | - | an easy double. |
| 65 (Sarin) | - | another double just north of Rasalgethi. |
| 75 | - | the last double on the list close to the upper left star making up the Hercules 'keystone' asterism. |
| M13 | - | obviously! A beautiful globular cluster. |
| M92 | - | another globular cluster but slightly harder to locate. |

These targets were listed in my observing notes along with RA/Dec and the pages where they appear in the Pocket Sky Atlas and the more detailed Deep Sky Atlas. Both of these books would join me outside tonight.

Session

Observing commenced at 10pm BST and too early to observe my targets as the sky remained light. The Moon was visible in the West and I took the opportunity to check that my red dot finder was properly aligned to my telescope. Having established all was well with the finderscope I then took a look around the waxing crescent with my eyepieces. I must confess that I am ignorant of the Moon. As I spend most of my time imaging, I tend to either try and avoid it or shake my fist at it when gradients appear in my hard earned data. Tonight, I was in awe of it. Sadly, I couldn't tell you the names of what I was looking at so maybe there is another project in the making.

By now Arcturus had revealed itself to me and I rotated the mount East and North to bring it into view. Lining up the red dot finder brought Arcturus into the centre of my 40mm eyepiece and I slowly worked through each, enjoying that soft red glow. The star was also shimmering due to the days heat rising from the ground and I thought that this would be a problem later but it proved not to be the case.

Having enjoyed Arcturus, I looked further East and could make out the triangle of Rasalhague and Ophiuchi with my first target, Rasalgethi, at the apex. Aligning my red dot finder, I was able to bring Rasalgethi into view. Both my 40mm and 25mm eyepieces failed to separate the primary and secondary, however, switching to 100x magnification I did discern a small separation which was confirmed when I stepped up to 125x. I don't know about you but I now see why observing doubles is so popular, watching that split 'pop' into view is so satisfying. Having seen that I could split two stars with a separation of 4.8", I was confident about the rest of the night.

Turning my attention North and a slightly easier separation of 11" between Sarin and its secondary, I could just make out a split between the two with my 40mm. My 25mm confirmed this as a clear double and Sarin's white colour. The secondary was more difficult and neither my 15mm or 12mm eyepiece could confirm the colour either. It is listed as blue-white so I will have to take that as read or buy a larger aperture scope!

Moving on now to 75 and the hardest double of the session with a separation of 4.0". It was not only a hard because of the separation but also hard on my knees! "Oh, for a GOTO mount" I thought as I knelt on the patio looking up towards the Zenith through my finderscope wearing varifocal glasses and viewing through the wrong part of the lens. Not only was that a challenge but matters got worse when I discovered I couldn't reach the slow-motion controls to move the scope. Oh, deep joy!

Still, I persevered and was rewarded when my target came into view. 40mm revealed no split but the 25mm suggested a split with averted vision. I decided to confirm if I was correct before increasing the magnification by checking the position angle, yep 321, roughly where I thought I could see it. At 100x magnification I confirmed the split and colour of both stars as white. Maintaining a steady image was difficult due to the vibration of the scope as I adjusted focus and this got worse when I stepped up to 125x. Adjusting the azimuth to bring the double to the East side of the eyepiece I watched it settle and come into focus as it drifted across to the West, a lovely sight.

Next on the list was M13, the Great Hercules Cluster. By this stage I had decided not to observe M92. This was even further North than 75 and I did not even want to imagine what position I would have to put myself in to locate it in the finderscope. Fittingly then I was saving the best view until last and it did not disappoint. Rather than contort my body to try and find M13, I took the chance that if I used my 40mm eyepiece with a 1 field of view and rotated the scope towards the West I just might have M13 stumble into view...and it did.

What a sight. At 37.5x it was a bright smudge in the centre of the eyepiece and moving up to 60x I could discern the bright core separated from the halo of stars surrounding it. With averted vision I thought I could resolve brighter individual stars outside of the cluster. 100x showed some of the brighter stars around the periphery of the core but 125x looked slightly dimmer and did not offer any additional detail.

Conclusions

The session ended at 23:54 BST and I could not have been happier with the outcome. I got to split some stars, view one of the best globular clusters in the Northern sky and stretch my back!

Reflecting on last night, I now appreciate that viewing the night sky in this way is harder but it also gives you a sense of satisfaction. Being able to research your targets and plan a night's observation is fulfilling and certainly gave me a better understanding of what I was looking at, how to use star charts and even where the cardinal points are in my eyepiece. I also think it helps your observing skills. Because I spent more time locating my targets, I felt compelled to spend more time with them and dare I say, observe rather than 'see'.

What would I do differently? I think it's obvious don't you.....I need to get better at star hopping for my back and knees sake!

Dates of solstices and equinoxes for the current epoch.

Bill Barton FRAS

UT date and time of
equinoxes and solstices on Earth^{[1][2]}

event	equinox		solstice		equinox		solstice	
month	March		June		September		December	
year	day	time	day	time	day	time	day	time
2015	20	22:45	21	16:38	23	08:20	22	04:48
2016	20	04:31	20	22:35	22	14:21	21	10:45
2017	20	10:29	21	04:25	22	20:02	21	16:29
2018	20	16:15	21	10:07	23	01:54	21	22:22
2019	20	21:58	21	15:54	23	07:50	22	04:19
2020	20	03:50	20	21:43	22	13:31	21	10:03
2021	20	09:37	21	03:32	22	19:21	21	15:59
2022	20	15:33	21	09:14	23	01:04	21	21:48
2023	20	21:25	21	14:58	23	06:50	22	03:28
2024	20	03:07	20	20:51	22	12:44	21	09:20
2025	20	09:02	21	02:42	22	18:20	21	15:03

The pattern is clearly influenced by leap years.

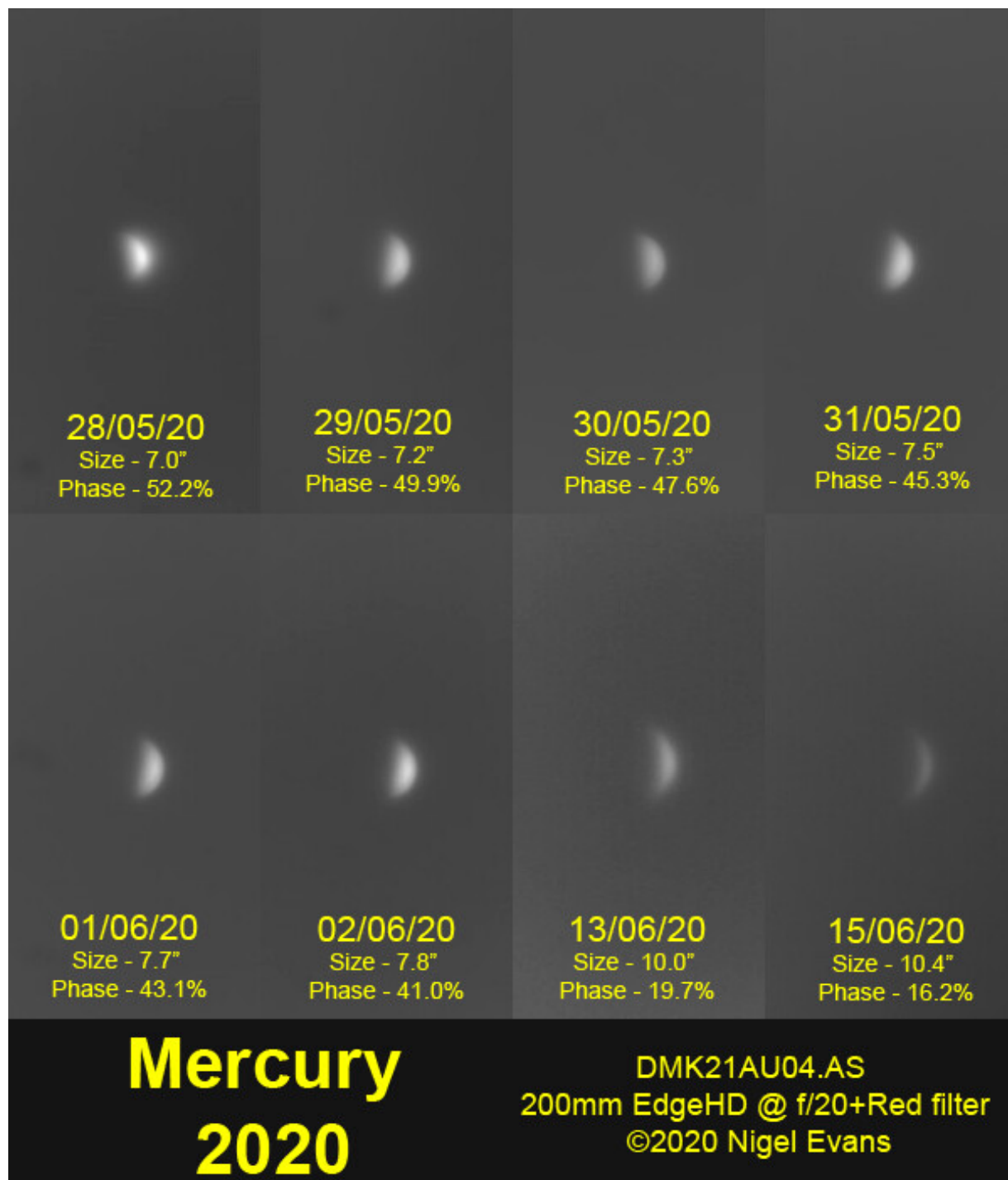
- 1, Spring equinox, always on March 20th
- 2, Summer solstice, three June 21st followed by a 20th
- 3, Autumn equinox, pairs of September 22nd and 23rd
- 4, Winter solstice, three December 21st followed by a 22nd

I don't see many pictures of Mercury!

Nigel Evans

With the recent evening apparition of Venus, it happened that Mercury was also in the evening sky, so I took the opportunity of recording it as well as Venus. It is smaller, not as bright, but it too shows the phases just as Venus does. In the beginning it was sufficiently far away from the Sun that the observatory dome blocked out the Sun, but towards the end I had to use the house roof to block the it, leaving a narrow window to find and record Mercury. Although there were clear skies after the 15th June, I just could not find the ever narrower crescent :-)

The seeing was fairly rubbish most of the time, but I am pleased that I have seen Mercury as something other than point of light



The Night Sky in July 2020

Martin RH

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



Moon

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

New Moon	1st Quarter	Full Moon	Last Quarter
20 July 18:33	28 June 09:16 27 July 13:33	05 July 05:44	13 July 00:29

Sun, Moon and planets

Source: <http://heavens-above.com/PlanetSummary.aspx> Times are BST (UTC+1).

Object	Date	Rise	Set	Mag.	Notes
Sun	1	04:40	21:18		
	31	05:16	20:46		
Moon	1	17:14	02:04		Apogee 404,199 km 12 July 20:27
	31	18:49	01:39		Perigee 368,361 km 25 July 06:02
Mercury	1	05:14	20:34	5.1	Inferior conjunction 01 July Maximum western elongation 22 Jul
	31	03:47	19:52	-0.6	
Venus	1	03:01	18:06	-4.3	
	31	02:03	17:35	-4.3	
Mars	1	00:39	12:15	-0.5	
	31	23:09	11:45	-1.1	
Jupiter	1	21:58	05:57	-2.6	Opposition 14 July
	31	19:49	03:38	-2.6	
Saturn	1	22:15	06:30	0.2	Opposition 20 July
	31	20:11	04:20	0.1	
Uranus	1	01:30	16:00	5.8	
	31	23:30	14:06	5.8	
Neptune	1	00:09	11:19	7.9	
	31	22:06	09:19	7.8	

Pluto comes to opposition on 15 July

Occultations during July 2020

James Appleton

The table lists occultations during the month under favourable circumstances. The data relates to Orwell Park Observatory, but will be similar at nearby locations.

The events should be readily visible in small telescopes or binoculars. The first two columns list the date and time (UT) of the occultation. Column three gives the phenomenon: 'D' denotes a disappearance and 'R' a reappearance. The table lists circumstances of disappearances and reappearances as dictated by the visibility of each phenomenon (determined by altitude, lunar phase, etc). Column four details the lunar phase ('+' for waxing and '-' for waning). Columns five and six give the altitude of the Sun and the star, both in degrees. A negative solar altitude means that the Sun is below the horizon. Columns seven and eight provide the star's magnitude and catalogue number.

The data relates to Orwell Park Observatory, but will be similar at nearby locations.

Please note that **times are shown in UTC**.

Date	Time (UT)	D/R	Lunar Phase	Sun Alt(°)	Star Alt(°)	Mag	Star
04 Jul	22:22:57	D	1.00+	-12	11	5.8	ZC 2719
28 Jul	21:07:49	D	0.65+	-10	16	5.6	32 Lib, ζ ¹ Lib

Meteor showers during July 2020

Source: BAA Handbook 2020 p100-101

Shower	Normal limits	Maximum	Dec.	ZHR at Max	Notes
Daytime Arietids	May 22 – July 2	June 7	+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	+27°	20?	Peak overlaps with that of Daytime Arietids. Good for radio observers. ZHR and radiant location uncertain.
June Bootids	Jun 22 – Jul 2	June 27	+48	?	Unexpected outburst with ZHR ~100 m/h in 1998 June 27 after quiescent period of several decades. Quite favourable.
α-Capricornids	July 3 – Aug 15	July 30	-09°	5	A good proportion of bright, slow-moving colourful meteors. Rather favourable
Southern δ-Aquarids	July 12 – Aug 23	July 31	-16°	20	Fine southern shower with double radiant. S component is more active. Rich in faint meteors. Unfavourable
Perseids	July 17 – Aug 24	Aug 12d 13d	+58°	80+	Rich and fast meteors. High proportion of bright events leaving persistent trains. Moonlight interferes.

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

Visible ISS passes $\geq 15^\circ$ max altitude

Martin RH

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

Times are BST. Predictions are approximate (26 May) 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.
03 Jul	-2	03:09:16	13°	S	03:11:15	20°	SE	03:13:49	10°	E
05 Jul	-3	03:09:31	15°	SW	03:11:54	37°	SSE	03:15:03	10°	E
06 Jul	-2.6	02:23:06	23°	S	02:24:04	28°	SSE	02:26:59	10°	E
07 Jul	-2.1	01:36:38	20°	SE	01:36:38	20°	SE	01:38:49	10°	E
07 Jul	-3.7	03:09:32	12°	WSW	03:12:38	62°	SSE	03:15:59	10°	E
08 Jul	-3.5	02:23:01	24°	SW	02:24:43	49°	SSE	02:28:00	10°	E
09 Jul	-3.2	01:36:26	35°	S	01:36:50	37°	SSE	01:39:58	10°	E
09 Jul	-3.8	03:10:04	10°	W	03:13:26	82°	S	03:16:48	10°	E
10 Jul	-2.4	00:49:45	24°	SE	00:49:45	24°	SE	00:51:53	10°	E
10 Jul	-3.9	02:22:38	14°	WSW	02:25:27	73°	SSE	02:28:49	10°	E
10 Jul	-3.8	03:58:51	10°	W	04:02:13	79°	S	04:05:35	10°	ESE
11 Jul	-3.8	01:35:50	26°	SW	01:37:29	61°	SSE	01:40:49	10°	E
11 Jul	-3.8	03:10:50	10°	W	03:14:13	85°	S	03:17:35	10°	E
12 Jul	-3.6	00:48:49	39°	SSW	00:49:32	48°	SSE	00:52:48	10°	E
12 Jul	-3.9	02:22:50	10°	W	02:26:12	86°	S	02:29:35	10°	E
12 Jul	-3.7	03:59:37	10°	W	04:02:55	57°	SSW	04:06:14	10°	ESE
13 Jul	-3.2	00:01:17	35°	SSE	00:01:37	36°	SSE	00:04:44	10°	E
13 Jul	-3.9	01:34	10°	W	01:38	82°	S	01:41:34	10°	E
13 Jul	-3.8	03:11:35	10°	W	03:14:56	70°	SSW	03:18:17	10°	ESE
13 Jul	-2.8	23:10:50	10°	SSW	23:13:42	26°	SSE	23:16:35	10°	E
14 Jul	-3.9	00:46:49	10°	WSW	00:50:11	73°	SSE	00:53:32	10°	E
14 Jul	-3.9	02:23:33	10°	W	02:26:56	80°	S	02:30:17	10°	ESE
14 Jul	-3.1	04:00:24	10°	W	04:03:29	33°	SSW	04:06:33	10°	SE
14 Jul	-2.4	22:23:22	10°	SSW	22:25:50	19°	SE	22:28:18	10°	E
14 Jul	-3.8	23:58:51	10°	WSW	00:02:10	60°	SSE	00:05:30	10°	E
15 Jul	-3.9	01:35:31	10°	W	01:38:53	86°	S	01:42:16	10°	E
15 Jul	-3.5	03:12:19	10°	W	03:15:33	45°	SSW	03:18:45	10°	SE
15 Jul	-3.6	23:10:55	10°	SW	23:14:10	47°	SSE	23:17:26	10°	E
16 Jul	-3.9	00:47:28	10°	W	00:50:51	86°	S	00:54:12	10°	E
16 Jul	-3.8	02:24:14	10°	W	02:27:33	58°	SSW	02:30:52	10°	ESE

Date	Bright -ness (mag)	Start			Highest point			End		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
16 Jul	-2.3	04:01:29	10°	W	04:03:51	18°	SW	04:06:13	10°	S
16 Jul	-3.2	22:23:06	10°	SW	22:26:12	35°	SSE	22:29:19	10°	E
16 Jul	-3.9	23:59:24	10°	W	00:02:46	81°	S	00:06:09	10°	E
17 Jul	-3.9	01:36:10	10°	W	01:39:31	71°	SSW	01:42:52	10°	ESE
17 Jul	-2.7	03:13:08	10°	W	03:15:58	25°	SSW	03:18:47	10°	SSE
17 Jul	-3.9	23:11:22	10°	WSW	23:14:43	72°	SSE	23:18:05	10°	E
18 Jul	-3.9	00:48:05	10°	W	00:51:28	81°	S	00:54:50	10°	E
18 Jul	-3.2	02:24:56	10°	W	02:28:02	34°	SSW	02:29:06	27°	SSE
18 Jul	-3.7	22:23:21	10°	WSW	22:26:40	59°	SSE	22:30:00	10°	E
19 Jul	-3.9	00:00:01	10°	W	00:03:23	86°	S	00:06:46	10°	E
19 Jul	-3.5	01:36:48	10°	W	01:39:50	45°	SW	01:39:50	45°	SW
19 Jul	-3.9	23:11:55	10°	W	23:15:18	86°	S	23:18:40	10°	E
20 Jul	-3.8	00:48:41	10°	W	00:52:00	59°	SSW	00:52:24	54°	SSE
20 Jul	-3.8	22:23:49	10°	W	22:27:11	81°	S	22:30:34	10°	E
21 Jul	-3.9	00:00:34	10°	W	00:03:56	72°	SSW	00:05:20	32°	ESE
21 Jul	-3.9	23:12:27	10°	W	23:15:50	81°	S	23:18:26	16°	E
22 Jul	-2.5	00:49:18	10°	W	00:51:19	27°	WSW	00:51:19	27°	WSW
22 Jul	-3.8	22:24:20	10°	W	22:27:42	86°	S	22:31:05	10°	E
23 Jul	-3.5	00:01:06	10°	W	00:04:22	47°	SSW	00:04:31	46°	SSW
23 Jul	-3.8	21:36:12	10°	W	21:39:34	86°	S	21:42:57	10°	E
23 Jul	-3.7	23:12:57	10°	W	23:16:17	60°	SSW	23:17:46	29°	SE
24 Jul	-3.8	22:24:48	10°	W	22:28:10	73°	SSW	22:31:04	13°	ESE
25 Jul	-2.3	00:01:45	10°	W	00:03:57	24°	SW	00:03:57	24°	SW
25 Jul	-3.8	21:36:39	10°	W	21:40:02	82°	S	21:43:24	10°	E
25 Jul	-3	23:13:28	10°	W	23:16:37	36°	SSW	23:17:16	32°	S
26 Jul	-3.4	22:25:16	10°	W	22:28:31	48°	SSW	22:30:37	19°	SE
27 Jul	-3.6	21:37:04	10°	W	21:40:24	61°	SSW	21:43:43	10°	ESE
27 Jul	-2.1	23:14:13	10°	W	23:16:44	20°	SW	23:16:54	20°	SSW
28 Jul	-2.5	22:25:48	10°	W	22:28:43	27°	SSW	22:30:19	19°	SSE
29 Jul	-2.9	21:37:29	10°	W	21:40:38	37°	SSW	21:43:46	10°	SE
31 Jul	-1.9	21:38:07	10°	W	21:40:42	20°	SW	21:43:15	10°	SSE

Starlink passes

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

Comets with magnitude brighter than magnitude 10

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

Comet	Brightness	Angular separation from Sun	Altitude	Azimuth	Constellation
C/2020 F3 NEOWISE	2.1	9°	46.1°	248° (WSW)	Taurus
C/2019 U6	7.1	60°	32.0°	156° (SSE)	Sextans
2P Encke	7.5	19°	54.8°	206° (SSW)	Gemini
C/2020 F8 SWAN	9.0	10°	54.7°	251° (WSW)	Auriga
C/2017 T2 PANSTARRS	9.1	73°	53.6°	83° (E)	Canes Venatici

Astronomy on the radio

During virus isolation these slots will either be reports read by the host or via phone to the studio.

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 (note change of time) 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>

FOR SALE

on behalf of member's widow:

Meade DS-2114S 114mm reflector, drive, tripod and autostar controller.

2x Barlow, 6.4mm, 4mm, 9mm & 25mm eyepieces.

Unopened packet Baader solar filter film.

2 solar eclipse viewers.!!

£100 the lot.

Contact Paul Whiting

Noctilucent clouds

Nigel Evans

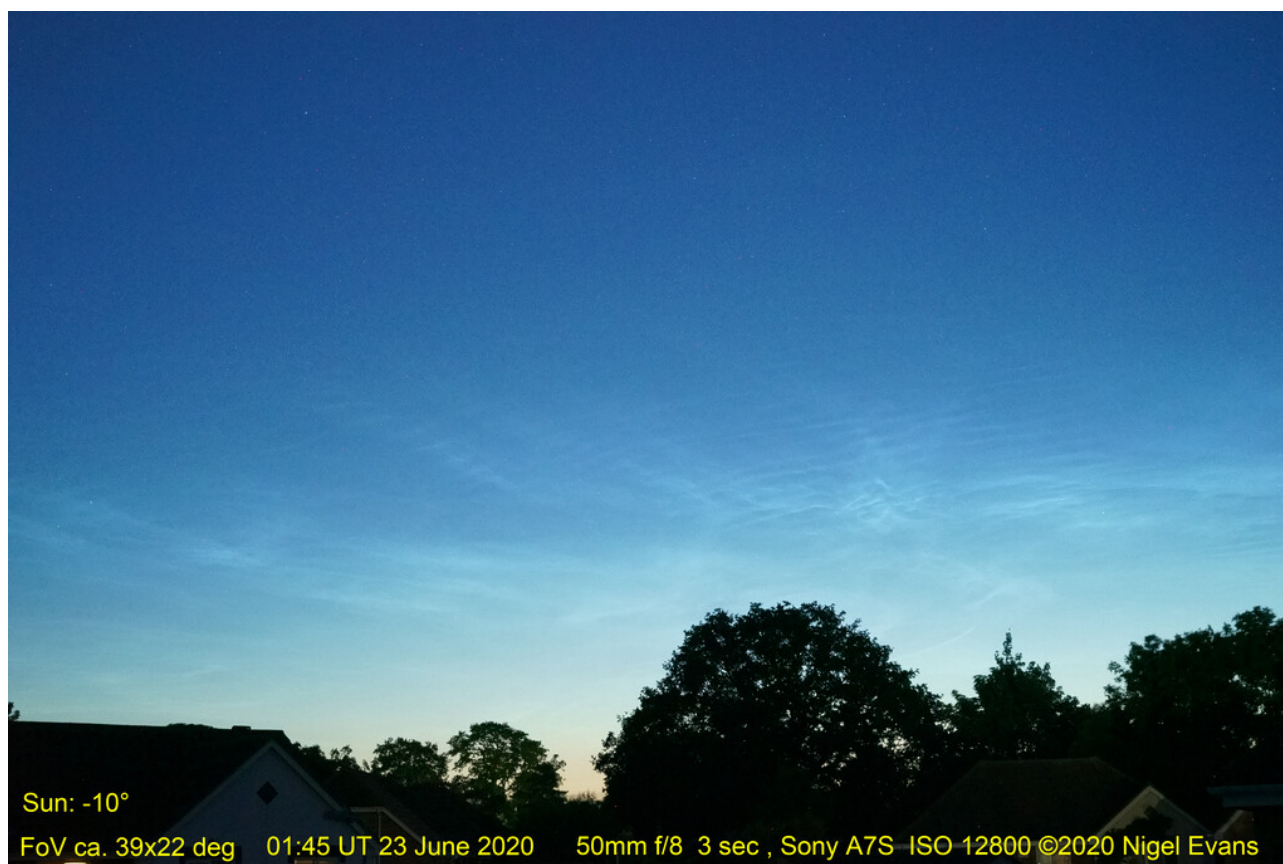
As a bit of a punt I set up my time lapse cameras to view towards the north. These have small lenses, limited night capabilities, resolution or exposure control so I was not expecting to record much.

The clouds are a long way off but nevertheless this camera did an impressive job of capturing the noctilucent clouds before it was overwhelmed by the dawn

The bright star Capella is just over 10 degrees high at the start of the sequence.

I also had a DSLR running at the same time. Here the exposure was fixed so bleached out earlier than the other camera. However this has higher resolution and sees fainter stars

Both camera were taken indoors.



Action on the Sun

Martin Cook

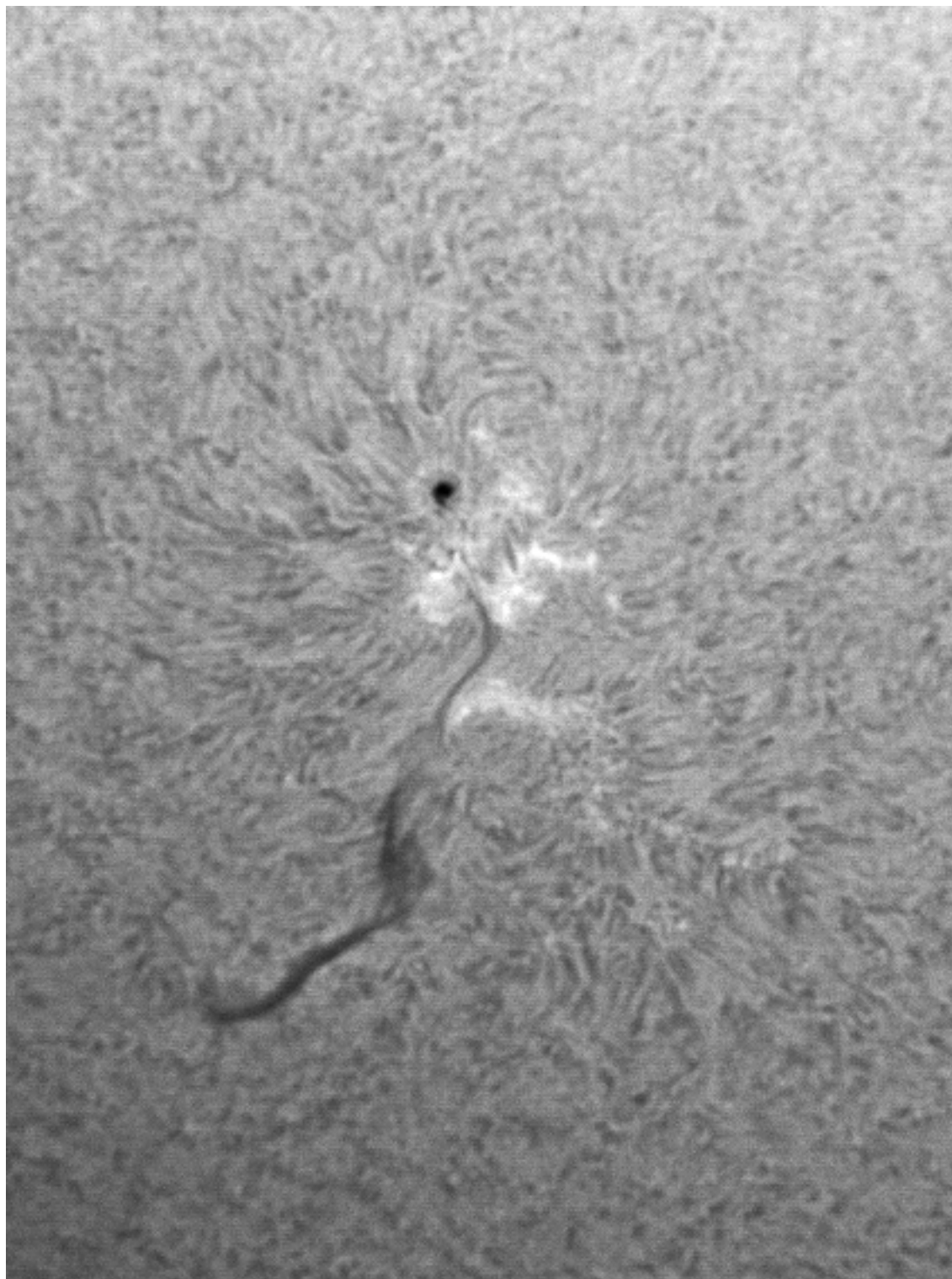
The Sun Tuesday 9 June at 8:45UT in H α light showing active regions AR2765 showing a sunspot a nice filament.

The best 15% of 2000 frames were stacked together to form the image.

Lunt LS60TH α /B1200 telescope

ZWOASI178mm camera

1.1ms exposure



Sunspot Tuesday 9 June at 08:45UT

First light with the Lunt LS60THa/B1200CPT

John Hughes

In previous Summer months I have switched from deep sky astrophotography to solar photography as the lack of any meaningful astronomical darkness makes it tougher to gather good data on night time targets.

Armed with my trusty William Optics Z61 refractor and a DayStar Quark Chromosphere, I can be found on clear days outside in the garden with a black sheet over my head to reduce glare so I can observe the Sun in Hydrogen Alpha on my laptop screen.

With the lockdown in full swing and working from home until the end of September at the earliest, I decided to use the monthly fare I am saving for my commute into London to put towards a new solar scope. I find one of the joys of Solar Imaging is to capture the full disc of the Sun, however, using the Quark this usually entails a nine pane mosaic due to the 4.2x barlow integral to the filter and a bit of luck.

I chose the Lunt LS60THa with an aperture of 60mm, the same aperture as the Z61. Using the Field of View simulator from astronomy.tools I confirmed that my choice of scope/camera produced a nice size full disc with room around the edges should any large prominences appear; well you have to be positive right?!

As well as the full disc I also wanted to be able to capture details of prominences or surface details such as filaments, sun spots and faculae. For this I chose a 2.5x Powermate from Televue as this minimises vignetting and is telecentric producing a 'flatter' image. The Lunt also has a choice of blocking filter and here I chose the B1200 over the B600 as the former is designed specifically for imaging.

So why a Lunt over, say, a Coronado Solar scope? The key difference for me was use. The research I undertook revealed that the Coronado is a great solar scope but the views it produces are more '3-d' in effect. In other words it produces fantastic views of the Sun for visual work, but not having a 'flat' view doesn't make it the best choice for taking pictures.

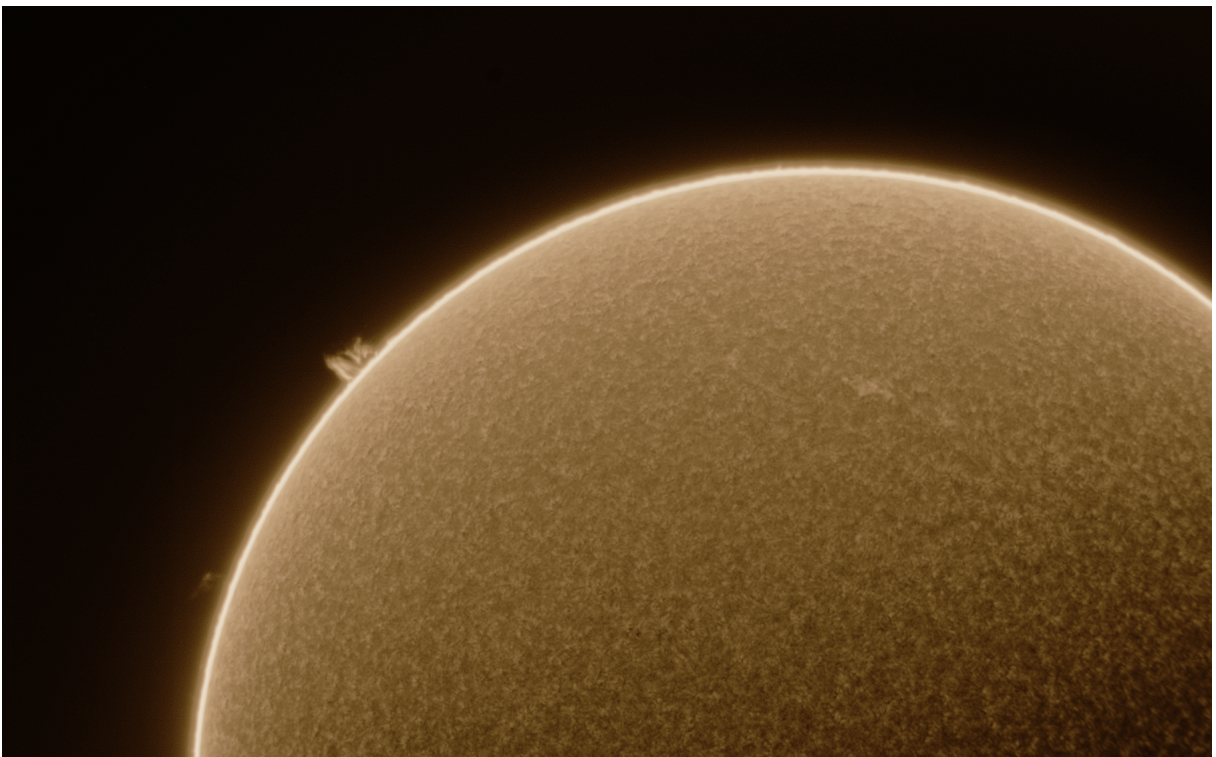
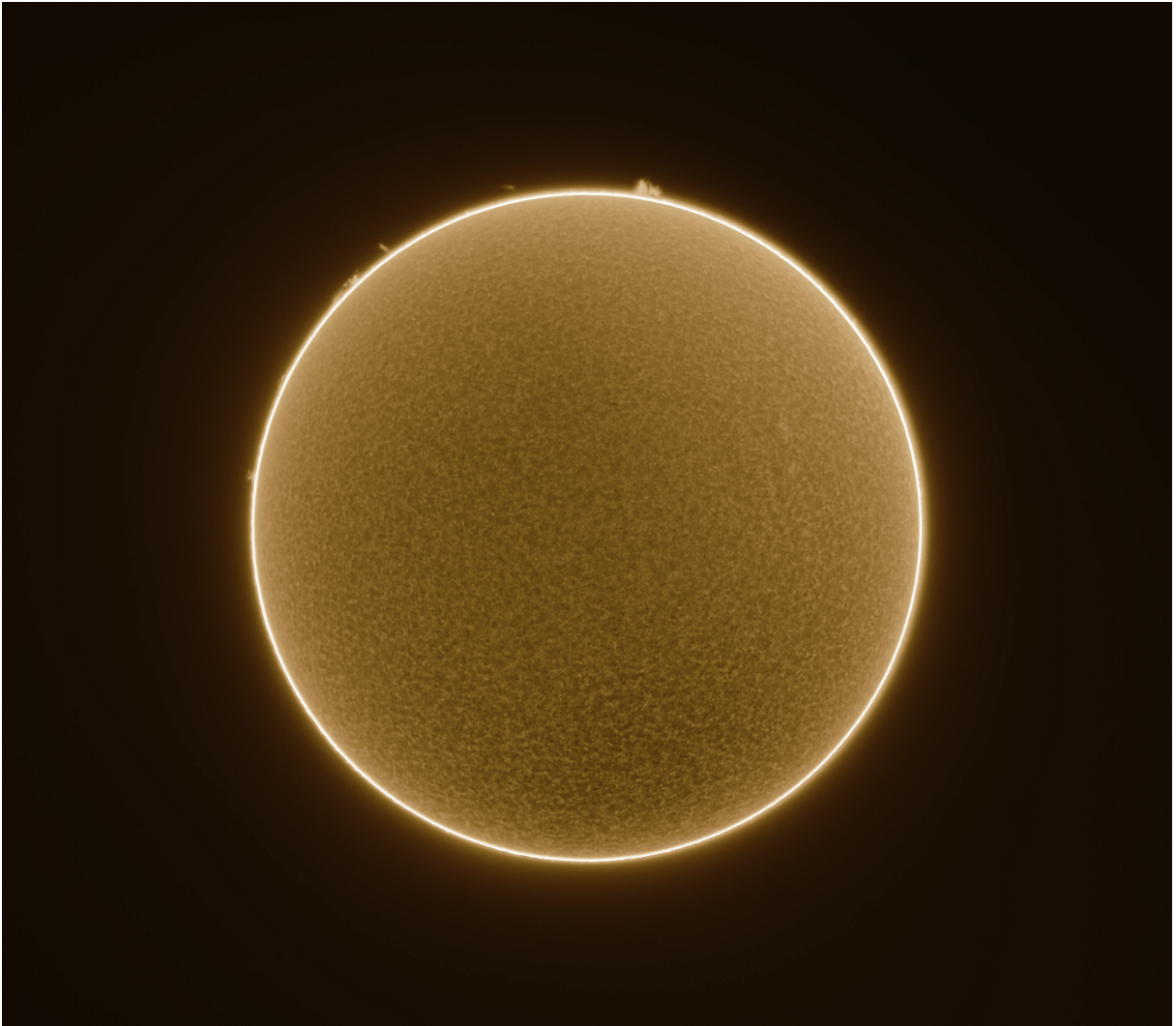
From ordering the Lunt to arrival took over a month as the scope had to come from the US to Germany and then to me here in Manningtree. It is neatly packaged in a protective aluminium case and cut out foam. I also purchased a longer dovetail bar to mount the Lunt on as this would be easier to achieve balance when attaching to an equatorial mount. The Lunt comes with a clam shell ring to which the dovetail is mounted using bolts with Allen key heads. Maybe it was this scope or maybe it is all of them but the dovetail uses imperial Allen key heads and the scope has metric. Both are produced by Lunt, go figure! So a further purchase of Imperial Allen keys was needed.

Set up is a breeze. Once attached to your mount of choice you then add your solar view finder and camera/eyepiece to the diagonal. If you are one for reading instructions then you will be pleased to learn they are clear and produce the required results first time. If you not an instruction type person then you will be pleased to note they are one page long and fit neatly in your bin.

Filtering the Sun's harmful rays is achieved through an Etalon built into the scope. Achievement of the required wavelength of 6562.8Å to view Hydrogen Alpha is undertaken by a Pressure Tuner. Firstly, you undo the large pressure tuner knob which then sets the pressure to your given altitude. You then screw the knob back on and gradually tighten this whilst viewing the Sun in focus through an eyepiece. As you tighten the knob more details on the Chromosphere come into view and you are done, simple as that. There isn't really any need to touch this again unless you are going to do something like take it to the top of a mountain!

The great joy of the Lunt over the Quark Chromosphere for me are twofold. First, there is no need for an added cable and battery to warm up the Quark and second you don't have a huge Quark filter coming out of your diagonal with a camera/eyepiece mounted on top. That always looked too precarious for my liking.

So what does it produce? Well, see for yourself below. Here are two images of the Sun taken on 22 June 2020 using the following additional equipment;



- ZWO ASI174mm camera.
- SkyWatcher SolarQuest mount.
- SharpCap Pro image capturing software.
- 2.5x Powermate (on the North East limb image).

Each image was produced from 200 frames. For the full disc I was able to use 75% of the 200 frames and for the limb shot I used 25%.

Exposure time on the full disc was 2.649ms and 10.185ms for the limb image. They were taken at 16:17 UT (full disc) and 16:34 UT (limb).

The frames were stacked using the free software AutoStakkert2 and initial curve adjustments and sharpening applied in more free software, this time imPGG. Final adjustments; de-hazing, contrast/brightness, embossing and colouring was added using Affinity Photo.

Overall I am delighted with the Lunt, its speed of set up and build quality are excellent and I am looking forward to many years of good Solar service.

Venus

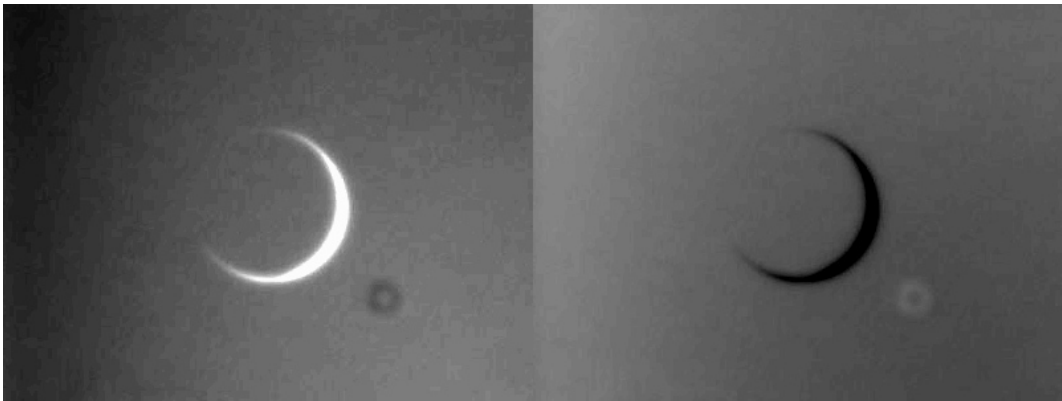
Nigel Evans

It is now 16 years since I went to the Sinai to observe the Transit of Venus, the first for more than a century. 8 years later there was another, for which only the last part was visible from the UK (weather permitting). Today 8 years later and unfortunately there will not be another transit. This June Venus passed only 29 minutes north of the centre of the Sun, creating an opportunity of seeing the extremely slender crescent phases.

When Venus is far from the Sun it is easy to shield my telescope, a Celestron 8 HD, from direct sunlight with the observatory dome. When I am looking at the sun directly, I have a Baader filter across the front of the scope to reduce the intense heat. So how do I observe something that is close to the Sun without damaging the scope? For this I was able to use the roof of the house as an occulting bar - the Sun would be hidden but Venus would not. This afforded a window of opportunity to see Venus, safe in the knowledge that the telescope would not be damaged. This would be late in the day, after 18:00 BST, would get shorter each day, but could be compromised by looking through the heat haze from the house.

I was able to record images of the narrow crescent for 8 out of 9 days just before conjunction, the last day being 1 Jun, some 48 hours before inferior conjunction, with Venus being only 3.3 degrees from the Sun. On 2 June there was an opportunity but the window was too short to both find Venus then record it. Indeed the view was filled with out-of-focus views of back-lit pollen!

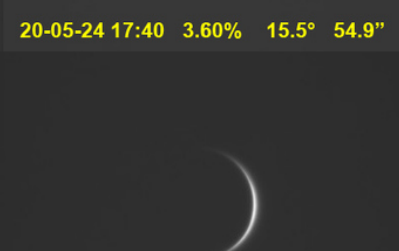
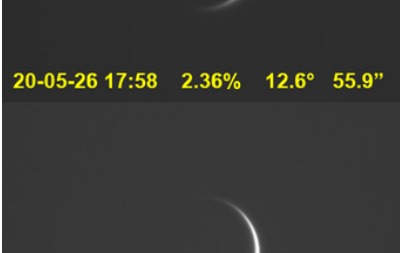
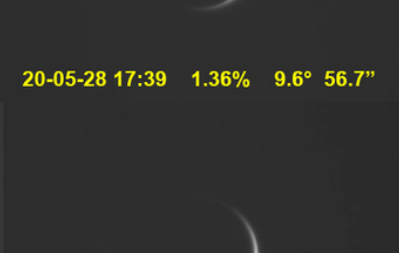
In the latter days the crescent arc did start to grow beyond 180 degrees, but I was only able to see about 240 degrees. The next opportunity to see phases this narrow will be around the inferior conjunction of 1 June 2028



Venus 2020

20-06-01 17:39 UT
Disc Illumination 0.16%
Angular separation 3.3°
Angular Size - 57.71"

DMK21AU04.AS
200mm EdgeHD+Red fliter
©2020 Nigel Evans

 20-05-23 17:56 4.28% 16.9° 54.4"	 20-05-24 17:40 3.60% 15.5° 54.9"	 20-05-25 17:36 2.96% 14.0° 55.5"
 20-05-26 17:58 2.36% 12.6° 55.9"	 20-05-28 17:39 1.36% 9.6° 56.7"	 20-05-29 17:50 0.96% 8.0° 57.0"
 20-05-30 17:41 0.62% 6.5 ° 57.3"	 20-05-31 17:42 0.36% 4.9° 57.5"	 20-06-01 17:39 0.16% 3.3° 57.7"
Date &Time (UT) Disc Illumination Angular separation Angular Size	Venus 2020	DMK21AU04.AS 200mm EdgeHD+Red fliter ©2020 Nigel Evans

All-sky camera picture

James Appleton

A satellite

Tuesday night [16 June] was a good night for satellites! The brightest of the crop was an old friend, US military intelligence satellite NOSS 3-1 which created a spectacular flare in Hercules.



Mr Smith (old “eagle-eyes”) has pointed out that if you look very closely, there is evidence of a double track, although it’s largely swamped by the flare. The NOSS satellites each comprised two or three co-orbiting bodies.

ZWO ASI 178mc with ASI fisheye lens

Gain 200

Stack of two 30s exposures terminating at 233020 and 233051 UT

The Megaconstellation Threat

Source: Federation of Astronomical Societies — Newsletter No 118 — June 2020 pp 3–24

Abstract

The plummeting cost of launching small satellites has led to several companies having ambitions to place tens of thousands of satellites into low Earth orbit with, potentially, as many as 100,000 in orbit over the next couple of decades. This article discusses three serious threats posed by the projected growth in these satellites:

- (i) The Optical and Radio pollution of the sky with the potential to end almost all professional ground-based astronomy over the next two decades, seriously hamper amateur astronomers’ contributions to astronomy and their enjoyment of the night sky and contamination of the pristine natural sky that is the birth right of all the people of the world and which has inspired young and old for generations.

- (ii) The vastly increased number of objects in Earth orbit will lead to a rapid growth in space debris that could endanger the lives of astronauts, damage existing satellites and, in worst case, potentially deny humanity access to space for any purpose for decades.
- (iii) The lower cost of getting to space makes it, the Moon and asteroids prime targets for the next era of commercial exploitation and the rush to occupy large volumes of near-Earth space by powerful companies, backed by powerful military nations, will raise international tensions.

The FAS Newsletter has been emailed to members.

Welcome to IMAP

Short article from the Library.

The Interstellar Mapping and Acceleration Probe or IMAP for short is a NASA selected mission that will study the solar wind boundary of the outer solar system. It can be considered as a heliophysics assignment investigating two main aspects of the heliosphere, which are connected to energetic particle acceleration and the relationship of solar winds with interstellar medium. Four sub-divisions can also be considered within objective criteria:

- a. Properties of the Local Interstellar Medium.
- b. Interaction boundary between the solar wind and LISM.
- c. Influence of the Sun's magnetic field and the LISM.
- d. Comprehension of particle acceleration in both heliosphere and heliosheath.

In 2018 NASA proposed a team of scientists led by Professor David J. McComas of Princeton University to carry out the mission. They have planned that the assignment will launch in October 2024, with the IMAP payload being continually orientated toward the Sun, and spin stabilization (approximately 4 rpm) allowing for altitude control around the Sun-Earth L1 (Lagrangian point), at a distance of 1.5×10^6 kilometres away from Earth. The craft will carry up to ten instruments and will broadcast in real time back to Earth with its data being used for the forecast of space weather. It is designed to be NASA's fifth investigative mission under the STP (Solar Terrestrial Probes programme) umbrella, and is cost-capped at \$492 million, which excludes the launch vehicle.



Picture Credit:NASA

Here is a little information about some of the ten instruments:

IMAP-Lo, is a single-pixel neutral atom imager which is fixed on a swivel platform. IMAP-Lo will be utilised to follow the trail of interstellar flow so that flow speed, direction and temperature of LISM can be analysed objectively. It will measure information obtained from the atoms H, He, O, Ne and D.

As part of the same instrumentation, **IMAP-Hi**, contains two identical single-pixel high energy ENA imagers (Energetic Neutral Atom). These measure atomic structure of H and He as well as heavier ENA's from the outer heliosphere. Charged particle streams can be re focused by the Earth's magnetic field. Occasionally they collide with neutral particles from which they pilfer electrons, making them neutral. These are ENA's, and images are produced from their detection.

$$I_1^+ + A_2 > A_1 + I_2^+$$

where I_1^+ = Plasma ion: A_1 = ENA : A_2 = background neutral atom.

The third of this group is known as **IMAP-Ultra**, which reproduces an image of ENA emissions. These ENA's are obtained mainly from H atoms between ~3 and 300keV, in the heliosheath.

The **Solar Wind Electron (SWE)** measures thermal and suprathermal electrons at 1eV to 5keV from the solar wind using 3D computational analysis. This is essential in order for comprehension of local structures affecting speed to be put into practice.

The **High-energy Ion Telescope (HIT)** is an energetic particle spectrometer, of H to Fe ions over ~2 to ~40 MeV/nuc. It has a dynamic range of 10^5 per second, and delivers full-sky coverage.

Finally in the main group of the ten instruments we have the **Interstellar Dust Experiment (IDEX)**. This is a high resolution dust spectrometer. It will analyse interstellar dust particles providing information about speed, mass distribution and elemental composition.

The remaining instruments are :

1. Global solar wind structure (GLOWS). Measures the heliospheric backscatter glow of H.
2. Magnetometer. Measures 3D interplanetary magnetic field.
3. Solar wind and pick-up ion. (SWAPI). Measures solar wind H⁺ and H⁺⁺ and interstellar He and H pick up ions.
4. Compact Dual Ion Composition Experiment (CoDICE). Charged particles are measured in two separate energy zones.

IMAP will have two 4 hour long communications connections per week through the NASA Deep Space Network. (DSN). The time allowed is enough to provide for uploading of commands and downloading of all science data. DSN is a network located in Australia, Spain and the USA (California) that underpins all NASA's interplanetary spacecraft missions.

There are plans also to provide facility for four or five secondary payloads to ride along with IMAP. Deployment of these will occur after IMAP has nestled down to its transfer orbit at Earth-Sun L1. Other divisions in the Science mission Directorate will use these extra resources.

References:

1. https://en.wikipedia.org/wiki/Interstellar_Mapping_and_Acceleration_Probe#Spacecraft
2. <https://directory.eoportal.org/web/eoportal/satellite-missions/content/-/article/imaphttps://imap.princeton.edu/instruments/idx>