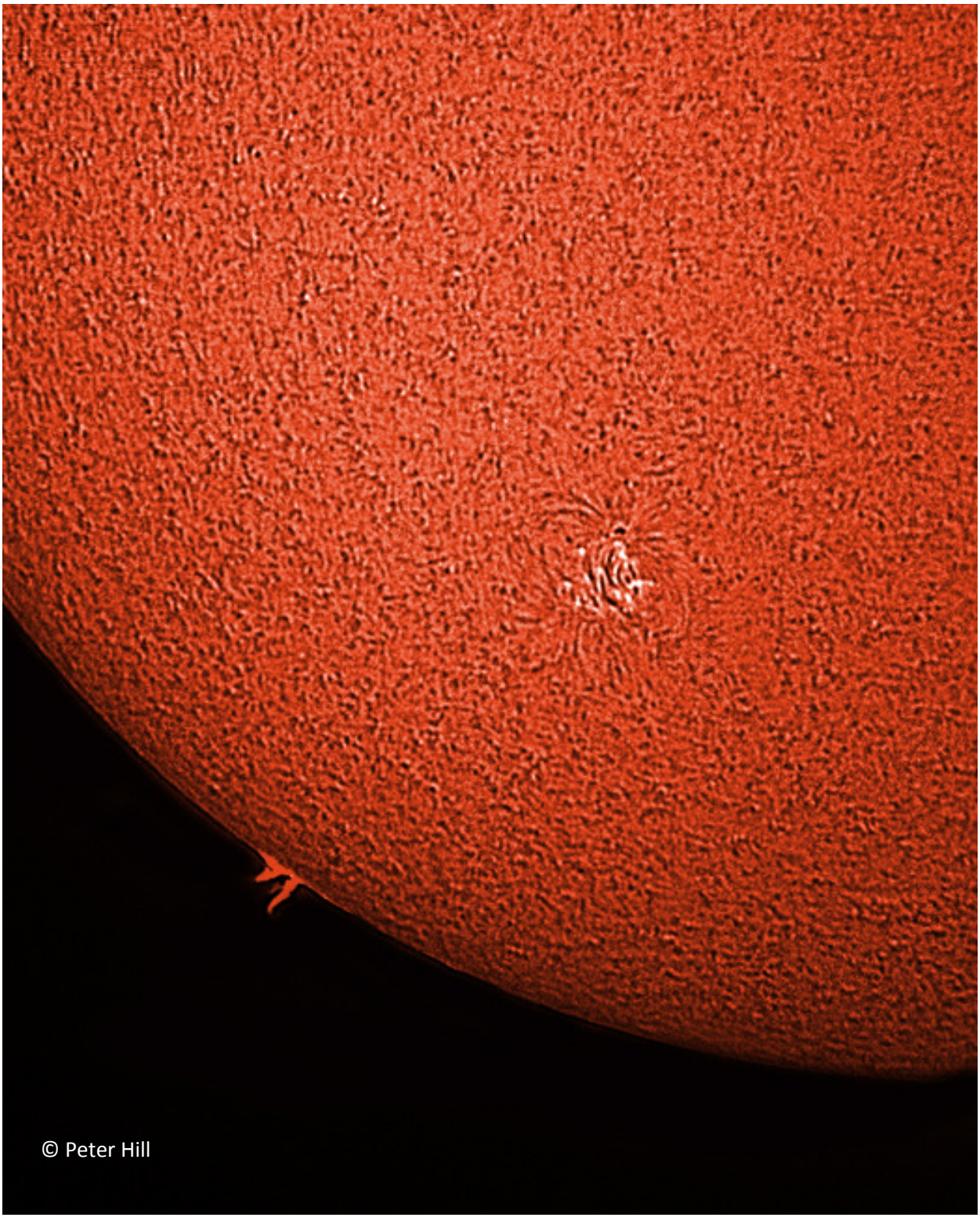
Summer 2021

Aries

derbyastronomy.org

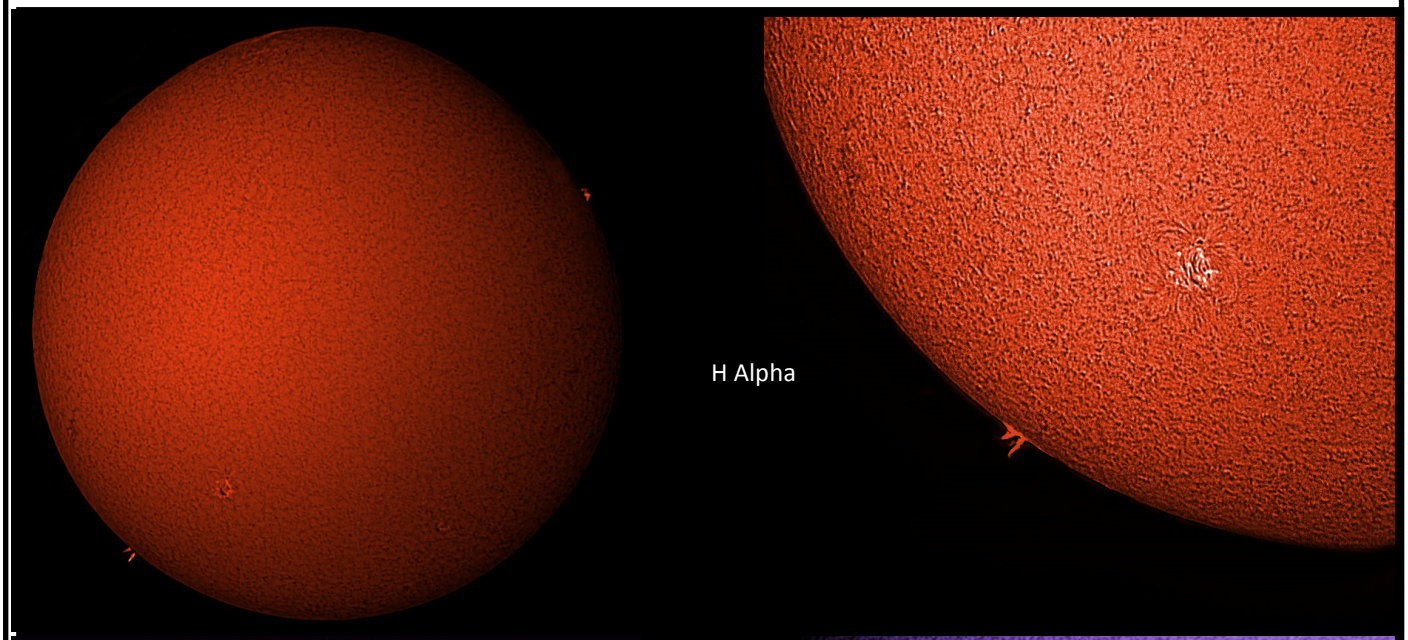
Derby & District Astronomical Society



© Peter Hill

Member Gallery— Peter Hill

Visit the D.D.A.S website for more information on how Peter obtained these wonderful images.



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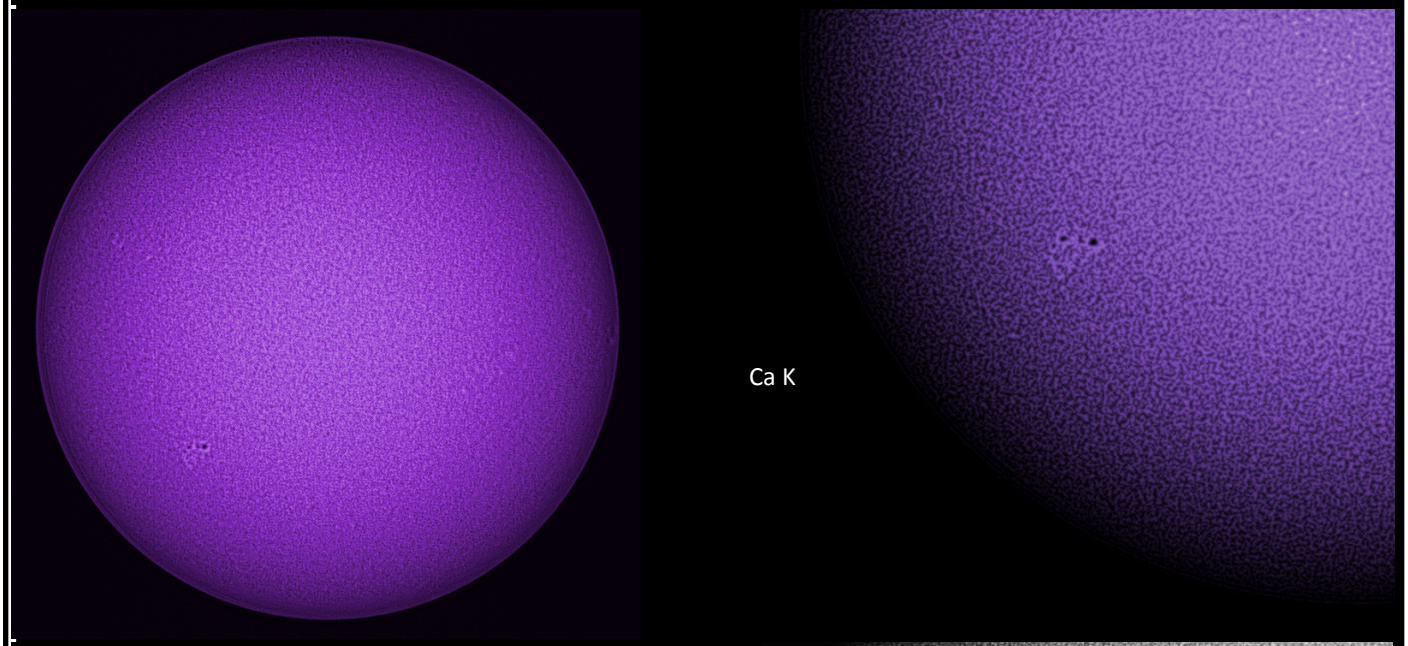

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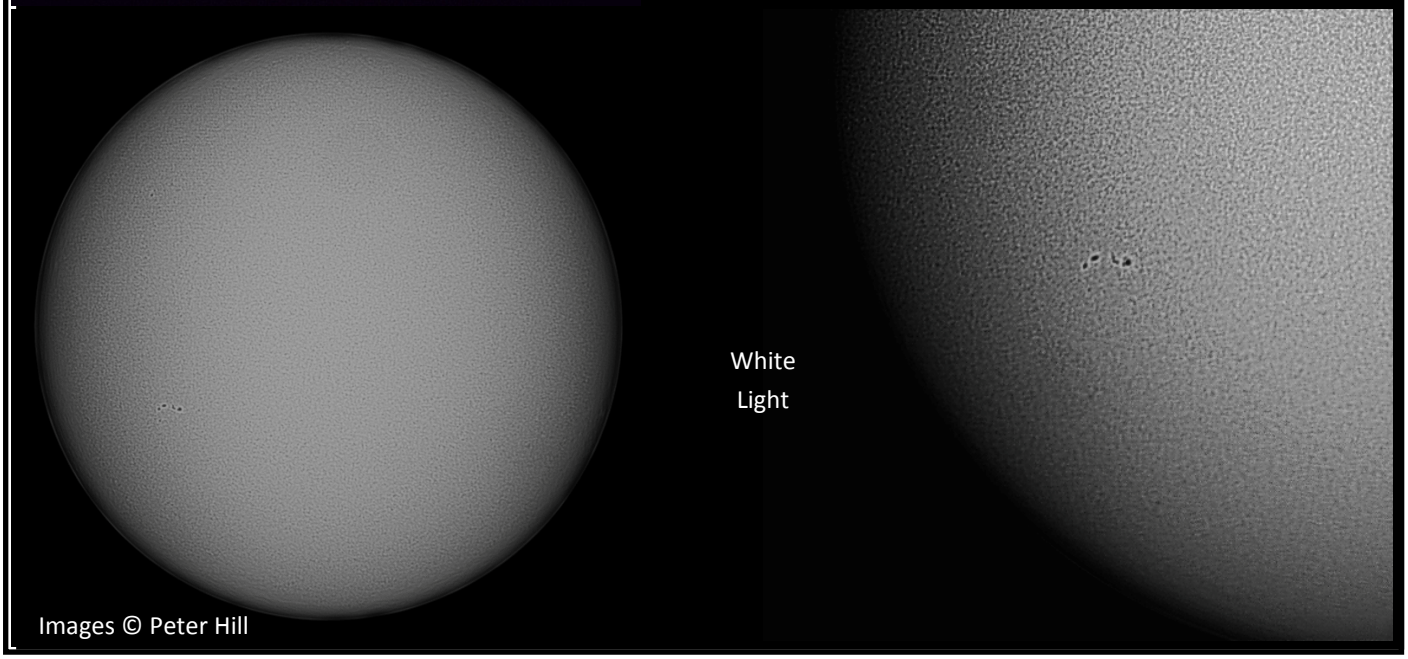


White Light

What's inside this issue...

Member Gallery

Each issue we would like to feature some of the fantastic photos taken by members of the society.

We would like to see yours.

So please send me your Astro Snaps.

Book Reviewers WANTED

Did you win a book in the Raffle? Or have you borrowed one from the Society Library.

Why not tell us what you thought about it in our Book Review . Guide others through the maze

Articles WANTED

Share your astronomical exploits with the Society.

You don't have to be the next Brian Cox or Stephen Hawking. We would love to hear your story.

Aries Next Issue

Articles for the **Autumn** edition of Aries, need to reach us by **5th September**

Email to the editing team at

arieseditor@derbyastronomy.org

Or

gillpryor@derbyastronomy.org

Editor Anthony Southwell: arieseditor@derbyastronomy.org Assistant Editor Gill Pryor email: gillpryor@derbyastronomy.org

COVID 19 Statement

The Derby and District Astronomical Society will endeavour to maintain a full programme of meetings during the COVID-19 pandemic.

All our scheduled meetings (see back cover) until Christmas 2020 (apart from observing sessions) will now take place via the Zoom video-conferencing medium.

Our scheduled observing sessions will involve appropriate safety measures and a requirement to provide contact details in line with government Track & Trace policy, the wearing of face masks, use of hand sanitiser, social distancing, limiting the number of people inside the observatory itself, and the cleaning of equipment before the next person uses it.

Visits to the society's observatory for members and small groups can be also be arranged by contacting the chair or secretary of the society, and will involve the same safety measures as our scheduled observing sessions.

If you would like further information about the society, on how you can join in our meetings via Zoom, or to attend observing sessions, then please contact the chair or secretary of our society. (see below)

Chairman

Peter Branson

Vice Chair & Webmaster

Mike Lancaster

Secretary

Brian Dodson

Treasurer

Simon Benkhe

Observatory Curator

Mike Dumelow

Aries Editor & PR Offcier

Anthony Southwell

Outreach Officer

Donald Anderson

Ordinary Committee Members

Harvey Saneria

Gary Lambert

Richard & Gill Pryor

You can also find us on...

Derby and District Astronomical Society and @AstroDerby

Editorial

Welcome to this edition of Aries.

As I write this Editorial we are currently heading out of the month of June. We have just had the Summer Solstice (Longest Day) on the 21st June, which heralds the start of the summer season, and, of course, lighter nights. Even though the sky does not get 'properly' dark, there are plenty of objects to observe in the summer night sky, as we shall discover later on in this Editorial.

It has been another busy period on Mars with the Perseverance Rover deploying the 'Ingenuity' helicopter in April. On 19th April, Ingenuity made its first flight, the first powered, controlled flight conducted on another planet and Ingenuity worked beautifully. It made three engineering flights to varying heights and distances and it always returned to its 'airfield' after each flight (the area where Perseverance originally deployed it – Editor). On one flight Ingenuity reached the dizzying height of 33 feet (10 metres). This plucky little helicopter has met and exceeded all the expectations of its builders.

As of writing this Editorial, Ingenuity has made seven flights and now, due to its brilliant performance, the Jet Propulsion Laboratory (JPL) has decided to let Ingenuity 'loose' and allow it to become an 'operational' facet of the Perseverance's mission. Ingenuity will now act as 'scout' for Perseverance looking for places of interest for the Rover to visit. I really do believe that we are witnessing the future of the robotic exploration of the Red Planet. A vehicle like Ingenuity can be sent to locations where you wouldn't dare send a Rover. Ingenuity will be the progenitor of a whole new class of robotic Martian explorers.

Whilst all these aerial shenanigans were going on, the Chinese National Space Agency (CNSA) successfully landed their Tiawen-1 Lander, with its rover, on the Martian surface on 14th May at Utopia Planitia (the Viking 2 Lander's old stomping ground – Editor). The rover, named Zhurong, was deployed by the Lander via a ramp on 22nd May. Zhurong's mission objectives are:

- study the topography and geology of its landing site
- examine the soil and any ice content
- survey the chemical elements of the soil and rocks, including their mineralogical make-up
- atmospheric sampling

Zhurong's operational lifetime is expected to be 90 days, but it could be longer if conditions are favourable. Zhurong, like Spirit and Opportunity, is a solar powered rover. Spirit and Opportunity, initially planned to operate for 90 days, Opportunity was operational for 8 Martian years, 14 Earth years and Spirit for 5 Martian years, 8 Earth years). Spirit got stuck in a sand dune and a dust storm did Opportunity in. The dust storm lasted from June to October 2018, obscuring the Sun, therefore reducing the amount of electrical power generated by its solar panels. The final communication with Opportunity came on 10th June 2018. Despite numerous attempts to re-establish contact with Opportunity, the Jet Propulsion Laboratory (JPL) declared that Opportunity's mission was completed in January 2019.

So, who knows? Maybe Zhurong will surprise us and do an 'Opportunity' and experience an extended mission. The Geologist and Planetary Science enthusiast in me is quite giddy with excitement with all the activity on the surface of Mars. We have three operational rovers on Mars, NASA's Curiosity and Perseverance Rovers and the Chinese National Space Agency's Zhurong rover.

10th June saw a rather special event take place, a solar eclipse, no, not a Total Eclipse this time around, but an Annular Eclipse, that is when the Moon is at such a distance from the Earth that it's disk does not completely cover the Sun and you get a 'ring of light' or annulus around the Moon. The Annular Eclipse was seen from parts of North -Eastern Canada, Greenland, the Arctic Ocean and the Russian Far East. Europe, the Northern Hemisphere and Northern Asia, witnessed a partial eclipse.

I could not get the day off work for the eclipse so I decided to take my trusty homemade Mylar (Baader Planetarium) Solar Filter and my six-inch Newtonian Reflector to work and set up in the Car Park around 10:30 am so as to catch the mid-eclipse. At mid-eclipse from our latitude, the Moon would only take up 30% of the Sun's disk. I told all my work colleagues and they seemed very interested in viewing the Eclipse, as did a few of the employees of the businesses around my Company on our industrial estate. The weather before hand was glorious, warm, sunny and cloudless and then on the morning of the eclipse, cloudy, almost 90% coverage. I still set my

telescope up and we managed to get a couple of fleeting views of the eclipse through the clouds, but that was it. I was hoping to take some images of the eclipse as I had brought my DLSR with me, but alas, it was not to be. It always seems to be the same old story. The weather is brilliant prior to the event, but on the day, not a sausage. Wall to wall cloud. Whether that is an eclipse, meteor shower, or any short-lived event, the weather will thwart you. It is the Astronomer's curse!

Oh well, never mind, at least my telescope turned a few heads, a lot of my work colleagues had never seen one, I spent more time discussing with them how it worked than discussing the eclipse we had barely witnessed. That proved to me that there is an appetite in the general population to know more about Astronomy, people want to look up, to wonder at the Universe and that is where we come in. I will do all I can to bring the Universe to as many people as I can, of all ages.

Now for a piece of breaking news, rather worrying news at that. News has emerged in the past week that the most successful scientific instrument ever built, the Hubble Space Telescope (HST), is currently in 'safe mode', with all astronomical observing halted until further notice. On 13th June, Hubble went into 'safe mode' when a computer, which was installed during the final servicing mission to Hubble in May 2008, developed a glitch, probably caused by a degrading memory module. Controllers and engineers on the ground are trying to resolve the issue by switching to one of the Hubble's backup modules. As of writing this Editorial, (22nd June) the situation has not improved and Hubble remains in safe mode. This is a worrying piece of news, for Hubble is THE instrument that has given us the most beautiful and clearest images of the Cosmos and has greatly advanced our knowledge of the Universe.

It will be heart-breaking to witness its demise, but, on the other hand, what a legacy it will leave behind, 30 plus years of astronomical discovery and stunning imagery. It was hoped (and still is – Editor) that Hubble would overlap with the initial operational life of its successor, the James Webb Space Telescope (JWST), which is scheduled for launch in October of this year, but may slip to mid-November this year. So all we can do is sit and wait and hope that Hubble responded to the care of it controllers and engineers and returns to operational capability. You can be assured that this journal will cover this evolving situation (let's hope that we have good news to report to you in the next edition of Aries – Editor).

So what do we have in this issue of Aries?

The front cover is courtesy of Peter Hill; it is of the Sun taken in the Hydrogen Alpha wavelength and shows an emerging Sunspot. Peter's solar imaging skills are also on display within the Member's Gallery feature, the images showcased here were taken in Hydrogen Alpha, Calcium and White light filters.

We have the next instalment of the 'Meet the Committee' feature, this time it is the turn of the Society Vice-Chair, Dr. Mike Lancaster and Ordinary Committee Member, Harvey Saneria.

Our Chairman, Peter Branson, has set up a challenge for the summer; the challenge involves in finding and recording your observations of Messier objects, numbers 10 to 20. A competition has been set up as part of this challenge, you image M13, in Hercules, and send your image to gillpryor@derbyastronomy.org who will pass it onto the Society Committee for judging. The winner will have their image of M13 on the front cover of the Autumn edition of Aries.

Our esteemed Editor has been out and about recently and has been investigating the appearance of 30, brightly decorated Ram statues that are located around Derby City centre. One of these Rams has a distinct astronomical theme and celebrates a notable son of Derbyshire. Can you guess who it is? No? Well, let our Editor give you all the details.

Malcolm Neal has provided a fascinating book review concerning a particular element of the Apollo Landing Program, without which, there would not have been 'one small step'. Malcolm's book review is for "The Apollo Guidance Computer: Architecture and Operation" by Frank O'Brien.

You will also find the usual Aries features and notices as well.

So, sit back, relax and enjoy the warm (and hopefully dry – Editor) weather and explore the pages of Aries.

Anthony Southwell

Editor in Chief

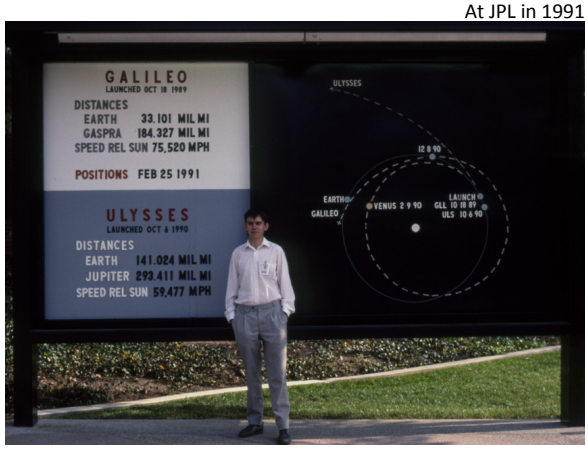
Meet Your Committee - Vice Chair / Web Master - Mike Lancaster

I was born in 1965 as the Space Age was really beginning to take off. I'm told that my grandfather showed me the moon from my pram, so maybe that instilled an interest in astronomy and space in me! When I was growing up I do remember watching the likes of Patrick Moore and James Burke covering some of the later Apollo missions on TV. But my passion for astronomy didn't actually begin until around 1980, when I happened to re-read a book I'd had since childhood called the 'The How and Why Wonder Book of Stars.' I cut out a paper planisphere at the back of this book and mounted it in cardboard. I began to learn the constellations and recognise the planets and voraciously read a growing number of books on astronomy to feed my interest. Memorable among these was a little Hamlyn guide called Constellations, given to me as a Christmas present in 1980. This contained maps of each constellation with lists of notable objects in them. I recently learned that our own Mike Dumelow was inspired by the very same book (see the Winter 2020 edition of Aries). My Dad bought me a pair of 'Boots Admiral III' 10x50 binoculars and I fondly remember my first view of Jupiter using these, the planet showing a tiny disc with the four Galilean moons glittering in a line. The Pleiades were also a delight, as was the fuzzy patch of the Orion Nebula. The following year my Dad bought me a six-inch 'Fullerscopes' Newtonian reflector on an equatorial mount. So, from what were then the relatively dark skies of Mickleover, with the Milky Way clearly visible on summer nights from our long back garden, my exploration of the cosmos continued in earnest. As well as the amazing views of the Moon, and the rings of Saturn, a passion for deep sky objects ensued. Favourites were the Double Cluster in Perseus, the Ring Nebula in Lyra, and of course the more detailed view of the Orion Nebula the telescope could provide.

I joined the DDAS in 1982, while studying for my A-levels. I had by now decided I wanted to become a 'professional astronomer' and in 1985 went to Leicester University to study Physics with Astrophysics. But neither university life nor the course suited me. So I left after the first year to pursue another interest of mine – geology, and by 1989 I had gained a degree in Earth and Life Studies from Derbyshire College of Higher Education. During these years I also helped in the construction the Society's Flamsteed Observatory. In 1989 I went to University College London where I gained an MSc in Remote Sensing in 1990. This brought my interests in earth science and space technology together. More importantly this put me in the right place at the right time to hear about an opportunity in Professor John Guest's Planetary Surfaces Group at The University of London Observatory (ULO) in Mill Hill. So, in 1990 I began research for a PhD working on data from NASA's Magellan Mission to Venus, studying volcanoes and lava flows on that planet. This was an incredible opportunity, and a time I will always cherish. In 1991 I went to the NASA Jet Propulsion Laboratory (JPL) for a few weeks. This was holy ground! I shall never forget standing one evening in the grounds of JPL, the twilight sky framed by palm trees, the planet Venus shining brilliantly in the west, with several other planets in the sky as well. Back inside the lab we had been pouring over the latest images from Magellan, seeing features and landscapes on Venus no one had ever seen before. In 1994 I gained my PhD in Astronomy from UCL, where I then spent a further two years as a post-doctoral research, but this time studying craters on Mars in the old Viking Orbiter images. I was also able to attend the Lunar and Planetary Science Conference in Houston a number of times. By the late 90s I was struggling to find further funding or work in this field and decided to change direction again. In 1997 I joined the space division of the software company Logica and spent two years working on data analysis software for the Ulysses solar probe at the European Space Agency's ESTEC facility in Holland. When that contract ran out, I moved back to the UK and pursued a more terrestrial career in IT.

In 2001 I moved back to the Derby area and renewed my involvement with the DDAS, soon joining the committee and ultimately serving as chairman for a while, as well as creating a new website for the society, which I maintain to this day. I have also had the pleasure of giving many talks to the DDAS and other groups over the years. For example, I was delighted to be able to give a lecture on John Flamsteed at the Old Royal Greenwich Observatory in 2015. In 2013 I completed building my own back garden observatory, using a Sky Shed POD. This is furnished with a 10-inch Meade Schmidt-Cassegrain on an EQ8 mount, with an 80mm APO piggy-backed on top. I had a brief dalliance with imaging, deciding to go 'left-field' and using a couple of ultra-sensitive Mallincam video cameras. I think my true enjoyment has always been visual observing though, especially of deep sky objects! To be honest I haven't used my observatory as much as I would have liked the past few years due to various commitments, but the lure of the night sky still beckons!

At JPL in 1991



In Houston in 1992

Demonstrating the Meade LX90 in 2006

Meet Your Committee - Ordinary Member - Harvey Saneria

'The only true wisdom is in knowing, you know nothing' (Socrates)

Hi, I have been a member of the Astronomical Society for about 4 years now, and an Ordinary Committee Member for the last two. I help out as much as I can to support our more advanced members during our exhibitions and shows.

I came to Derby from India in May 1964 and attended local schools, Pear Tree Juniors and Homelands Secondary School. The secondary school no longer exists (but not because of me).

I have lived in Derby almost all my life except for two years when I worked in Bedford. During this time I became fond of our local football team, Derby County. They were quite force to be reckoned with in those days but have unfortunately lost their way over the last few years. These days I do my best to support them as much as I can but it doesn't seem to be doing them any good.

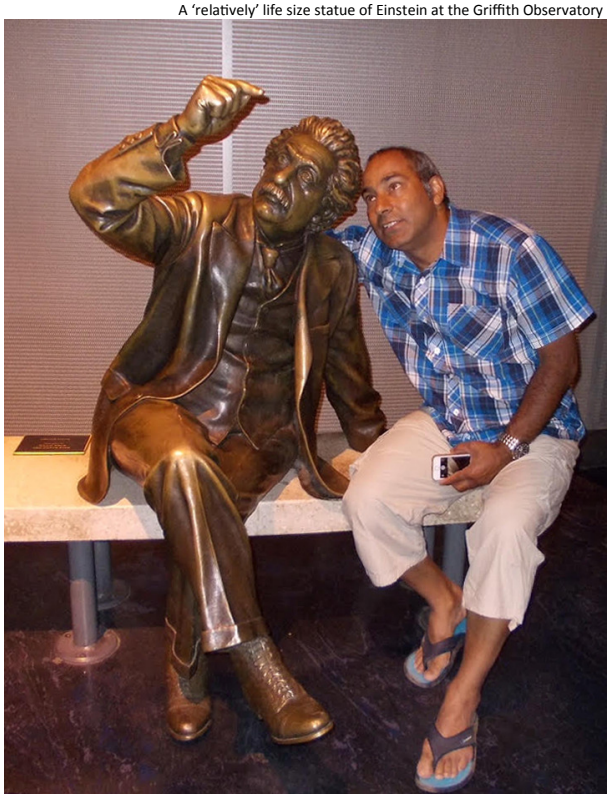
At the Griffith Observatory in Los Angeles

Before I left school, I was successful in obtaining an apprenticeship with Rolls-Royce, Aero-Engine Division, gaining my Craft Apprenticeship as a skilled Turner/Grinder. I left Rolls-Royce (RR) in 1982 to pursue other adventures but came back in 1989 and have worked there for the last thirty-two years. During my second stint at RR I gained a BSC in Applied Technology at Derby University through part-time studying. I am now an 04 Compressor Module Fitter building the RR Trent family of engines.

My interest in astronomy was sparked at a young age by two 1960's giants - the Apollo Missions, and one of my favourite television series Star Trek. I always tried to emulate Mr Spock - he fascinated me - especially those ears.

My knowledge of astronomy was very limited so when I found out about DDAS I decided to give it a go. I came with a friend but unfortunately he preferred the pub while I enjoyed finding out about the Sun, Moon and Stars from fellow members and guest speakers. Everyone is friendly and helpful and keen to share their knowledge and experiences with new members.

A 'relatively' life size statue of Einstein at the Griffith Observatory



It was during an Annual General Meeting that I was persuaded to become an Ordinary Committee Member (I was told you don't have to do much). I am a firm believer that the society is only as good as its members and the more you put in the more you get out - sometimes you have to get involved to achieve success.

My main viewing equipment at the moment, is two pairs of good quality binoculars of different magnitudes. I do hope to buy a telescope before too long and it's great having such expert help and advice available from fellow members. The last 12 - 15 months have been very tough on everybody and it will be really nice to come out of this pandemic and have our meetings in person and not over Zoom. I'm also looking forward to going to the Severn Stars for a nice cool pint with my friends from the society.

I would like to take this opportunity to thank all the other members of the Astronomical Society for making me so welcome and for organising such interesting and informative events and functions. THANK YOU.

Best regards Harvey

Chairman's Challenge

The challenge I have set for you keen astronomers for this summer is to find and record your observations of the Messier objects numbered 10-20, (either tick it off or take a photograph). There's a variety of objects to see and all of these objects are visible in the summer sky (late at night!). Some are quite low down so you may not be able to see them due to your location.

Messier 10, 11, 12, 13, 14, 15 and **19** are all tightly bound globular clusters

Messier 16 is the Eagle Nebula containing the famous 'Pillars of Creation

Messier 17 is the nearby Swan Nebula

Messier 18 is an open cluster of stars

Messier 20 is the well known Triffid Nebula

M16—29x120s—© Peter Branson

Messier 13 - also known as the Great Globular Cluster in Hercules - is a favourite photographic object for many astronomers. So, the extra bit of the challenge will be to enter the 'best picture of M13' competition. The winner will get a round of applause from the society!

M13—6x55—© Peter Branson

Peter Branson (DDAS Chair)

A/Editor's Note:

Let's make this a competition!

The winner will feature on the front cover of the Autumn 21 issue of Aries.

Send your images to the Assistant Editor at gillpryor@derbyastronomy.org

Peter and the committee, not including myself of course, will vote on them blind (yes they will see the image, just not who submitted it).

Closing Date - 31st August

The Flamstead Ram

(Text & Images © Anthony Southwell)

I had to pop into Town (05/06/2021) to get a few things and I thought that, whilst I was in the City Centre, I would have a look at a few of the 'Derby Rams' that have sprung up around the place. I believe there are about 30 of them scattered across the City Centre, but I did not have the time to go hunting for all of them, oh no! I wanted to see and take a picture of a particular Ram.

People have been posting images of the Derby Rams on Facebook, but one of them caught my eye. It looked a bit 'astronomical' it was located next to the QUAD and opposite the Derby City Council building.

So off I went into the City Centre in search of this 'Astro Ram' and I was not to be disappointed.
The Ram next to the QUAD commemorates none other than John Flamsteed, born in Denby in 1646 and lived for time in Queen Street in Derby and in 1675 he was appointed the first Astronomer Royal by King Charles II. And took up residence at the Royal Observatory in Greenwich, London in the Summer of 1676. Flamsteed's 'job description' was set out in this paragraph of the charter that set the position of the Astronomer Royal up:

"the rectifying of the tables of the motions of the heavens, and the places of the fixed stars, so as to find out the so much desired longitude of places for the perfecting of the art of navigation."

For this Flamsteed produced an atlas, after much painstaking work, the "Historia Coelestis Britannica," which was published posthumously in 1719 by his wife Margaret and the "Atlas Coelestis," again published by his wife, in 1729.

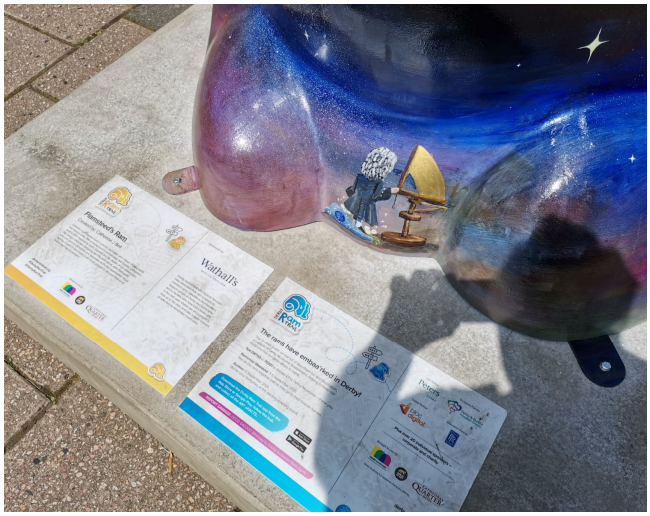
The Ram portrays the night sky and on the Ram's chest you can see a figure in 17th Century period dress looking up to the Sky with a Quadrant to the person's left and a star atlas behind the figure lying on the ground. The figure is Flamsteed of course. The plaque on the base that Ram is on talks about the creator of this particular Ram and introduces John Flamsteed, but apart from that, not much else really.

I was pleased to see that Flamsteed is getting some recognition in his home town, but it was not much. I know that there is not much room on the bases to put descriptions on. But to anyone who doesn't know who Flamsteed was or what he did, or even, Derby's scientific past, this may not mean very much.

I know that anyone could find out more if they wanted, they could go to Derby Museum and find out more, but I do feel that this was a missed opportunity. We seem in Derby not to want, or even care, to celebrate and embrace our past and our achievements. Other towns and cities do a far better job. I really do think that and I will, of course, single out the Flamsteed Ram, that the Council should have asked groups, such as our astronomical society to contribute to this project or even be available to answer any questions that the creator of the Ram may have had during its making.

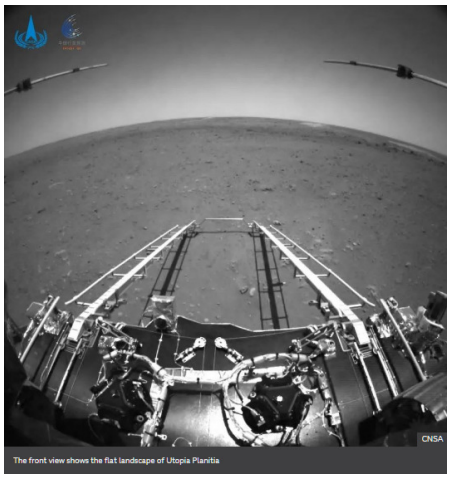
No, Dear Reader, I am not complaining, I am just making an observation, Personally, I think the Derby Rams are a good idea. Its is great to see these colourful, interesting objects scattered around the City Centre, it brightens the place up, and by God do we need cheering up!

They did look really striking on a hot, sunny Saturday morning!



BBC News – 19/05/2021 and 22/05/2021

China on Mars: Zhurong Rover Returns First Pictures – 19/05/2021



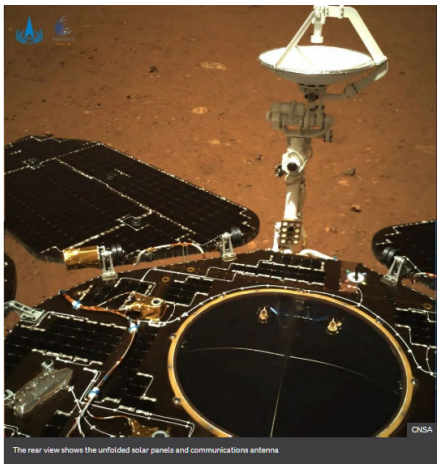
China has released the first pictures taken by its Zhurong rover on Mars.

The forward view shows the landscape ahead of the robot as it sits on its landing platform; the rear-looking image reveals Zhurong's solar panels.

The rover touched down on the Red Planet early on Sunday, Beijing time.

In doing so, it made China only the second nation - after America - to successfully put a probe on the surface of Mars and operate it for a significant length of time.

Chinese scientists hope get at least 90 Martian days of service out of the six-wheeled robot at its location on Utopia Planitia, a vast terrain in the planet's northern hemisphere.



China's National Space Administration (CNSA) posted the pictures on its website. There are even a couple of short videos that record the moment the rover's aeroshell - the capsule it used to enter the Martian atmosphere - departs the Tianwen-1 orbiter, the satellite that carried the rover from Earth.

The surface imagery tells us that critical hardware deployments after landing were completed cleanly.

These deployments included the unfurling of the solar arrays to provide power to the robot; the release of the antenna to communicate with Tianwen-1, and onwards with controllers back in China; and the extension of the ramp down which Zhurong will soon roll to begin its mobile mission.

Zhurong looks a lot like the US space agency's (Nasa) Spirit and Opportunity vehicles from the 2000s.

It weighs some 240kg. A tall mast carries cameras to take pictures and aid navigation; five additional instruments will investigate the mineralogy of local rocks and the general nature of the environment, including the weather.

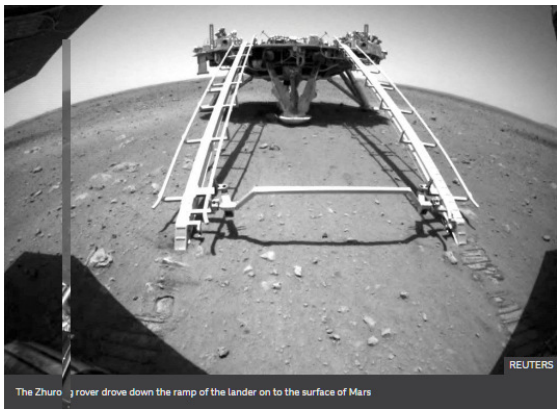
Like the current American rovers (Curiosity and Perseverance), Zhurong has a laser tool to zap rocks to assess their chemistry. It also has a radar to look for sub-surface water-ice - a capability it shares with Perseverance.

Utopia Planitia is where Nasa landed its Viking-2 mission in 1976. It's a colossal basin - more than 3,000km across - that was formed by an impact early in Mars' history. There is some evidence pointing to it having held an ocean long ago. Remote sensing by satellites indicates there are significant stores of ice at depth.

America put down the much larger (one tonne) Perseverance robot in February.

Europe, which has twice failed with landing attempts, will send a rover called Rosalind Franklin to Mars next year (in a joint project with the Russians).

China's Zhurong rover takes first drive on Mars – 22/05/2021



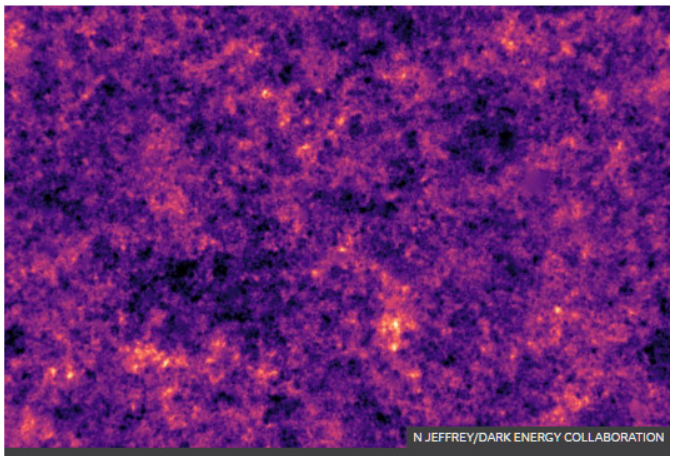
China's remote-controlled rover, which landed on Mars a week ago, has driven down from its landing platform to the surface of the planet. This makes China the second country after the US to operate a rover there. The Zhurong robot is due to study the planet's surface rocks and atmosphere. It will also look for signs of life, including any subsurface water or ice. China's Tianwen-1 mission, consisting of an orbiter, lander and rover, was launched in July last year.

The deputy chief commander of the mission, Zhang Yuhua, said the rover was designed to operate for 92 Earth days (or 90 Mars days, known as "sols", which are slightly longer than Earth days) and would share its data via the orbiter.

The solar-powered, 240kg (530lb) six-wheeled robot - named after a Chinese mythical fire god - will be exploring Utopia Planitia in Mars' northern hemisphere.

BBC News – 27/05/2021

New Dark Matter Map Reveals Cosmic Mystery



This is the most detailed map of of the distribution of dark matter in the Universe. The bright areas represent its highest concentrations - which is where galaxies form

An international team of researchers has created the largest and most detailed map of the distribution of so-called dark matter in the Universe.

The results are a surprise because they show that it is slightly smoother and more spread out than the current best theories predict. The observation appears to stray from Einstein's theory of general relativity - posing a conundrum for researchers. The results have been published by the Dark Energy Survey Collaboration.

Dark Matter is an invisible substance that permeates space. It accounts for 80% of the matter in the Universe. Astronomers were able to work out where it was because it distorts light from distant stars. The greater the distortion, the greater the concentration of dark matter. Dr Niall Jeffrey, of École Normale Supérieure, in Paris, who pieced the map together, said that the result posed a "real problem" for physics.

"If this disparity is true then maybe Einstein was wrong," he told BBC News. "You might think that this is a bad thing, that maybe physics is broken. But to a physicist, it is extremely exciting. It means that we can find out something new about the way the Universe really is."

Prof Carlos Frenk, of Durham University, who was one of the scientists that built on the work of Albert Einstein and others to develop the current cosmological theory, said he had mixed emotions on hearing the news.

"I spent my life working on this theory and my heart tells me I don't want to see it collapse. But my brain tells me that the measurements were correct, and we have to look at the possibility of new physics," said Prof Frenk.

"Then my stomach cringes, because we have no solid grounds to explore because we have no theory of physics to guide us. It makes me very nervous and fearful, because we are entering a completely unknown domain and who knows what we are going to find."

Using the Victor M Blanco telescope in Chile, the team behind the new work analysed 100 million galaxies.

The map shows how dark matter sprawls across the Universe. The black areas are vast areas of nothingness, called voids, where the laws of physics might be different. The bright areas are where dark matter is concentrated. They are called "halos" because right in the centre is where our reality exists. In their midst are galaxies like our own Milky Way, shining brightly like tiny gems on a vast cosmic web.

According to Dr Jeffrey, who is also part of a department at University College London, the map, clearly shows that galaxies are part of a larger invisible structure.

"No one in the history of humanity has been able to look out into space and see where dark matter is to such an extent. Astronomers have been able to build pictures of small patches, but we have unveiled vast new swathes which show much more of its structure. For the first time we can see the Universe in a different way."

But the new dark matter map is not showing quite what astronomers expected. They have an accurate idea of the distribution of matter 350, 000 years after the Big Bang, from a European Space Agency orbiting observatory called Planck. It measured the radiation still present from that moment, called the cosmic microwave background, or more poetically, the "afterglow of creation".

Drawing on the ideas of Einstein, astronomers, such as Prof Frenk, developed a model to calculate how matter should disperse over the next 13.8bn years to the present day. But the actual observations from the new map are out by a few per cent - it shows that matter is slightly too evenly spread.

As a result, Prof Frenk thinks there may be big changes afoot in our understanding of the cosmos.

"We may have uncovered something really fundamental about the fabric of the Universe. The current theory rests on very sketchy pillars made of sand. And what we may be seeing is the collapse of one of those pillars."

But others, such as Prof Ofer Lahav, of University College London, have a more conservative view.

"The big question is whether Einstein's theory is perfect. It seems to pass every test but with some deviations here and there. Maybe the astrophysics of the galaxies just needs some tweaks. In the history of cosmology there are examples where problems went away, but also examples when the thinking shifted. It will be fascinating to see if the current 'tension' in Cosmology will lead to a new paradigm shift," he said.

The DES collaboration consists of over 400 scientists from 25 institutions in seven countries.

Astronomy.com – 14/05/2021

James Webb Space Telescope Launch Delay "Likely," Says Government Report

For once, the delay isn't due to a problem with the telescope — but with the Ariane 5 rocket it's scheduled to fly on.

An Ariane 5 rocket lifts off from French Guiana on September 25, 2018, carrying two telecom satellites into space.

ESA/CNES/Arianespace

NASA officials have acknowledged that the scheduled October launch of the James Webb Space Telescope (JWST) could be pushed back yet again, according to a report from the Government Accountability Office (GAO) released May 13. But this time, the issue isn't with the telescope.

Instead, it's with the usually reliable, European-produced Ariane 5 rocket, which is slated to carry JWST aloft on October 31 from Kourou, French Guiana. "According to NASA project officials, the JWST launch date will likely be delayed beyond October 2021 due to anomalies discovered in the JWST launch vehicle," says the report.

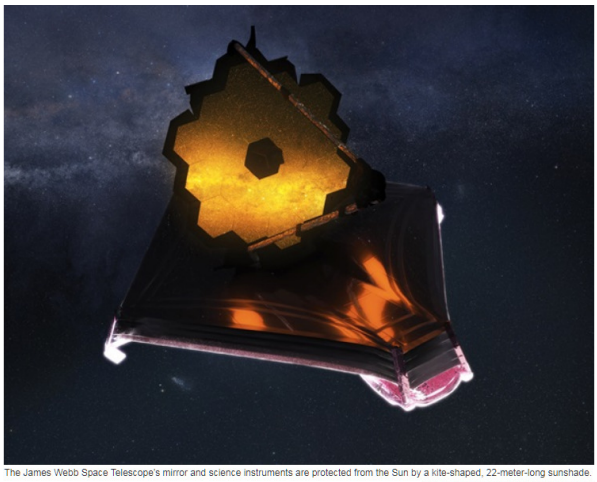
The issue lies with the Ariane 5's fairing, the nose cone that protects its payload as it accelerates up through the atmosphere. Once the vehicle reaches space, the fairing separates from the rocket in two pieces and falls away.

But in two recent launches, the rocket experienced "unexpected vehicle accelerations" during fairing separation, according to the GAO report. As a result, Ariane 5 launches have been postponed while the European Space Agency and Arianespace, the rocket's manufacturer, investigate the issue.

The bright side

The good news is that any potential delay may only be a matter of weeks, rather than months or years. The JWST launch will not go ahead until an Ariane 5 has flown and successfully demonstrated a fix to the issue, says the report. But there are two Ariane 5 launches — planned for June and August of 2021— ahead of JWST's scheduled October flight.

Although NASA has not officially announced any revision to JWST's current October 31 launch date, recent public comments reported by Space News indicate officials expect it will take roughly four months to prepare JWST after Ariane 5 is again approved for flight. So, if the June launch shows the fairing issue is resolved, JWST could be set to fly in November.



The James Webb Space Telescope's mirror and science instruments are protected from the Sun by a kite-shaped, 22-meter-long sunshade.

Adriana Manrique Gutierrez, NASA Animator

A delay of a few weeks — or even a few months — would be far from the worst delay James Webb has faced so far. As the long-awaited successor to the Hubble Space Telescope, JWST is already seven years behind its initial launch target of June 2014. Furthermore, its budget has nearly doubled, from $5 billion to an estimated $9.7 billion. In July 2020, when NASA pushed back JWST's launch from March 2021 to October 2021, it cited the COVID-19 pandemic, "as well as technical challenges."

Encouragingly, the GAO report found that work on JWST is still steadily moving forward, and "has made significant technical progress" since the most recent launch delay. For instance, earlier this week, the telescope passed a milestone as workers commanded it to unfurl its golden, 6.5-meter primary mirror — the last time it will do so on Earth. The test was the final preflight check of the intricate deployment process it will undergo when it reaches space.

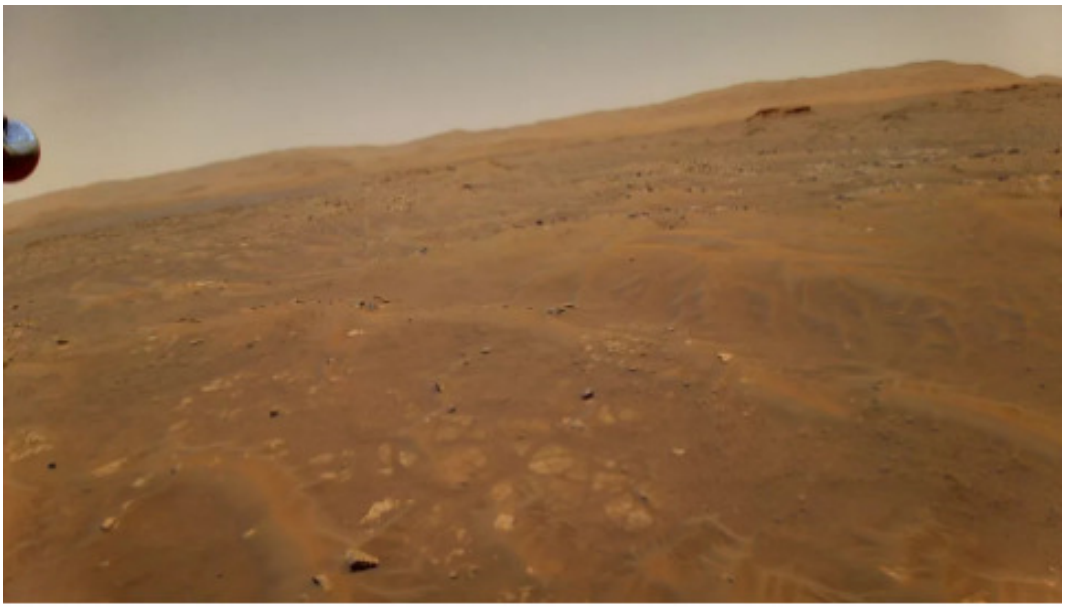
"The completion of this last test on its mirrors is especially exciting because of how close we are to launch later this year," said Ritva Keski-Kuha, JWST's deputy optical telescope element manager, in a news release. Considering the latest issues with the Ariane 5, though, it seems the JWST team may have to wait just a little bit longer than they would like.

ASTRO NEWS

Space.com – 05/06/2021 *(Text & Images © Space.com)*

NASA's Mars helicopter Ingenuity set for 7th Red Planet flight on Sunday

NASA's Mars helicopter Ingenuity will take to the air again this weekend, if all goes according to plan.



This image was taken from the height of 33 feet (10 meters) by NASA's Ingenuity Mars helicopter during its sixth flight on May 22, 2021. (Image credit: NASA/JPL-Caltech)

Ingenuity's handlers are prepping the 4-lb. (1.8 kilograms) chopper for its seventh Martian flight, which will take place no earlier than Sunday (June 6). The plan is to send Ingenuity to a new airfield, about 350 feet (105 meters) south of its current location on the floor of Jezero Crater.

"This will mark the second time the helicopter will land at an airfield that it did not survey from the air during a previous flight," NASA officials wrote in an update on Friday (June 4). "Instead, the Ingenuity team is relying on imagery collected by the HiRISE camera aboard NASA's Mars Reconnaissance Orbiter that suggests this new base of operations is relatively flat and has few surface obstructions."

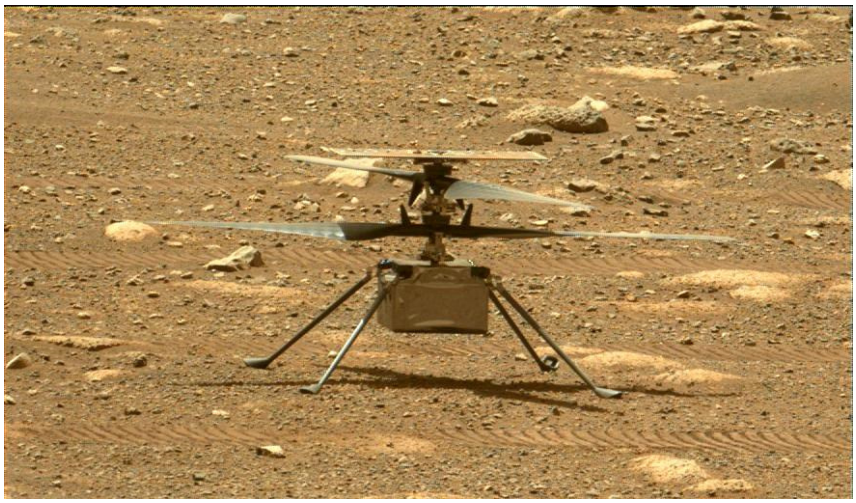
Data from the flight will be beamed home to Earth over the three days following the flight, they added.

Ingenuity also flew to an unscouted airfield on its sixth flight, which occurred on May 22 and did not go 100% smoothly. The solar-powered rotorcraft suffered a glitch that briefly interrupted the flow of photos from its navigation camera to its onboard computer. But Ingenuity managed to power through the anomaly, landing safely close to its designated touchdown spot.

Ingenuity landed with NASA's Perseverance rover inside the 28-mile-wide (45 kilometers) Jezero on Feb. 18. On April 3, the helicopter deployed from Perseverance's belly, kicking off a month-long flight campaign designed to demonstrate that powered flight is possible on Mars.

Ingenuity aced that original mission with five flights, which got successively more complex and ambitious. NASA then granted a mission extension for the helicopter, which focuses on showcasing the scouting potential of Martian rotorcraft. Sunday's planned flight will be the second one in this new campaign.

Perseverance documented Ingenuity's first five flights extensively, capturing video and audio of the history-making hops. But the rover has now begun focusing on its own science mission, which involves hunting for signs of ancient Mars life and collecting samples for future return to Earth, so shots of Ingenuity in action are harder to come by these days.



Bonus image

The Ingenuity Helicopter on the Martian surface as imaged by he Perseverance Rover.
Image © Sky and Telescope.com

ASTRO NEWS

BBC News – 03/06/2021 *(Text & Images © BBC.co.uk)*

NASA Announces Two New Missions to Venus

The missions will take place between 2028 and 2030

Nasa has announced that it is sending two new missions to Venus in order to examine the planet's atmosphere and geological features.

The missions, which have each been awarded $500m (£352m) in funding, are due to launch between 2028 and 2030. Nasa administrator Bill Nelson said the missions would offer the "chance to investigate a planet we haven't been to in more than 30 years". The last US probe to visit the planet was the Magellan orbiter in 1990.

However, other spacecraft - from Europe and Japan - have orbited the planet since then. The missions were picked following a peer review process and were chosen based on their potential scientific value and the feasibility of their development plans.

"These two sister missions both aim to understand how Venus became an inferno-like world, capable of melting lead at the surface," Mr Nelson said. Venus is the second planet from the sun and the hottest planet in the solar system with a surface temperature of 500C - high enough to melt lead.

The Davinci+ (Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging) mission will measure the planet's atmosphere to gain insight into how it formed and evolved. It will also aim to determine whether Venus ever had an ocean.

Davinci+ is expected to return the first high resolution images of the planet's "tesserae" geological features. Scientists believe these features could be comparable to continents on Earth and could suggest that Venus has plate tectonics.

The second mission, Veritas (Venus Emissivity, Radio Science, InSAR, Topography, and Spectroscopy), will map the planet's surface to understand its geological history and investigate how it developed so differently than Earth. It will use a form of radar to chart surface elevations and discover whether volcanoes and earthquakes are still happening.

"It is astounding how little we know about Venus, but the combined results of these missions will tell us about the planet from the clouds in the sky through the volcanoes on its surface all the way down to its very core," said Tom Wagner from Nasa's Planetary Science Division. "It will be as if we have rediscovered the planet," he added.

Derby & District Astronomical Society

General Rules and Safety Regulations for the use of the Flamsteed Observatory.

ALL VISITORS MUST:-

Sign the visitor's book upon arrival.

One person to be designated as 'in charge' of the observing session and responsible for the operation of the telescope.

Not enter any areas deemed off limits as designated by 'No Unauthorised Access' signs unless permission is granted.

Be aware of and take notice of all warning signs

Use the handrails when ascending or descending the stairs to and from the upper level.

Ensure the barrier is down at all times whilst inside the dome.

Not lean over any barriers or attempt to exit the dome through the observation opening.

Take every care to look after the telescope and equipment.

Leave the observatory in a clean and tidy condition.

The designated 'Leader' to make sure the dome is closed and secure, all lights and power is off, and the observatory locked and secure before leaving.

Not forget to sign out.

Derby and District Astronomical Society

COVID – 19

Rules and Safety Regulations for the use of the Society's Flamsteed Observatory

ALL VISITORS MUST:-

Enter their Name and contact Telephone Number in the visitor's book.
(In accordance with the Gov't Track and Trace Policy)

Wear a face mask, (unless medically exempt).

Only 3 adults, (including the telescope operator) plus 2 children under t he age of 14 will be allowed inside the observatory at any one time.

Maintain at least 1 metre gap between each person.

Not venture into areas deemed off limits.

Adhere to all other Rules set out by the society for the general use of t his observatory.

THE SOCIETY WILL:-

Provide sanitising and cleaning materials for use at all times

With large groups provide other telescopes for use

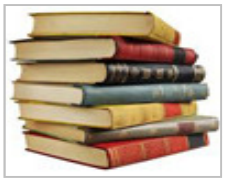
Sanitise all equipment and surfaces before and after use.

Make the use of the observatory as safe as possible and try to ensure the safety of their visitors at all times.

The operators of the observatory are all volunteers and these rules and regulations have been put in place to protect us all, please adhere to them.

Thank you.

BOOK



REVIEW

‘ The Apollo Guidance Computer’

by Frank O’Brien

Reviewed by Malcolm Neal

This is a paperback book of some 440 pages of which about 20% are the appendices, bibliography and index. It is not a cheap book at just over £30 (from Amazon) which is a reduction on the RRP of £34 and is published by Springer ISBN 978-1-4419-0876-6. The book is an ideal twin to the book "Sunburst and Luminary" by Don Eyles that describes a similar computing system in the Lunar lander and to a lesser extent the command module.

It starts with a brief introduction to computing in aviation and spaceflight and goes into the usual and often spurious comparison of the computer power then and now especially when compared to a modern mobile phone. However it does make the point that with such limited resources available at the time just how much they packed into it and how effective and efficient it was, as it had the grand total of 38k of usable memory to do everything that was required. The book describes how by the final Apollo mission the AGC was completely obsolete especially the hardware because technology had advanced so much BUT the AGC was never redesigned to make use of these advances as it had served its purpose, getting man to the Moon, and ended with the last Apollo mission.

The book next has a fairly detailed description of the hardware, number systems and some computer arithmetic. It helps to have some knowledge of what happens inside a computer to really understand what is going on here. This section then goes on to describe the Executive program, what we would now call the operating system and then the Interpreter which is not what we now think of as a language translator but "a new system architecture" to quote the book which complements the AGC. The Interpreter is based on the same 15 bit system as the AGC but its instruction opcodes were limited to 3 bits. This allows 8 different opcodes (instructions). This is obviously too few and over time the opcode length was increased to 5 or 7 bits for the opcode giving a maximum of 32 or 128 instructions, depending on which system is being used. The 7 bit opcode also allowed two such instructions to fit into any 15 bit memory slot which was another important but esoteric solution to the limitations of the 38k of hardware memory. Describing the Interpreter and how it works takes some forty to fifty pages and is probably the most detailed part of the book. Memory management is also a problematic thing as a 12 bit address cannot access all the memory. This memory is divided into two parts 4k of erasable read write memory and the rest as essentially ROM (read only) but in the form of a rope. One interesting aside about the memory is that it was obsolete when it flew on the later Apollo missions but was still in use up to 1990 in the Shuttle.

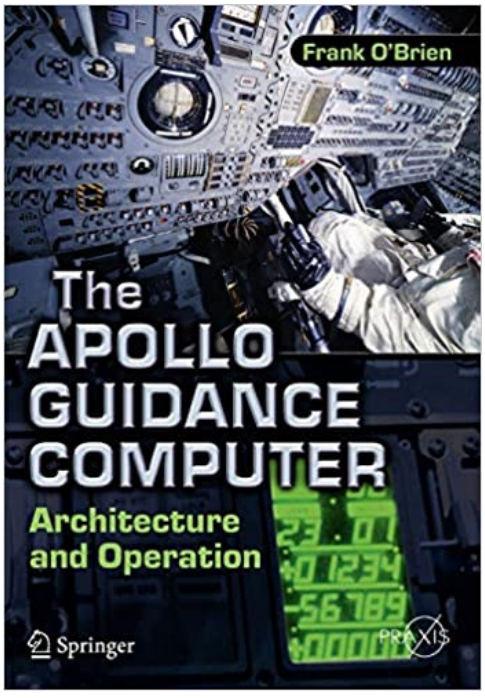
The second major section describes the Executive and Interpreter programs. The Executive is essentially the operating system for the AGC but is far from what a modern OS is. There is some detail about how this works and especially with regard to scheduling programs to run and the memory management involved. This gets even more complex when Interpreter programs need to run. Again reading this book benefits from having some knowledge or experience with more modern computer hardware and operation for it to be immediately clear. The book then moves on to the design and use of the DSKY (display keyboard) which is the astronauts input output device; allowing them to tell the AGC what they want it to do and in an emergency reprogram it. Finally the Interpreter program is discussed in detail. This is a form of high level language and overlies rather than replaces the Executive in the AGC. It complements the Executive and it is here that the 7 bit addressing is used. Once again, a great deal of ingenuity by the designers and programmers is shown in the book to once again make so much use out of so little memory.

The next section is all about guidance and navigation and also like the "Sunburst and Luminary" describes the gyroscope system and how star sights are taken but with a little more detail. This is the shortest part of the book. This section then goes on to ask three questions and then shows, briefly, how they were solved for the trips to the moon. They are:

a) Which way up am I? b) Where am I? c) Where am I heading?

Each of these questions is answered in some detail and in some cases these answers complement information given in the other book I mentioned at the start.

The final part is the mission programs and operations and is the longest section of the book at about 130 pages. It describes many of the phases of a typical mission from launch to landing and then the lunar orbit rendezvous for the returning lander. For some of these phases it shows the instruments used by the astronauts and the programs involved and in some cases how the input and output needed were done using the DSKY (display keyboard) system. The mission to the moon as describes begins several weeks before take-off and again is described in detail. This was entirely lost to me as a 19 to 20 year old watching the missions terminating in the Apollo 11 mission to the moon as the complexity of, or even, computers were not really part of my world at that time. Each described phase shows the complexity of each step and given the limitations of computational power and the memory makes me wonder how they ever managed to achieve the successes they did. Even testing the core rope memory involved processes that boggle the mind and this was just one of the very earliest tests carried out, well before the astronauts even approached the rocket. This section ends with some detail about the autopilot and finally about computer problems in Apollo 11 and 14. The problem in mission 14 was far more serious and is explained in rather more detail.



This is a brief overview of a very technical book that is well worth reading but it is not for the feint hearted as much of it is very detailed and quite heavy going especially if you have no knowledge of what happens inside a modern computer. The book is far more about the hardware than the Don Eyles book mentioned which is more about the programming of the AGC and to a lesser extent the people who did the work. I keep referring to the Eyles book as it would help to read that one first as O'Brien's book is much more technical.

Malcolm.

DDAS Library

Members may borrow books for free from our growing library. Loans last for one month or more, depending on whether other members may wish to borrow a loaned item. The library is available at our main monthly meetings for browsing, borrowing and returns. A number of these volumes were kindly donated by the estate of the late Keith Plamping, DDAS member. The library contains nearly 70 volumes and the books cover a wide range of astronomy related subjects. For more information please ask for Libby Ray at one of our meetings.

1 **The Road to the Stars** ….. Iain Nicholson (1978)
2 **The Intelligent Universe**: **A New View of Creation and Evolution** ….. Fred Hoyle (1983)
3 **Amateur Astronomy: A Comprehensive & Practical Survey** ….. Colin Ronan (Consultant Editor) (1989)
4 **Earth: A New Perspective** ….. Nicolas Cheetham (2006)
5 **Universe: A Journey from Earth to the Edge of the Cosmos** ….. Nicolas Cheetham (2005)
6 **The Pictorial Atlas of the Universe** ….. Kevin Krisciunas and Bill Yenne (1989)
7 **Moon Flight** ….. Patrick Moore (1970)
8 **The Great Atlas of the Stars** ….. Serge Brunier (2001)
9 **The Cambridge Encyclopedia of Space** ….. Michael Rycroft - Editor (1990)
10 **Brother Astronomer: Adventures of a Vatican Scientist** ….. Brother Consolmagno (2000)
11 **Space is a Funny Place: Fifty Years (and more) of Space Exploration** ….. Colin Pillinger (2007)
12 **Astronomy Before the Telescope** ….. Christopher Walker (Editor) (1996)
13 **Full Moon** ….. Michael Light (1999)
14 **The Guinness Book of Astronomy** ….. Patrick Moore (1983)
15 **Observing the Moon** ….. John S. Folkes (2003)
16 **The Greenwich Guide to Stars, Galaxies and Nebulae** ….. Stuart Malin (1989)
17 **The Greenwich Guide to Astronomy in Action** ….. Carol Stott (1989)
18 **The Story of the Earth** (Geological Museum) (1977, third edition)
19 **A Guide to the Old Royal Observatory** (National Maritime Museum)
20 **Official Guide to the National and Space Museum** (1993)
21 **Rockets, Missiles and Spacecraft of the National Air and Space Museum** (1983)
22 **NASA Kennedy Space Center's Spaceport USA** (English Tourbook) (1992)
23 **Astronomical Observatory of Jaipur** (Tourbook)
24 **Atlas of Uranus** ….. Garry Hunt and Patrick Moore (1988)
25 **Guinness Spaceflight: The Records** ….. Tim Furness (1985)
26 **Space Shuttle: The History of Developing the National Space Transportation System** ….. Dennis R. Jenkins
27 **Philip's Atlas of the Universe** ….. Patrick Moore (1999)
28 **The Story of Astronomy: A New Edition** ….. Patrick Moore (1977)
29 **The Planets: Portraits of New Worlds** ….. Nigel Henbest (1992)
30 **Cambridge Star Atlas 2000.0** (Cambridge University Press) (1991)
31 **Observing the Constellations: The Mitchell Beazley Guide to the Stars** ….. John Sanford (1989)
32 **Patrick Moore's Astronomy Quiz Book** ….. Patrick Moore (1987)
33 **Early Astronomy from Babylonia to Copernicus** ….. W. M. O'Neil (1986)
34 **Practical Amateur Astronomy** (Revised Edition) ….. Patrick Moore - Editor (1971)
35 **Astronomer by Chance** ….. Bernard Lovell (1990)
36 **Star Seekers** ….. Colin Wilson (1980)
37 **Astronomy** ….. John E. Thompson (1979)
38 **The Cosmic Gallery: The Most Beautiful Images of the Universe** ….. Giles Sparrow
39 **The New Astronomy Guide: Stargazing in the Digital Age** ….. Patrick Moore & Pete Lawrence
40 **My Brief History: A Memoir** ….. Stephen Hawking (2013)
41 **A Brief History of Time: From the Big Bang to Black Holes** ….. Stephen Hawking (1988)
42 **A Briefer History of Time** ….. Stephen Hawking with Leonard Mlodinow (2008)
43 **Philip's Moon Observers Guide** ….. Peter Greco (2003)
44 **A Man on the Moon: The Voyages of the Apollo Astronauts** ….. Andrew Chaikin (1995)
45 **Heaven & Earth: Unseen by the Naked Eye** ….. Introduction by David Malin (2002)
46 **Failure is not an Option: Mission Control from Mercury to Apollo 13 and Beyond** ….. Gene Kranz (2000)
47 **Cosmos** ….. Carl Sagan (1980)
48 **Gravity's Lens: Views of the New Cosmology** ….. Nathan Cohen (1988)
49 **The Illustrated Encyclopedia of Astronomy and Space**: Revised edition ….. Ian Ridpath – Editor (1979)
50 **Spacecam: Photographing the Final Frontier – from Apollo to Hubble** ….. Terry Hope (2005)
51 **The Cambridge Enclyopaedia of Astronomy** ….. Simon Mitton – Editor (1977)
52 **The Flammarion Book of Astronomy** ….. Translated from the French Original published 1880 Readers Union
53 **Stars & Telescopes for the Beginner** ….. Roy Worvill (1979)
54 **The Return of Halley's Comet** ….. Patrick Moore & John Mason (1984)
55 **The Backyard Astronomer's Guide** ….. (Dickinson and Dyer)
56 **Turn Left at Orion** ….. (Consolmagno and Davis)
57 **Phillips Stargazing with a Telescope** ….. (Scagell)
58 **Phillips Stargazing with Binoculars** ….. (Scagell and Frydman)
59 **The Rebirth of the Russian Space Program** ….. (Harvey)
60 **The Amateur Astronomer 12th Edition** ….. (Patrick Moore)
61 **2014 Yearbook of Astronomy** ….. (Patrick Moore and John Mason)
62 **Lunar and Planetary Webcam Users Guide** ….. (Martin Mobberley)
63 **A Walk Through The Heavens 3rd Edition** ….. (Heifetz and Tirion)
64 **Complete Guide to Astrophotography** (Sky at Night Magazine)
65 **Astronomy Photographer of the Year 2013** Royal Observatory Greenwich (2013)
66 **The Magellan Venus Explorer's Guide** ….. Carolynn Young, Ed (1990)
67 **Visions of Heaven (revealed by the Hubble Space Telescope)** ….. Tom Wilkie & Mark Rosselli (1998)
68 **The Illustrated Atlas of the Universe** ….. Mark A Garlick (2006)

Meeting Schedule ****

The following events are subject to change at short notice, please keep updated with the full list on the website
http://derbyastronomy.org/Meetings2021.htm

Date	Title	Speaker	Venue
Jul 3rd 7:30pm	Society BBQ and Observing Session	-	The Flamsteed Observatory Please email the secretary of the society to book
Jul 10th 9:30 pm	OBSERVING SESSION	-	The Flamsteed Observatory Please email the secretary of the society to book
Aug 14th 8:30 pm	OBSERVING SESSION	-	The Flamsteed Observatory Please email the secretary of the society to book
Aug 31st	**Ensure your M13 photos have been**	**submitted for the First**	**Chairman's Challenge Competition**
Sep 3rd 7:30 pm	Mr Hubble and his Amazing Telescope	Howard Parkin Isle of Man Astronomical Society	Zoom Please email the secretary for further details
Sep 5th	**A gentle reminder for articles for**	**the Autumn issue of Aries.**	
Sep 11th 8:00 pm	OBSERVING SESSION	-	The Flamsteed Observatory Please email the secretary of the society to book
Sep 17th 7:30 pm	INTRODUCTION TO ASTRONOMY EVENING The Autumn Sky	Mike Lancaster	TBA
Oct 1st 7:30 pm	TBA		TBA
Oct 9th 7:30 pm	OBSERVING SESSION	-	The Flamsteed Observatory Please email the secretary of the society to book
Oct 15th 7:30 pm	INTRODUCTION TO ASTRONOMY EVENING Building a Binocular Observing Chair	Brian Dodson	TBA
Nov 5th 7:30 pm	The Next Blink of a Cosmic Eye: Astronomy in the Next 200 Years	Dr Megan Argo University of Central Lancashire	TBA
Nov 13th 7:30 pm	OBSERVING SESSION		The Flamsteed Observatory Please email the secretary of the society to book

Come and Join Us

We extend a warm welcome to anyone who would like to come along to our meetings and suggest that people come along to a few of them before deciding if they would like to join.

Benefits of being a member include anytime use of our observatory and site, a telescope hire scheme, borrowing books from our library, a discounted room collection, invitation on Society trips, and the right to vote on Society matters at our AGM.

If you would like to become a member please contact our Treasurer Simon Behnke, who is usually available at our main meetings.

Membership is £27 per year (concessions £18)