NWASNEWS

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February 2017

Newsletter for the Wiltshire, Swindon, Beckington Astronomical Societies and Salisbury Plain

LETS HOPE SCIENCE GOES ON

Our speaker tonight Professor David Southwood speaking in his role as advisor to the European Space Agency will have some updates on how recent political developments may pan out for UK scientists in astronomy and other sciences.

I know from his time at UCL he will know a couple of my close friends very well, Allan Willis and dear John Griffiths my co founder of the observatory in Spain.

What ever happens the cooperation has helped several members medically recently, so can I wish speedy recovery to Nick Howes who is slowly replacing bits of his body with elements created in Neutron stars, with titanium in his new hip and magnesium pills to work on the recovery. Seems to be going well.

But so many of the above we know were very highly engaged in outreach, taking science and our hobby out to non scientists and importantly, to children to inspire and help create scientists of the future.

But this leads me to Pete Glastonbury, who heard of a young boy with autism in the Devizes area, and with help from people on Facebook has built up a very good collection of tools, from telescope to computer, books and CDs has enable this young boy to develop skills way beyond those of his teachers within the hobby of astronomy. I will be showing him solar views over the half term, but well done Pete for engaging with him and his family.

We are due at the Paragon School in Bath this Friday, but it is an early start (6pm for setting up). Volunteers please. And remember the traffic problems getting there. It will be full Moon, and final weather considerations may change whatwe do and what help we need.

After the last meeting I was told my daughter was taken into hospital to have another grandchild. Mother and daughter are doing well.

On top of that quite a few imaging opportunities until the week of the observing night! Just typical.

Astrofest is also on the Friday and Saturday so it is unlikely I will attend this year.

Clear skies

Andy

The Pleiades on 20th January 2017. 60seconds exposure, Nikon D810a single shot through 127 Televue telescope. The nebulosities around of left over gases from the recent starbirth make some large areas around Meriope Alcyone and Maia are easy to see, but the blurring around all the bright blue stars show the nebulosity is huge. Andy Burns

Wiltshire Society Page

Wiltshire Astronomical Society
Web site: www.wasnet.org.uk
Meetings 2015/2016Season.
NEW VENUE the Pavilion, Rusty Lane, Seend
Meet 7.30 for 8.00pm start
2016

7 Feb	Professor David Southwood, 10 Years of Space Science at the European Space Agency
7 Mar	Steve Tonkin, And yet it Moves!
4 Apr	Dr Chris North, Telescopes through the Ages
2 May	Martin Griffiths, Planetary Nebulae Marathon
6 Jun	Mark Radice, Observing from the Caribbean + AGM

Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

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Vice chair: Keith Bruton

Bob Johnston (Treasurer)

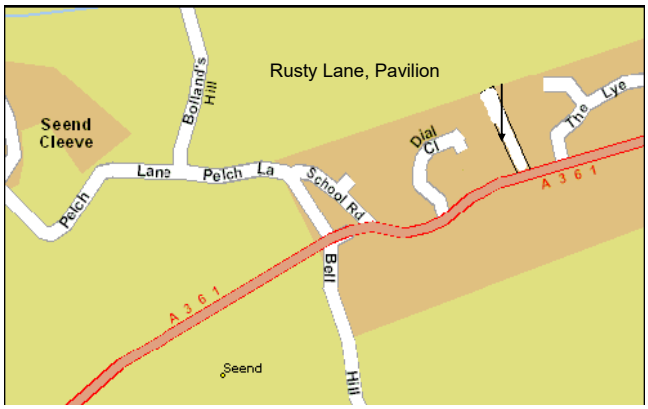
Philip Proven (Hall coordinator)

Peter Chappell (Speaker secretary)

Nick Howes (Technical Guru)

Observing Sessions coordinators: Jon Gale, Tony Vale

Contact via the web site details. This is to protect individuals from unsolicited mailings.

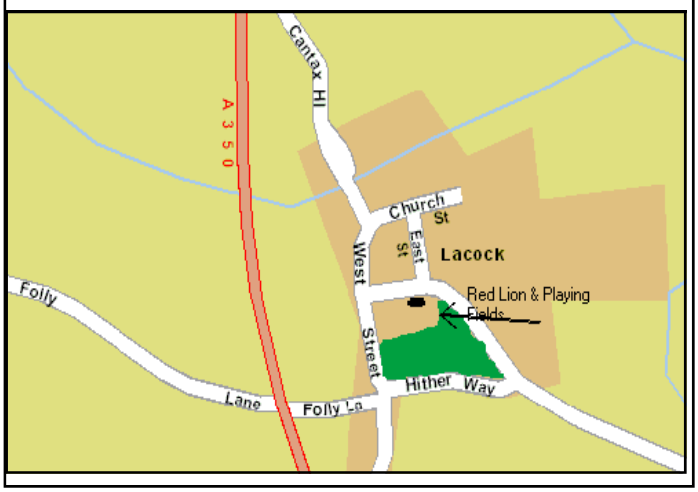


Observing Sessions

The Wiltshire Astronomical Society's observing sessions are open, and we welcome visitors from other societies as well as members of the public to join us.
We will help you set up equipment (as often as you need this help), and let you test anything we have to help you in your choice of future astronomy purchases.

Please treat the lights and return to full working order before leaving. With enough care shown we may get the National Trust to do something with them!

PLEASE see our proposed changes to the observing sessions, contacting and other details. Back Page



Professor David Southwood

David is now a Senior Research Investigator at Imperial College, and a Non-Executive member of the UK Space Agency Steering Board. He had an academic career in Britain and USA, eventually becoming head of Physics at Imperial College, London. From 2001 to 2011 he was the Director of Science and Robotic Exploration at the European Space Agency (ESA). Before that he was head of Earth Observation strategy at ESA. Appointed in 1997 he drew up what has become the current architecture for European Earth Observation space programmes.

He is past president of the Royal Astronomical Society, a fellow of the Royal Aeronautical Society, and a visiting professor at the Universities of Plymouth and Lancaster, and a Distinguished Visiting Scientist at the NASA Jet Propulsion Laboratory, USA. He is vice-chair of the EU Horizon 2020 Space Expert Advisory Group. He is patron of the British Science Fiction Foundation and the Plymouth Astronomical Society and honorary president of the Bristol Astronomical Society. A space magnetometer he built at Imperial still operates in orbit around the planet Saturn aboard the NASA Cassini spacecraft.

Swindon Stargazers

Swindon's own astronomy group

The club meets once a month at Liddington Hall, Church Road, Liddington, Swindon, SN4 0HB at 7.30pm. See programme below.

Sally Russell – Astronomical Sketching

Our January meeting sees the return of Sally Russell who is an amateur astronomer and accomplished artist who sketches the objects of the Cosmos.

Soon after you begin studying the sky through your small telescope or binoculars, you will probably be encouraged by others to make sketches of what you see. Sketching is a time-honoured tradition in amateur astronomy and dates back to the earliest times, when telescopes were invented. Even though we have lots of new imaging technologies nowadays, including astrophotography, most observers still use sketching to keep a record of what they see, make them better observers, and in hopes of perhaps contributing something to the body of scientific knowledge about the Moon. Some even sketch because it satisfies their artistic side.

Sally has also been published in *Sketching the Moon: An Astronomical Artist's Guide (The Patrick Moore Practical Astronomy Series,* and is regarded as one of the five best lunar observer-artists working today. The Moon presents some unique challenges to the astronomer-artist, the Moon being so fond of tricks of the light.

Ad-hoc viewing sessions

Regular stargazing evenings are being organised near Swindon. To join these events please visit our website for further information.

Lately we have been stargazing at Blakehill Farm Nature Reserve near Cricklade, a very good spot with no distractions from car headlights.

We often meet regularly at a lay-by just outside the village of Uffcott, near Wroughton. Directions are also shown on the website link below.

When we use East Kennett, we meet at the public car park just below The Red Lion pub at Avebury; we usually hang on for 10 minutes and then move on to our viewing spot at East Kennett. Information about our evenings and viewing spots can be found here:

http://www.swindonstargazers.com/noticeboard/noticeboard06.htm

If you think you might be interested email the organiser Robin Wilkey (see website). With this you will then be emailed regarding the event, whether it is going ahead or whether it will be cancelled because of cloud etc.

We are a small keen group and I would ask you to note that you DO NOT have to own a telescope to take part, just turn up and have a great evening looking through other people's scopes. We are out there to share an interest and the hobby. There's nothing better than practical astronomy in the great cold British winter! And hot drinks are often available, you can also bring your own.

Enjoy astronomy at it's best!

Members of the Wiltshire Astronomical Society always welcome!

At Liddington Village Hall, Church Road, Liddington, SN4 0HB – 7.30pm onwards

The hall has easy access from Junction 15 of the M4, a map and directions can be found on our website at:

http://www.swindonstargazers.com/clubdiary/directions01.htm

Meeting Dates for 2017:
Friday 17 February 2017

Programme: David Boyd - Spectroscopy

Friday 17 March 2017

Programme: AGM plus Dr Bob Gatten - Using the Faulkes Telescope Project's remote telescopes, results so far

Friday 24 April 2017

Programme: Dr Pauline Norris - The Ancient Egyptians and their Astronomy

Friday 19 May 2017

Programme: Martin Griffiths - Contact with extraterrestrials, how will it affect us

Friday 16 June 2017

Programme: Paul Roche - Robotic Astronomy

---------SUMMER BREAK--------

Friday 15 September 2017

Programme: Prof. Richard Harrison MBE BSc Phs FRAS FinstP - Space Weather

Friday 20 October 2017

Programme: Steve Tonkin - Binocular Astronomy

Friday 17 November 2017

Programme: Mike Leggett: Exploration of Mars

Friday 15 December 2017

Programme: Christmas Social

Website:

http://www.swindonstargazers.com

Chairman: Peter Struve

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Comet Campaign: Amateurs Wanted

By Marcus Woo

In a cosmic coincidence, three comets will soon be approaching Earth—and astronomers want you to help study them. This global campaign, which will begin at the end of January when the first comet is bright enough, will enlist amateur astronomers to help researchers continuously monitor how the comets change over time and, ultimately, learn what these ancient ice chunks reveal about the origins of the solar system.

Over the last few years, spacecraft like NASA's Deep Impact/EPOXI or ESA's Rosetta (of which NASA played a part) discovered that comets are more dynamic than anyone realized. The missions found that dust and gas burst from a comet's nucleus every few days or weeks—fleeting phenomena that would have gone unnoticed if it weren't for the constant and nearby observations. But space missions are expensive, so for three upcoming cometary visits, researchers are instead recruiting the combined efforts of telescopes from around the world.

"This is a way that we hope can get the same sorts of observations: by harnessing the power of the masses from various amateurs," says Matthew Knight, an astronomer at the University of Maryland.

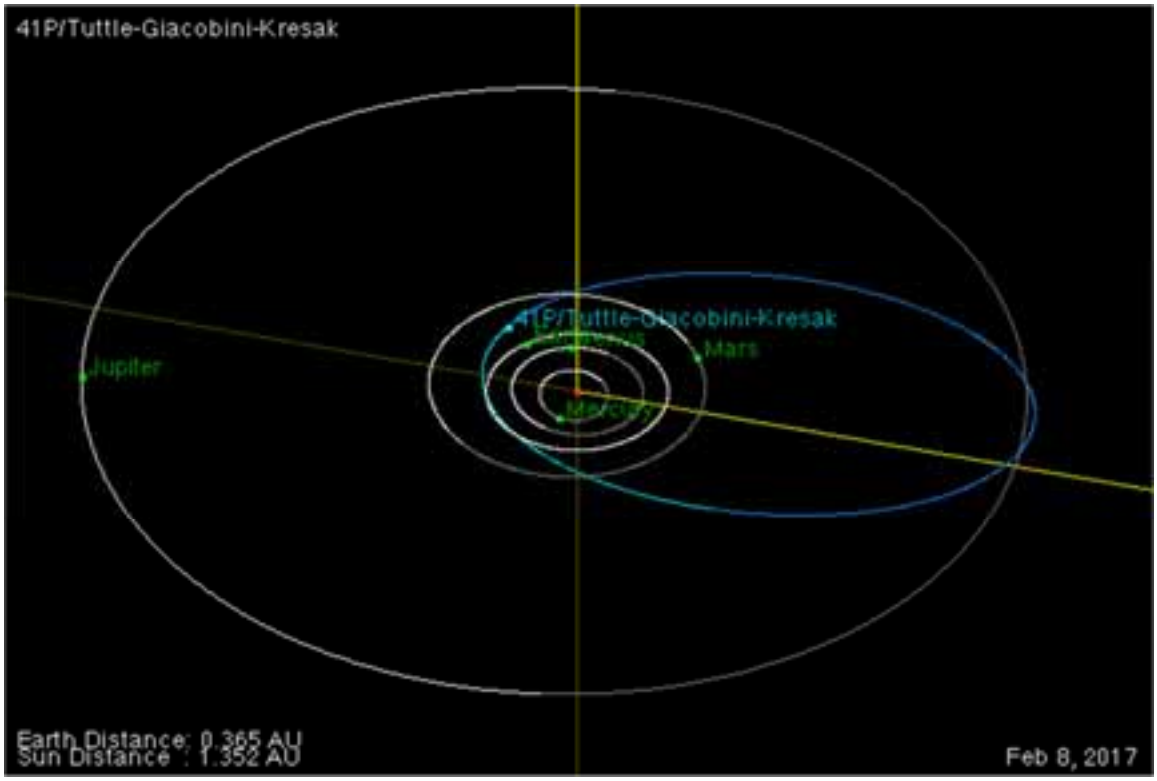
By observing the gas and dust in the coma (the comet's atmosphere of gas and dust), and tracking outbursts, amateurs will help professional researchers measure the properties of the comet's nucleus, such as its composition, rotation speed, and how well it holds together.

The observations may also help NASA scout out future destinations. The three targets are so-called Jupiter family comets, with relatively short periods just over five years—and orbits that are accessible to spacecraft. "The better understood a comet is," Knight says, "the better NASA can plan for a mission and figure out what the environment is going to be like, and what specifications the spacecraft will need to ensure that it will be successful."

The first comet to arrive is 41P/Tuttle-Giacobini-Kresak, whose prime window runs from the end of January to the end of July. Comet 45P/Honda-Mrkos-Pajdusakova will be most visible between mid-February and mid-March. The third target, comet 46P/Wirtanen won't arrive until 2018.

Still, the opportunity to observe three relatively bright comets within roughly 18 months is rare. "We're talking 20 or more years since we've had anything remotely resembling this," Knight says. "Telescope technology and our knowledge of comets are just totally different now than the last time any of these were good for observing."

For more information about how to participate in the campaign, visit http://www.psi.edu/41P45P46P.



An orbit diagram of comet 41P/Tuttle-Giacobini-Kresak on February 8, 2017—a day that falls during the comet's prime visibility window. The planets orbits are white curves and the comet's orbit is a blue curve. The brighter lines indicate the portion of the orbit that is above the ecliptic plane defined by Earth's orbital plane and the darker portions are below the ecliptic plane. This image was created with the Orbit Viewer applet, provided by the Osamu Ajiki (AstroArts) and modified by Ron Baalke (Solar System Dynamics group, JPL). http://ssd.jpl.nasa.gov/sbdb.cgi?orb=1;sstr=41P

BECKINGTON ASTRONOMICAL SOCIETY

Society Details & Speakers programme can be found on our Website www.beckingtonas.org

General enquiries about the Society can be emailed to chairman@beckingtonas.org.

Our Committee for 2016/2017 is

Steve Hill----------Chairman- 01761 435663

John Ball----------Vice Chairman- 01373 830419

…….john@abbeylands1.freeserve.co.uk

Sandy Whitton---- Secretary-07974-841239

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Mike Witt---------- Membership-……
mjwitt@blueyonder.co.uk.

John Dolton------
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Meetings take place in Beckington Baptist Church Hall in Beckington Village near Frome.

See the location page for details of how to find us on our website……

Post Code for Sat Nav is BA11 6TB.

Our start time is 7.30pm.

Programme details for 2016/2017

2016

Feb 17th: A Very Victorian Scientist……. Andy Burns

Mar 17th: The Sun…….. Ron Westmaas

Apr 21st: Observing the Solar System…… Mark Radice

May 19th: Imaging Colloquium `Open discussion bring your kit along`…… Steve Hill.

All are welcome to come along for a chat from beginners to experts.

The Binocular Observer -

Targets for February Jonathan Gale

Telescopes can be a chore to set up (especially where electronics are involved) so the maxim “easy and convenient” is a good one to live by, especially when time is precious. Ever since their invention, binoculars have been the astronomers tool for quick and leisurely observing, so the intention of these columns is to give some targets for those with binoculars in the range of 10x50 to 15x70 - coincidentally the ones I have!

However, adopting “easy and convenient” to our targets will give us a limited selection, so some will be easy, some challenging and a few downright difficult. I am also going to gloss over the obvious ones, but do observe them - astronomical eye candy is there to be enjoyed, but not to the exclusion of other deserving targets.

In addition, I hope to rekindle the spirit of past astronomers and get you star hopping around the sky, as I am not aware of a pair of “goto” binoculars so you cannot cheat. I am expecting comments from those who have made some, but I am not aware of any commercially available and anyway this spoils the fun. Finder charts will be available from the WAS website or printed for those who do not have the necessary facilities.

Open Clusters

I’ll start with an admission - open clusters used to leave me cold until I started the Herschel 400 observing list. Frankly there a lot of them in it, but they do grow on you and you start hallucinating patterns within them; read Steve O’Meara’s Deep Sky Companions series if you do not believe me

M41 (Canis Major)

Our targets begin with M41, a little south of Sirius. This must be one of the most overlooked clusters as Sirius gets all the attention. Just point your binoculars toward Sirius then drop them down a little and look for M41 which hangs, as Steve O’Meara poetically writes “ below Sirius’s collar like an ice covered tag reflecting moonlight”. M41 lies some 2,300 light years away and is estimated to hold some 100 stars in a cluster around 26 light years across.

NGC 1647 - The Crab Cluster (Taurus)

With Taurus dominated by the Pleiades and the Hyades, its lesser known clusters are very often overlooked. Gary Seronik termed NGC 1647 the Crab Cluster when he observed it from a beach and was no doubt deep in crustacean thought. To locate it find Aldebaran and Ain which form the top of the head of Taurus, and NGC 1647 lies at right angles to these forming a tip of a triangle.

I spotted it in my 8” reflector some 5 years ago at Kelling Heath and was less inspired: “Diffuse at 40x, bright star at upper left, with cluster members in a wedge shape with a curved handle.” You cannot be less crab-like if you tried. Maybe it is better in binoculars, or, the more likely reason, Gary was very unlikely to be observing from the UK!

M35 (Gemini)

If I had to sum up M35 in a single phrase, I think I’d say “visual bliss”. It truly is one of the loveliest open clusters in the sky. Packed with stars, it is easy to find in binoculars, but point a small telescope to it and you can trace myriads of patterns and chains of stars.

Whilst observing M35, have a go at seeing if you can pick up NGC 2158, its fainter companion. A dark, moonless night is required, along with steady, mounted binoculars. NGC 2158 appears as a very dim, hazy glow on the south western edge of M35 and as it is on the borders of binocular visibility, if you can see it then you have met the challenge!

To locate M35, look eastwards at around 21:00 to 22:00 and locate Castor and Pollux in Gemini. Using Pollux as your guide, sweep down Pollux's edge and down the "leg" and M35 is the football at the end.

M50 (Monoceros)

Monoceros is a constellation often overlooked in favour of its brighter neighbour Orion, but it contains some amazing objects, the most famous being the Rosette Nebula, Hubble's Variable Nebula and for binoculars a host of open clusters from the NGC catalogue. The only Messier object it contains is M50, also known as the Heart Cluster.

M50 was spotted by Messier in 1774 and is located by taking a line from Sirius to Procyon and the cluster lies around one third of the way along. It is a while since I looked at M50, but looking at photos I can't quite make out the heart shape; have a look yourself and let us know what you saw.

M34 (Perseus)

M34 has been describes as a "true binocular cluster" as it defeats poor skies, even if it is low down. Gary Seronik in his book "Binocular Highlights" recounts how he saw this cluster low down in June 2000, whilst searching for Comet Linear. "Despite the clusters low altitude and the brightness of my suburban backyard M34 looked great - the comet didn't fare so well!" he writes.

To find M34, take a line from Almach through to Algol and the cluster lies approximately half way along this line.

Galaxies

Spring is galaxy season so to get you started how about the pair below?

M81 and M82 (Ursa Major)

This well-known pair of galaxies are probably the Messier catalogue's most conspicuous, after Andromeda of course. Riding high in the north, they can be found in 10 x 50 binoculars, whilst 15 x 70 gives a little more contrast.

To find them, locate the Plough and take a line through Phad and Dubhe and extend it the same distance as between the two stars. M81 and 82 lie at the end of this line.

Asterisms

Asterisms are a pattern of stars, occurring purely by chance, which form a recognisable shape. This month we will find two - one probably the most famous of all and another which is easy to find in a watery constellation!

Cosmic Question Mark (Cetus)

Cetus is most well-known for the variable star Mira, but the attraction for me is the asterism the "Cosmic Question Mark"; easily visible in 10 x 50 binoculars, it looks exactly what it is.

To locate the Cosmic Question Mark, first we have to locate Cetus; take a straight line through the bottom two stars of Orion (Saiph and Rigel) and keep on going until you are underneath the bottom of Taurus; pause now and look for the six-sided circlet which is the tail of Cetus. Scan your binoculars around this area and seek the Cosmic Question Mark!

Kemble's Cascade (Camelopardalis)

One of the most famous asterisms, but perhaps not often located by the beginner is Kemble's Cascade. This is probably due in part to it being in one of the faintest constellations in our sky, Camelopardalis. However, with a little judicious navigation it is not that hard to find, especially in February as it is well placed for early evening viewing.

Facing east, start by identifying the star Capella in the constellation Auriga. Now imagine a line drawn from Capella to the tip of the W in Cassiopeia. Aim your binoculars roughly half way across and scan down gently from this point and you ought to be able to pick up the Cascade as a "beautiful cascade of faint stars". At the end of the cascade, see if you can pick out a small smudge of light - this is the open cluster NGC 1502

Nebula

The most obvious nebula is the Orion Nebula, but how about its neighbour in Monoceros?

NGC 2237 (Rosette Nebula)

I have seen the Rosette Nebula with the 8" from Lacock and Devon, but I have to confess not with binoculars (yet). The nebula (NGC 2237) surrounds the open cluster NGC 2244. Most binocular guides state that "under pristine skies it appears as a faint, nebulous haze surrounding the cluster".

To locate the nebula, take a line from the top star of Orion (Meissa) down through Betelgeuse and you will find the nebula and cluster around a quarter of the way along the line heading towards Procyon.

So, a few ideas for February targets. Finder charts will be on the website so you have the targets, the charts and the optical weapons - now go hunt!

Jonathan Gale

SPACE NEWS

Iridium to share Falcon 9 launch with NASA-German gravity satellites

February 6, 2017 Stephen Clark

The first 10 Iridium Next satellites launched Jan. 14 on a Falcon 9 rocket from Vandenberg Air Force Base, California. Credit: SpaceX

Iridium has secured a launch for five more of its next-generation communications craft in a rideshare arrangement with two U.S.-German research satellites aboard a SpaceX Falcon 9 rocket by early 2018.

The announcement Jan. 31 came two-and-a-half weeks after the first 10 Iridium Next satellites lifted off on a Falcon 9 booster from Vandenberg Air Force Base in California. Another 10 spacecraft are scheduled for launch on a Falcon 9 flight in April.

Iridium will share the Falcon 9's lift and volume capacities on the newly-announced mission — also due to launch from Vandenberg — with two gravity research probes jointly developed by NASA and the German Research Center for Geosciences, or GFZ, of Potsdam, Germany.

The twin research satellites will replace the Gravity Recovery and Climate Experiment — GRACE — spacecraft in orbit since March 2002. The GRACE-Follow On, or GRACE-FO, satellites are being built and tested in Germany by Airbus Defense and Space.

NASA's Jet Propulsion Laboratory is responsible for the overall mission — valued at nearly $400 million — and pays for the construction of the two GRACE-FO spacecraft and a microwave instrument, the centerpiece of the satellites' science payload.

The German government and GFZ are in charge of part of the science payload and arranging launch services for the GRACE-FO mission, roughly one-quarter of the project's overall cost.

The identical GRACE-FO satellites will launch into a polar orbit around 300 miles (500 kilometers) above Earth, and fly around the planet in formation separated by 137 miles (220 kilometers). The microwave ranging instrument will track the distance between the two spacecraft with a precision of 0.002 millimeters, a fraction of the width of a human hair.

Changes in the range between the satellites will tell scientists about the strength and lumpiness of Earth's gravity field, allowing the ground team to produce a global gravity map every 30 days through the mission's expected five-year lifetime.

GRACE's data archive aids studies of earthquakes and other seismic activity, ocean currents and glaciers, and the structure of Earth's interior.

"GRACE-FO will continue GRACE's legacy of tracking changes in the distribution of Earth's mass over time by creating monthly maps of Earth's gravity field," said Frank Flechtner, project manager of the mission at GFZ. "GRACE is improving our understanding and knowledge of a variety of important Earth system processes such as the terrestrial water cycle and changes in ice sheets, glaciers and sea level or surface and deep-ocean currents. These climate change related measurements provide a unique view of the Earth system and have far-reaching benefits to society."

The original GRACE satellites are low on fuel, and could run out of propellant as soon as this summer, around the time the follow-on craft were originally scheduled for liftoff, according to GFZ.

GFZ and NASA agreed in 2013 to launch the satellites on a Russian-Ukrainian Dnepr rocket provided by Kosmotras in August 2017, but that program's future is in doubt after relations between the two partner countries deteriorated following Russia's annexation of Crimea in 2014.

Iridium also booked two satellites to launch on a separate Dnepr rocket, but the Virginia-based communications company is no longer counting on the converted Soviet-era missile's availability for the mission.

The indefinite grounding of Dnepr left Iridium and GFZ looking for an alternate ride.

Iridium said the rideshare launch with SpaceX offered a "particularly compelling economical solution" through cost-sharing with GFZ.

File photo of 10 Iridium Next satellites before encapsulation inside the Falcon 9 rocket's payload fairing. Each tier of the two-part dispenser holds five satellites. Credit: Iridium

"This is a very smart way to get additional Iridium Next satellites into orbit," said Matt Desch, CEO at Iridium. "This launch provides added resiliency to our network for not much more than we had planned originally to launch 72 satellites, including two with Kosmotras.

"We are pleased to be sharing a rocket with NASA and GFZ German Research Center for Geosciences for this additional SpaceX launch, and GFZ has been a great business partner throughout this process," Desch said in a statement.

Iridium said it will consider future launches with Kosmotras's Dnepr rocket "once approvals are available."

Financial terms of the rideshare SpaceX launch contract were not disclosed.

GFZ said the agreement with SpaceX calls for a launch between December 2017 and February 2018.

Iridium's satellite contractors — Thales Alenia Space and Orbital ATK — are building 81 spacecraft for the new-generation fleet, which replaces the company's aging satellites in orbit since the late 1990s. Iridium booked seven Falcon 9 launches with SpaceX in 2010 — enough to put 70 satellites into orbit — and the latest contract adds five more to that number.

Launch arrangements for the remaining six satellites, considered ground spares, will be announced at a later date. Desch has said previously that Iridium intends to eventually launch all 81 of the satellites.

Iridium's network requires 66 satellites in space spread out in six orbital planes. The rest of the satellites launched will be stored in orbit.

Airbus Defense and Space is building a multi-satellite adapter to accommodate the dual-launch, according to GFZ.

SpaceX builds the dispenser for the Iridium satellites.

Planet acquires rival satellite company from Google

February 6, 2017 Stephen Clark

One of Terra Bella's SkySat satellites captured this image of downtown San Francisco on Dec. 27. Credit: Planet/Terra Bella

San Francisco-based Planet, a company with a fleet of miniature satellites in orbit looking down on Earth, has acquired Terra Bella from Google to add high-resolution imaging to its business portfolio.

The financial terms of the transaction were not disclosed in Friday's announcement.

Officials said the addition of Terra Bella, rumored since December, will strengthen Planet's capabilities, enabling continued growth and complementing the company's existing globe-spanning satellite constellation.

"As part of this agreement, a number of Terra Bella employees will join Planet to continue their great work within our combined organization," wrote Will Marshall, co-founder and CEO of Planet, in a blog post on the company's website. "We're honored and pleased to welcome Terra Bella to the Planet family and look forward to working with the Google team."

Planet also announced Friday it plans to launch 88 shoebox-sized CubeSats on an Indian Polar Satellite Launch Vehicle later this month, the most spacecraft a company has ever sent into orbit on a single mission. The PSLV will loft 104 satellites in total, setting a record for the largest number of payloads on a single rocket.

Google purchased Terra Bella — then known as Skybox Imaging — in 2014 for $500 million in a bid to rapidly refresh imagery used in Google Maps, which previously relied on pictures from larger Earth observation satellites owned by DigitalGlobe. At the time of the 2014 transaction, Google said the purchase of Skybox Imaging could also infuse small satellite expertise into the tech giant's plans for a large space-based network to provide worldwide Internet service.

Artist's concept of four 242-pound (110-kilogram) SkySat satellites launched in September 2016. Credit: Terra Bella

In early 2015, Google and Fidelity Investments made a $1 billion investment in SpaceX to support that company's satellite business, which eyes the deployment of more than 4,000 spacecraft in orbits around 800 miles (1,300 kilometers) above Earth to beam broadband Internet signals to customers on the ground.

Officials announced Friday that Google has agreed to enter into a multi-year contract to purchase Earth-imaging data from Planet upon closing of the acquisition, which is subject to "customary closing conditions," including regulatory approvals in the United States.

Founded in 2009 with a business plan devised in a Stanford University entrepreneurship course, Skybox Imaging manufactured its first two satellites with an in-house engineering team. The company licensed the construction of follow-on spacecraft to Space Systems/Loral of Palo Alto, California.

Renamed Terra Bella last year, the company has seven SkySat satellites in orbit providing high-resolution "sub-meter" imagery of locales around the world. The SkySat fleet includes four satellites launched in September aboard an Arianespace Vega rocket, and six more SkySat craft are scheduled for launch in mid-2017 on an Orbital ATK Minotaur-C booster, each capable of resolving objects on the ground as small as 3 feet (less than 1 meter) in size.

"From the start, Planet and Terra Bella have shared similar visions and approached aerospace technology from a like-minded position, and while our on-orbit assets and data are different, together we bring unique and valuable capabilities to users," said John Fenwick, Terra Bella's co-founder. "Planet and Terra Bella together enables the continuation of our mission and makes for an ever-stronger business."

Planet says it has around 60 satellites in orbit, primarily comprised of modified CubeSats released from the International Space Station after launching inside visiting robotic supply ships. Planet also owns the five-satellite RapidEye constellation after buying the spacecraft and their owner, Blackbridge Ltd. of Berlin, Germany, in 2015.

File photo of two Planet CubeSats released from the International Space Station in May 2016. Credit: NASA

Marshall wrote that the SkySat fleet is "highly complementary" with Planet's satellites.

The SkySat satellites "enable regular, rapidly updated snapshots of select areas of the globe at sub-meter resolution," Marshall wrote, while the Planet fleet offers "regular, global coverage at 3-5 meter (10-16 foot) resolution."

"The two systems under one roof will be truly unique and will enable valuable new capabilities," he wrote.

The SkySat and Planet satellites cannot match the sharpness of Earth imagery collected by larger, more expensive satellites owned by DigitalGlobe. But examples of differentiation include the SkySat birds' ability to record high-definition video from orbit — with enough resolution to see cars moving on city streets — and the Planet fleet's strength in numbers, allowing the capture of medium-resolution images of the entire planet every day.

Planet will take charge of distributing and selling Terra Bella's imagery, helping the company reach new customers and mar-

kets, Marshall wrote.
“When we thought about a company that shares Terra Bella’s passion and strengths in high frequency satellite imaging, Planet was a natural home,” said Jen Fitzpatrick, vice president of product and engineering at Google. “Terra Bella has accomplished a lot in the past two years — including the design and launch of five more satellites. We’re excited to see what’s ahead for Terra Bella, and look forward to being a long-term customer.”

Japanese cargo ship ends mission after space debris experiment flounders

February 6, 2017
Japan’s HTV supply ship fell to Earth on Sunday more than a week after leaving the International Space Station, burning up in the atmosphere after officials gave up on an experiment looking into ways to remove space junk from orbit.

Russia recalls rocket engines, grounding Proton missions until spring

February 3, 2017 The Russian government is investigating flaws found in Proton rocket engines, ordering all suspect components to be replaced before the heavy-lift booster can resume launches and promising penalties for those responsible for allowing substandard parts to slip through inspection.

SpaceX rocket tagged for reuse test-fired in Texas

February 3, 2017
The Falcon 9 first stage booster assigned to launch as soon as March on SpaceX’s first mission with a previously-flown rocket has been test-fired at the company’s development facility in Central Texas.

WorldView 4 high-resolution satellite now open for business in space

February 3, 2017 Justin Ray

The launch of WorldView 4 as seen from space by WorldView 2. Credit: DigitalGlobe
Less than three months after rocketing into space, the commercial WorldView 4 Earth-imagery satellite has finished in-orbit testing and calibration to begin operations for DigitalGlobe.
To commemorate the milestone, the company has released a stunning image taken from space of the United Launch Alliance Atlas 5 blasting off with WorldView 4 on Nov. 11 from Vandenberg Air Force Base, California.
The picture was snapped by WorldView 2, which launched from the same base atop a Delta 2 booster in 2009. The image was captured as WorldView 2 was 396 miles (637 km) northeast of Vandenberg and 38 degrees off-nadir, according to DigitalGlobe.
At the moment the image was taken, the Atlas 5 was powering away from the Space Lauch Complex 3-East pad on 860,000 pounds of thrust.
Just 19 minutes later, the rocket released WorldView 4 into a sun-synchronous orbit to circle the planet every 97 minutes and join DigitalGlobe’s fleet of high-resolution observatories.
WorldView 4 is the new companion to WorldView 3, effectively doubling the amount of best-on-the-market imagery with unmatched 30-cm resolution.
WorldView 3 is booked by U.S. government contracts.
WorldView 4 will enable DigitalGlobe sales to foreign allies and commercial uses like agriculture, mining, land developers and oil and gas firms.
“Meeting our commitment to delivering WorldView 4 access on time for our customers is a tremendous achievement,” said Tim Hascall, DigitalGlobe EVP and chief operations officer.

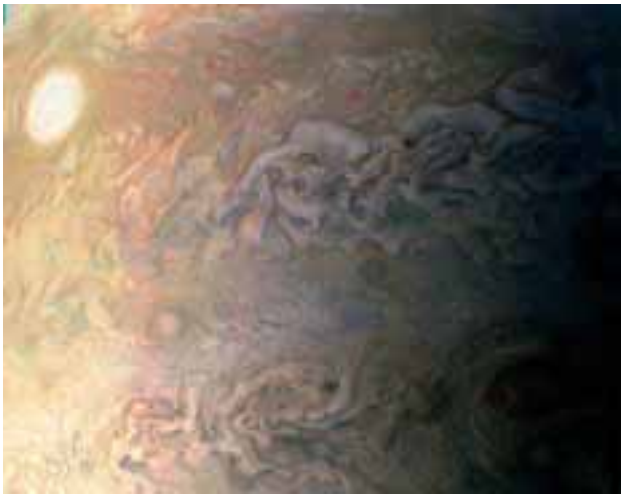
"We look forward to making WorldView 4's capabilities available to all of our customers, helping them to make critical decisions with confidence for many years to come."

WorldView 4 image of the Subi Reef in the South China Sea. Credit: DigitalGlobe
See full image here.

From its orbit 383 miles (617 km) high, WorldView 4 is designed to see objects as small as 1-foot-wide (31 cm) in panchromatic mode and has a color capability with 4-foot resolution (1.24 m). It will image 263,000 square miles (680,000 square km) of the Earth's surface per day.
"Imagery with this level of detail enables users to reliably read street markings, distinguish between cars, trucks and vans, and confidently understand activities of significance," DigitalGlobe says.
The craft uses the Global Positioning System satellite network and onboard star trackers to determine its precise location in orbit relative to the spot on Earth being observed. The imaging options include shooting targeted scenes, large-area collections or long, narrow strips of land.
Built by Lockheed Martin, WorldView 4 stands 18 feet (5.5 meters) tall and has a wingspan of 26 feet (8 meters) with the five power-generating solar arrays extended.
Harris Corp., which built the camera system on WorldView 4, says the primary mirror was manufactured to an accuracy of 1/1000th of a human hair. It has an aperture of 3.6 feet (1.1 meters).
Control Moment Gyroscopes will enable superior agility for the satellite, allowing it to slew in just 10.6 seconds from one target to another 125 miles (200 km) away.
It features a 3200-Gb solid state onboard storage capability and will communicate with the ground via X-band for data transmissions and S-band for control functions.

Juno dives over Jupiter's cloud tops with main engine still offline

February 2, 2017 Stephen Clark



This amateur-processed image was taken on Dec. 11, 2016, at 9:27 a.m. PST (12:27 p.m. EST), as NASA's Juno spacecraft performed its third close flyby of Jupiter. Credits: NASA/JPL-Caltech/SwRI/MSSS/Eric Jorgensen
NASA's Juno spacecraft made a high-speed pass less than 3,000 miles over Jupiter's turbulent clouds Thursday, taking dozens of pictures, measuring radiation and plasma waves, and peering deep inside the planet's atmosphere, but officials still have not cleared the orbiter's main engine for a planned maneuver to position the probe in its intended science orbit.
As Juno prepared for Thursday's encounter, managers weighed whether to cancel an engine burn originally scheduled for October to reshape the craft's orbit.
The solar-powered spacecraft made its closest approach about 2,670 miles (4,300 kilometers) over Jupiter's cloud tops at 1257 GMT (7:57 a.m. EST) Thursday. NASA said all of Juno's science instruments and its JunoCam color camera were operating during the flyby, and the data is being returned to Earth.
Juno zipped by Jupiter at a relative velocity of about 129,000 mph (57.8 kilometers per second), approaching the planet over its north pole and departing over the south pole, according to NASA.
For the first time, the Juno team solicited votes from the public to select all the pictures the JunoCam camera would take during the flyby.
Participants on the mission's web site will be able to vote on which points of interest on Jupiter they want imaged by JunoCam on each future encounter. Once the raw images are back on Earth, the data will be posted online for interested members of the public to do their own processing.
Thursday's close flyby, called a perijove, was the fourth time Juno has come so close to Jupiter since the probe arrived in orbit July 4. Two of the previous perijove encounters — on Aug. 27 and Dec. 11 — have yielded science data, giving researchers a taste of the harsh environment surrounding the planet.

Artist's concept of the Juno spacecraft. Credit: NASA/JPL-Caltech
The data haul from the $1.1 billion mission so far shows that Jupiter's magnetic field and auroras are bigger than expected, and the belts and zones seen at the top of the planet's clouds extend deep into the atmosphere, according to NASA.
A pair of problems thwarted manager's plans during Juno's Oct. 19 close approach.
The original flight plan called for Juno to fire its main engine Oct. 19 to send the spacecraft into a tighter 14-day orbit around Jupiter. Juno currently takes about 53 days to complete one orbit.
But ground controllers discovered a potential problem with two check valves in the spacecraft's propulsion system less than a week before the scheduled engine burn. The valves are part of the spacecraft's helium pressurization system, and they took several minutes to open after receiving commands, when they should have taken only a few seconds.
The behavior of the valves led managers to postpone the Oct. 19 engine burn to study the problem, and researchers hoped to use the flyby to collect science data from Juno's nine instruments, comprising 29 individual sensors.

An unexpected computer reboot just before the perijove shut down Juno's science instruments. The spacecraft safely made the passage by Jupiter, but it gathered no data.
Scott Bolton, Juno's principal investigator, said in October that the mission can still obtain its intended measurements from the 53-day orbit. The prime time for Juno's observations of Jupiter come when the spacecraft is closest to the planet, and the probe will still pass through that region on each orbit.
But the science opportunities will come less frequently, just once every 53 days instead of once every two weeks.
"We can obtain all of the science goals of Juno even if we stay in a 53-day orbit," said Bolton, a scientist based at the Southwest Research Institute in San Antonio. "Each pass has the same value that a 14-day orbit would have had. We were changing to 14 days primarily because we wanted the science faster, but there was no requirement to do that."
"Shortening the orbit gets the science faster but it is not improved," Bolton wrote in an email to Spaceflight Now on Friday. "The larger orbit is better science. "
One factor limiting Juno's lifetime around Jupiter is the spacecraft's radiation exposure. The spacecraft only flies through Jupiter's intense radiation belts just before and after each perijove, and Bolton said in October that keeping Juno in its current orbit will not affect the radiation dose on each flyby, but it will spread out the overall exposure over a longer period of time.
Juno's original flight plan called for the mission to complete 32 of the 14-day science orbits before the spacecraft was to be intentionally crashed in Jupiter's thick atmosphere in February 2018. That outline is now being re-evaluated with the delay in Juno's orbital adjustment.
Juno's next low-altitude flyby of Jupiter will come March 27.

A Black Hole's Record Breaking Lunch

by Nancy Atkinson
Does a distant black hole provide a new definition of pain and suffering?
The black hole, named XJ1500+0154, appears to be the real-life equivalent of the Pit of Carkoon, the nesting place of the all-powerful Sarlacc in Star Wars, which slowly digested its victims.
Over ten years ago, this giant black hole ripped apart a star and has since continued a very long lunch, feasting on the stars' remains. Astronomers have been carefully monitoring this slow 'digestion,' because it is so unusual for what are called tidal disruption events (TDEs), where tidal forces from black holes tear stars apart.
"We have witnessed a star's spectacular and prolonged demise," said Dacheng Lin from the University of New Hampshire in Durham, New Hampshire, who led the observations of this event. "Dozens of tidal disruption events have been detected since the 1990s, but none that remained bright for nearly as long as this one."

This artist's illustration depicts what astronomers call a "tidal disruption event," or TDE, when an object such as a star wanders too close to a black hole and is destroyed by tidal forces generated from the black hole's intense gravitational forces. (Credit: NASA/CXC/M.Weiss.
This decade-long feast has gone on ten times longer than any other observed TDE.
XJ1500+0154 is located in a small galaxy about 1.8 billion light years from Earth, and three telescopes have been monitoring this X-ray event: the Chandra X-ray Observatory, the Swift satellite, and the XMM-Newton.
TDEs are different from another, more common black-hole related source of X-rays in the galaxy, active galactic nuclei (AGN). Like the digestion of the Sarlacc, AGNs really can last for thousands of years. These are supermassive black holes at the center of galaxies that pull in surrounding gas and "emit copious amounts of radiation, including X-rays," explained Lin in a blog post on the Chandra website. "Radiation from AGNs do not vary a lot because the gas surrounding them extends over a large scale and can last for tens of thousands of years."
In contrast, TDEs are relatively short-lived, lasting only a few months. During a TDE, some of the stellar debris is flung outward at high speeds, while the rest falls toward the black hole. As it travels inwards to be consumed by the black hole, the material heats up to millions of degrees, generating a distinct X-ray flare.
XJ1500+0154 has provided an extraordinarily long, bright phase, spanning over ten years. Lin and his team said one explanation could be the most massive star ever to be completely torn apart during a TDE.
"To have the event last so long at such high luminosity requires full disruption of a relatively massive star, about twice the mass of the sun," Lin wrote; however, "disruption of such massive stars by the SMBH is very unlikely because stars this massive are rare in most galaxies, unless the galaxy is young and actively forming stars, as in our case.
So, another more likely explanation is that this is the first TDE observed where a smaller star was completely torn apart.
Lin also said this event has broad implications for black hole physics.

An X-ray image of the full field of view by of the region where the 'tidal disruption event' is taking place. The purple smudge in the lower right shows the disruption from the black hole XJ1500+0154. Credit: X-ray: NASA/CXC/UNH/D.Lin et al.
"To fully explain the super-long duration of our event requires the application of recent theoretical progress on the study of TDEs," he wrote. "In the last two years, several groups independently found that it can take a long time after the disruption of the star for the stellar debris to settle onto the accretion disk and into the SMBH. Therefore, the event can evolve much more slowly than previously thought."
Additionally, the X-ray data also indicate that radiation from material surrounding this black hole has consistently surpassed what is called the Eddington limit, which is defined as

a balance between the outward pressure of radiation from the hot gas and the inward pull of the gravity of the black hole.
Seeing evidence of such rapid growth may help astronomers understand how supermassive black holes were able to reach masses about a billion times higher than the sun when the universe was only about a billion years old.
“This event shows that black holes really can grow at extraordinarily high rates,” said co-author Stefanie Komossa of QianNan Normal University for Nationalities in Duyun City, China. “This may help understand how precocious black holes came to be.”
Lin and his team will continue to monitor this event, and they expect the X-ray brightness to fade over the next few years, meaning the supply of ‘food’ for this long lunch will soon be consumed.
For further reading:
Paper: A likely decade-long sustained tidal disruption event
Lin’s blog post on the Chandra website
Chandra press release

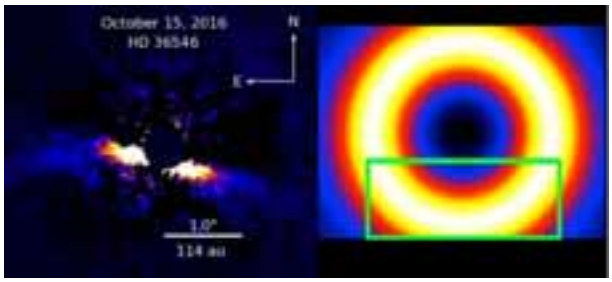
The Race To Image Exoplanets Heats Up!

by Matt Williams
Thanks to the deployment of the Kepler mission, thousands of extrasolar planet candidates have been discovered. Using a variety of indirect detection methods, astronomers have detected countless gas giants, super Earths, and other assorted bodies orbiting distant stars. And one terrestrial planet (Proxima b) has even been found lurking in the closest star system to Earth – Proxima Centauri.

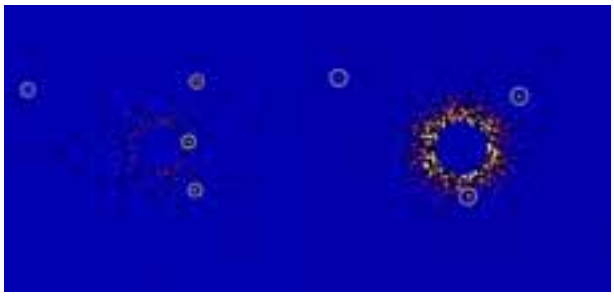
The next step, quite logically, is to observe these planets directly. Hence why the Subaru Coronagraphic Extreme Adaptive Optics (SCExAO) instrument was commissioned at the National Astronomical Observatory of Japan (NAOJ) in Mauna Kea, Hawaii. Designed to allow for the direct detection of planets around other stars, this instrument will help ensure that the Subaru Telescope remains on the cutting-edge of exoplanet hunting.
As of January 22nd, 2017, some 3,565 exoplanet candidates have been detected in 2,675 planetary systems, and over 2000 of these have been confirmed. However, as already noted, the vast majority of these have been detected by indirect means – generally through the measurement of a star’s radial velocity, or by measuring dips in a star’s luminosity as an exoplanet passes in front of it (i.e. the transit method).

The Subaru Telescope atop Mauna Kea. CHARIS works in conjunction with Subaru. Credit: Dr. Hideaki Fujiwara/NAOJ
Adaptive Optics, meanwhile, have allowed for the detection of exoplanets directly. When used in astronomy, this technology removes the the effects of atmospheric interference so that light from distant stars or planets can be seen clearly. Relying on experimental technology, the SCExAO was specifically designed and optimized for imaging planets, and is one of several newly-commissioned extreme AO instruments.
However, as Dr. Thayne Currie – a research associate at the NOAJ – indicated, the Observatories on Mauna Kea are particularly well suited to the technology. “Mauna Kea is the best place on this planet to see planets in other stellar systems,” he said. “Now, we finally have an instrument designed to utilize this mountain’s special gifts and the results are breathtaking.”

What makes the SCExAO special is that it allows astronomers the ability to image planets with masses and orbital separations that are similar to those in our own Solar System. So far, about a dozen planets have been detected directly using AO instruments, but these planets have all been gas giants with 4 to 13 times the mass of Jupiter, and which orbit their stars at distances beyond that of Neptune from our Sun.
This improved imaging capacity is made possible by the SCExAO’s ability to compensate for atmospheric interference at a faster rate. This will enable the Subaru Telescope to be able to capture far images of distant stars that are sharper and subject to less glare. And astronomers will be able to discern the presence of fainter objects that are circling these stars – i.e. exoplanets – with greater ease.



The debris disk detected around a young star HD 36546 using SCExAO/HiCIAO (left, seen nearly edge-on) and its model (right, viewed face-on). Credit: NAOJ
The first discovery made with the SCExAO, took place back in October of 2016. At the time, the Subaru telescope had detected a debris disk around HD 36546 – a 2 solar-mass star in the direction of the Taurus constellation – which appeared almost edge on. Located about twice as far from HD 36546 as the Kuiper Belt is from our Sun, this disk is believed to be the youngest debris disk ever observed (3 to 10 million years old).
This test of the SCExAO not only revealed a disk that could be critical to studying the earliest stages of icy planet formation, but demonstrated the extreme sensitivity of the technology. Basically, it allowed the astronomers conducting the study to rule out the existence of any planets in the system, thus concluding that planetary dynamics played no role in sculpting the disk.
More recently, the SCExAO instrument managed to directly detect multiple planets in the system known as HR 8799, which it observed in July of 2016. Prior to this, some of the systems four planets were spotted by surveys conducted using the Keck and the Subaru telescope (before the SCExAO was incorporated). However, these surveys could not correct for all the glare coming from HR 8799, and could only image two of three of the planets as a result.
A follow-up was conducted in the Fall of 2016, combining data from the SCExAO with that obtained by the Coronagraphic High Angular Resolution Imaging Spectrograph (CHARIS). This resulted in even clearer detection of the system’s inner three planets, not to mention high-quality spectrographic data that could allow researchers to determine the chemical compositions of their atmospheres.



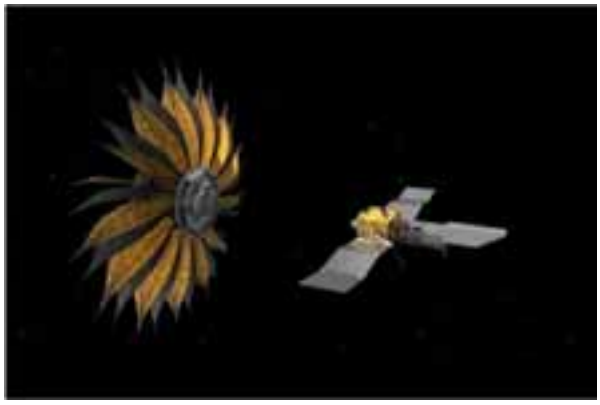
The star and multiple planet system HR 8799 imaged using the SCEAO and the HiCIAO camera (left) and the Keck facility AO system coupled with the NIRC2 camera (right). Credit: NAOJ

As Dr. Olivier Guyon, the head of the SCExAO project, explained, this is a major improvement over other AO surveys. It also presents some major advantages when it comes to exoplanet hunting. “With SCExAO, we know not only the presence of a planet but also its character such as whether it is cloudy and what molecules it has, even if that planet is tens of trillions of miles away.”

Looking at the year ahead, the SCExAO is scheduled to undergo improvements that will allow it to detect planets that are 10 to 10o times fainter than what it can right now. The CHARIS instrument is also scheduled for additional engineering tests to improve its capabilities. These improvements are also expected to be incorporated into next-generation telescopes like the Thirty Meter Telescope – which is currently under construction at Mauna Kea.

Other recently-commissioned extreme AO instruments include the Gemini Planet Imager (GPI) at Gemini Observatory on its telescope in Chile, the Spectro-Polarimetric High-contrast Exoplanet Research (SPHERE) on Very Large Telescope (VLT) in Chile, and the AO system on the Large Binocular Telescope (LBT) in Arizona. And these are only some of the current attempts to reduce interference and make exoplanets easier to detect.

For instance, coronagraph are another way astronomers are attempting to refine their search efforts. Consisting of tiny instruments that are fitted inside telescopes, coronagraphs block the incoming light of a star, thus enabling telescopes to spot the faint light being reflected from orbiting planets. When paired with spectrometers, scientists are able to conduct studies of these planet’s atmospheres.



An artist’s illustration of the Starshade deployed near its companion space telescope. Credit: NASA

And then you have more ambitious projects like Starshade, a concept currently being developed by Northrop Grumman with the support of NASA’s Jet Propulsion Laboratory. This concept calls for a giant, flower-shaped screen that would be launched with one of NASA’s next-generation space telescopes. Once deployed, it would fly around in front of the telescope in order to obscure the light coming from distant stars.

The era of exoplanet discovery loometh! In the coming decades, we are likely to see an explosion in the number of planets were are able to observe directly. And in so doing, we can expect the number of potentially habitable exoplanets to grow accordingly.

Further Reading: NAOJ/Subaru Telescope

Meteorite Confirms 2 Billion Years of Volcanic Activity on Mars

by Evan Gough

Mars is renowned for having the largest volcano in our Solar System, Olympus Mons. New research shows that Mars also has the most long-lived volcanoes. The study of a Martian meteorite confirms that volcanoes on Mars were active for 2 billion years or longer.

A lot of what we know about the volcanoes on Mars we’ve learned from Martian meteorites that have made it to Earth. The meteorite in this study was found in Algeria in 2012. Dubbed Northwest Africa 7635 (NWA 7635), this meteorite was actually seen travelling through Earth’s atmosphere in July 2011.

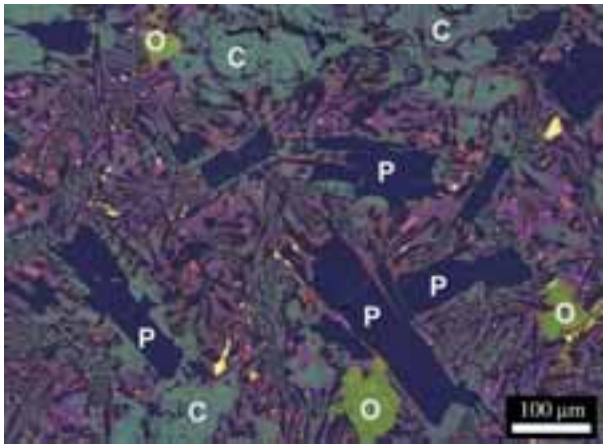
A sample from the meteorite Northwest Africa 7635. Image: Mohammed Hmani

The lead author of this study is Tom Lapen, a Geology Professor at the University of Houston. He says that his findings provide new insights into the evolution of the Red Planet and the history of volcanic activity there. NWA 7635 was compared with 11 other Martian meteorites, of a type called shergottites. Analysis of their chemical composition reveals the length of time they spent in space, how long they’ve been on Earth, their age, and their volcanic source. All 12 of them are from the same volcanic source.

Mars has much weaker gravity than Earth, so when something large enough slams into the Martian surface, pieces of rock are ejected into space. Some of these rocks eventually cross Earth’s path and are captured by gravity. Most burn up, but some make it to the surface of our planet. In the case of NWA 7635 and the other meteorites, they were ejected from Mars about 1 million years ago.

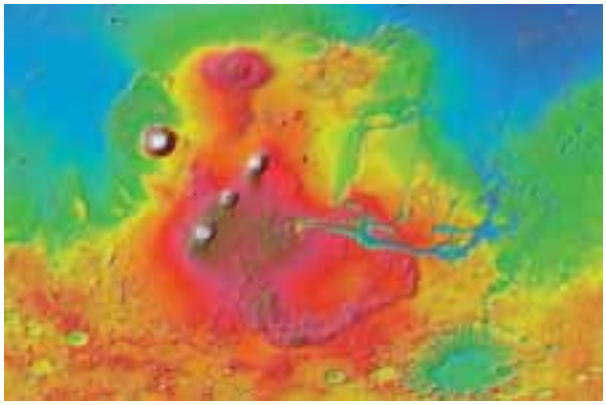
“We see that they came from a similar volcanic source,” Lapen said. “Given that they also have the same ejection time, we can conclude that these come from the same location on Mars.”

Taken together, the meteorites give us a snapshot of one location of the Martian surface. The other meteorites range from 327 million to 600 million years old. But NWA 7635 was formed 2.4 billion years ago. This means that its source was one of the longest lived volcanoes in our entire Solar System.



This false color X-ray of NWA 7635 shows the meteorite’s mineralogy mineral textures. O, olivine; P, plagioclase (maskelynite); C, clinopyroxene (augite). Chemical compositions: Fe (purple), Mg (green), Ca (blue), Ti (magenta), and S (yellow). Purple colors in the mesostasis represent Fe-rich augite. You’re welcome, mineral nerds. Image: Lapen et. al.

Volcanic activity on Mars is an important part of understanding the planet, and whether it ever harbored life. It's possible that so-called super-volcanoes contributed to extinctions here on Earth. The same thing may have happened on Mars. Given the massive size of Olympus Mons, it could very well have been the Martian equivalent of a super-volcano.
The ESA's Mars Express Orbiter sent back images of Olympus Mons that showed possible lava flows as recently as 2 million years ago. There are also lava flows on Mars that have a very small number of impact craters on them, indicating that they were formed recently. If that is the case, then it's possible that Martian volcanoes will be visibly active again.



A colorized image of the surface of Mars taken by the Mars Reconnaissance Orbiter. The line of three volcanoes is the Tharsis Montes, with Olympus Mons to the northwest. Valles Marineris is to the east. Image: NASA/JPL-Caltech/ Arizona State University
Continuing volcanic activity on Mars is highly speculative, with different researchers arguing for and against it. The relatively crater-free, smooth surfaces of some lava features on Mars could be explained by erosion, or even glaciation. In any case, if there is another eruption on Mars, we would have to be extremely lucky for one of our orbiters to see it.
But you never know.

Preleminary Results In NASA Twins Study Released

by Evan Gough
In 1996, something remarkable happened at NASA. Twin brothers Mark and Scott Kelly were accepted into NASA; Mark as a shuttle pilot, and Scott into technical operations on the ground, at least initially. Eventually, both brothers became astronauts. They are the only siblings to have both been in space.
Whether it was intentional or not, having twin brothers gave NASA an important opportunity. They could use one twin as a control group, and send the other on a prolonged mission into space. That allowed NASA to carry out important research on the effects of space travel on the human body.
In March 2016, Scott Kelly returned from a year long (340 days) mission aboard the International Space Station, while his brother Mark stayed on Earth. Genetic samples were taken from each brother before and after Scott's time aboard the ISS. Now, NASA has released the preliminary results of this unprecedented opportunity.

Expedition 46 Commander Scott Kelly of NASA is seen after returning to Ellington Field, Thursday, March 3, 2016 in Houston, Texas after his return to Earth the previous day. Kelly and Flight Engineers Mikhail Kornienko and Sergey Volkov of Roscosmos landed in their Soyuz TMA-18M capsule in Kazakhstan on March 1 (Eastern time).
NASA's Human Research Program did the study, and the results were released at their Investigator's Workshop on the week of January 23rd. The theme of that workshop was *A New Dawn: Enabling Human Space Exploration.* Though the studies are on-going, these initial results are interesting.
Omics
Mike Snyder, who is the Integrated Omics investigator, reported his findings. He found an altered level of lipids in Scott, the flight twin, which indicates inflammation. He also found increased 3-indolepropionic (IPA) in Mark, the ground twin. IPA is a potential brain antioxidant therapeutic, and also helps maintain normal insulin levels, to stabilize blood sugar after meals.
Telomeres and Telomerase
Telomeres and Telomerase are part of the chromosomal system in the human body. Susan Bailey reported that for Scott, the flight twin, the length of his white blood cell's telomeres increased while in space. Typically, they decrease as a person ages. Once on Earth, they began to shorten again. Telomerase, an enzyme that repairs telomeres, increased in both brothers in November, which could be related to a stressful family event at that time.

The Soyuz TMA-18M spacecraft is seen as it lands with Expedition 46 Commander Scott Kelly of NASA and Russian cosmonauts Mikhail Kornienko and Sergey Volkov in Kazakhstan on Wednesday, March 2, 2016. Photo Credit: (NASA/Bill Ingalls)
Cognitive Performance in Spaceflight
Mathias Basner is studying Cognitive Performance in Spaceflight, especially the difference in cognition between a 12-

month mission and a six-month mission. Though he found a slight decrease in speed and accuracy after the mission, he found no real difference in cognition between 6 month and 12 month missions.

Biochemistry

Scott Smith's investigation into biochemistry showed a decrease in bone density during the second half of Scott's mission. Scott also had increased levels of a biochemical marker for inflammation once he returned to Earth.

Microbiome in the Gastro-Intestinal Tract

Fred Turek reported preliminary results of his investigation into the bacteria in the GI (microbiome) tract that help digestion. There were many differences in the twins' biomes, but that was expected because of their different diets and environments. There were interesting differences in Scott's biome between his time in space and his time on the ground. The ratio between two dominant bacterial groups shifted during his flight time compared to his ground time.

Immunome Studies

Emmanuel Mignot investigated changes in the bodies of both twins before and after a flu vaccine was given. Both twins showed increased levels of T-cell receptors after the vaccine, which was the expected immune response.

Genome Sequencing

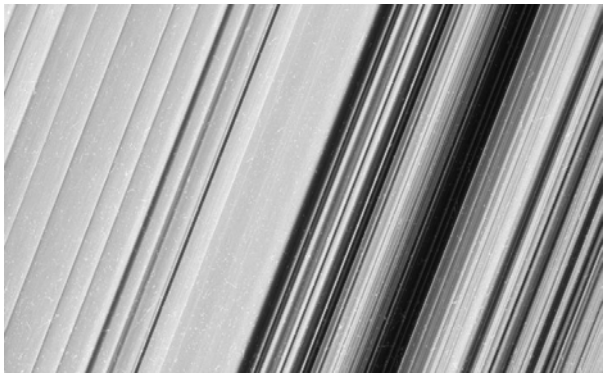
Chris Mason is performing Genome Sequencing on the DNA and RNA contained within the twins' white blood cells with his investigation. RNA sequencing showed that over 200,000 RNA molecules were expressed differently between the twins. Mason will look closer to see if a "space gene" could have been activated while Scott was in space.

Epigenomics

Andy Feinberg studies how the environment regulates our gene expression, which is known as epigenomics. Scott's white blood cell DNA showed decreased levels of chemical modification while in flight, and a return to normal once back on Earth. The same level in Mark (the ground twin) increased midway through the study, but then returned to normal. There was variability between the twins, called epigenetic noise. This noise was higher in Scott during his spaceflight, and returned to baseline levels once back on Earth. This could indicate that some genes are more sensitive to the changing environment of spaceflight than others.

There's a lot more research required to truly understand these results. Once they're looked at in coordination with other physiological, psychological, and technological investigations, the picture will become clearer. Later in 2017, there will be a joint publication of further results, as well as individual research papers.

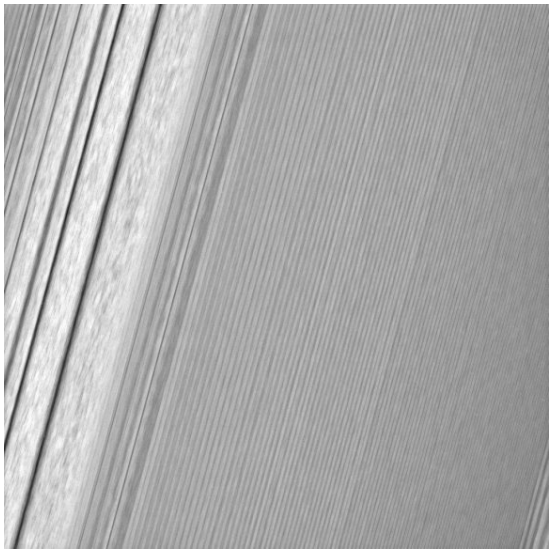
NASA's goal is to make space travel safer for astronauts, and to make missions more effective and efficient. With all the talk of missions to Mars in the next decade, these results are arriving at the perfect time.



This image shows a region in Saturn's outer B ring. NASA's Cassini spacecraft viewed this area at a level of detail twice as high as it had ever been observed before. And from this view, it is clear that there are still finer details to uncover. Credit: NASA/JPL-Caltech/Space Science Institute

Unprecedented Views of Saturn's Rings as Cassini Dances Death Spiral

by Nancy Atkinson



As the Cassini spacecraft moves ever closer to Saturn, new images provide some of the most-detailed views yet of the planet's spectacular rings. From its "Ring-Grazing" orbit phase, Cassini's cameras are resolving details in the rings as small as 0.3 miles (550 meters), which is on the scale of Earth's tallest buildings.

On Twitter, Cassini Imaging Team Lead Carolyn Porco called the images "outrageous, eye-popping" and the "finest Cassini images of Saturn's rings."

Project Scientist Linda Spilker said the ridges and furrows in the rings remind her of the grooves in a phonograph record. These images are giving scientists the chance to see more details about ring features they saw earlier in the mission, such as waves, wakes, and things they call 'propellers' and 'straw.'

This Cassini image features a density wave in Saturn's A ring (at left) that lies around 134,500 km from Saturn. Density waves are accumulations of particles at certain distances from the planet. This feature is filled with clumpy perturbations, which researchers informally refer to as "straw." Credit: NASA/JPL-Caltech/Space Science Institute

As of this writing, Cassini just started the 10th orbit of the 20-orbit ring-grazing phase, which has the spacecraft diving past the outer edge of the main ring system. The ring-grazing orbits began last November, and will continue until late April, when Cassini begins its grand finale. During the 22 finale orbits, Cassini will repeatedly plunge through the gap between the rings and Saturn. The first of these plunges is scheduled for April 26.

The spacecraft is actually close enough to the 'F' ring that occasionally tenuous particle strike Cassini, said project scientist Linda Spilker, during a Facebook Live event today. "These are very small and tenuous, only a few microns in size," Spilker said, "like dust particles you'd see in the sunlight. We can actually 'hear' them hitting the spacecraft in our data, but these particles are so small, they won't hurt Cassini."

MEMBERS VIEWING LOGS and IMAGES

Viewing Log for 2nd January

A New Year start with a clear cold sky (- 2 ° when I left my house), this meant I had to get outside and do some viewing! So after my last session with the Salisbury Plain Observing Group I was back at my old viewing site of Uffcott just south of Swindon off the A4361.

As I have been having trouble trying to look for some Caldwell (C) objects thru my 81 mm refractor I decided I needed more aperture to try and capture the dim light being given off by these objects? So this time I brought out my Williams Optics 98 mm doublet refractor on the Skywatcher EQ3-2 Pro mount. The scope weighs in at 6.75 kg, the maximum the mount can take has been suggested at 5.0 kg so I might be trying to carry too much on the mount? I paid special attention to balancing the scope with the mount and after I had done the star alignment everything seemed to be working okay? Only time will tell if the mount can take the extra weight of this scope!

I had everything set up and ready to roll by 20:28, first object of the night was going to be the moon as it was getting close to the western horizon, it looked okay to view thru the Pentax 10 mm WX eye piece, it showed a 20.5 % lit phase or 4.61 day old Moon. Not far away was Mars, this planet showed no details at all. As for Neptune, not a chance of seeing everything (I am using an f6.8 refractor which really is for deep sky objects and not the solar system!). Uranus looked like the pale blue dot which Cassini saw from Saturn looking back to the Earth, again nothing to see. So off to the Caldwell list and hopefully knock some off my viewing list, again C 24 (a galaxy) and C 27 (Crescent Nebula) would not be viewed (might have to get my 127 mm triplet refractor out to view these at a later date?). I thought I could see a very dim glow while trying to find the Veil Nebula (C 33 & 34), putting on a Deep Sky Filter the Witches Bloom part (C 34) finally gave itself up J. Back to my favourite Spiral Galaxies and C 48, this galaxy looked like a faint fuzzy blob (normal to me and galaxies!). C 50 was an Open Cluster (O C) in Monoceros, this O C was very loose to look at? My next object in C 54 yet another O C was very dim and very loose to look at! There was no moon light as it has set by now! C 58 was a dim and compact O C to look at in the constellation of Canis Major, my final object of the evening was C 64 yet again an O C and was very loose to look at! While I was looking at some Caldwell objects I had a camera running as the peak of the Quadrantids meteor shower was not far off. Of all the pictures I took I have yet to find one trail? It was now 22:14 and my equipment had a nice covering of frost on it as the temperature was – 4° C and my fingers had had enough so it was time to pack everything away and go home and dry everything off. I was surprised the glass lens had not been affected by the frost as the air was very dry?

Hopefully this year I will have more time out viewing the night sky but only time will tell.

As I keep records of my viewing logs I thought I would compare some of the notes from tonight and a refracting telescope against a SCT telescope while viewing the Herschel 400 list.

Caldwell Object	Refracting telescope	SCT
48 (Spiral Galaxy)	Faint Fuzzy Blob	Not impressed
50 (Open Cluster)	Loose	Nice
54 (Open Cluster)	Very dim/loose	Not impressed
58 (Open Cluster)	Dim compact (got a thumbs up in the notes!)	Good
64 (Open cluster)	Very loose	Nice

Comparing the results C 50, C 54 & C 58 looked better with the 8 inch SCT, the other two did nothing for me.

Peter Chappell

Viewing Log for 22nd of January

Recently I was reading the December edition of 'The Sky at Night' magazine and there was an article about 'The Treasures of Orion' which seemed pretty interesting to read? So the next time I went out viewing I would look at this constellation in better detail. It is normal for me to look at some objects in a constellation and then go on to something else!

I arrived at my usual viewing site at Uffcott and had everything set up and ready to start by 20:23, the equipment, as usual I was using the Meade eight inch LX 90 with a Pentax WX 14 mm eye piece attached, this would give a magnification of about 143. By now Neptune is too close to the sun for any viewing so my first target was Venus, shining a -4.4 magnitude (Mag) in the western sky it would be very hard to miss this object? It was starting to show a waning phase of about 40%, this will get less over the next couple of months but the planet will appear bigger to us as it comes to its inferior junction with Earth on the 25th of March. Not far away and in an 11 o'clock position from Venus was Mars, this planet is still hanging in the western sky many months after its superior conjunction with Earth. Uranus was not that far away from Mars but its viewing session is nearly finish until after its conjunction with the Sun later in the year.

Now on to my look at the constellation of Orion, normally I might look at the Messier (M) objects and maybe Betelgeuse or Rigel as alignment stars when doing my set ups of the telescope and that would be that! So I thought I would start with the main seven stars of the constellation: Betelgeuse (top left corner) is the Alpha star of the constellation even though it is not the brightest star, which goes to Rigel!

Star Designation	Position in Orion Type of Star		Mag	Bayer
Betelgeuse	Top left corner M, red supergiant	0.5	Alpha	
Rigel	Bottom right corner B, blue supergiant		0.1	Beta
Saiph	Bottom right corner B, blue star		2.0	Kappa
Alnilam	Middle belt B, blue supergiant	2.0	Epsilon	
Alnitak	Left belt O, blue supergiant	2.0	Zeta	
Bellatrix	top right corner	1.6	Gamma	B, blue supergiant
Mintaka	Right belt star B, blue giant	2.2	Delta	

When I looked at these stars during the evening they did look similar apart from Betelgeuse, after doing some research I found all the others where blue supergiant or blue giant stars. Now on to the M objects and as usual M42, the Great Orion nebula was brilliant as ever ☺, this area is producing new stars as I write this article and is about 1,500 light years from us? Next door, M43 did not look that bad but is sometimes over looked due to its bright neighbour? The other M object is M78, the brightest Reflection nebula (R N) in the sky and is lit by the star V351 Orionis, I have had trouble finding this object when I try and do the Messier marathon with non GOTO equipment even though it has good markers for its position in the night sky? This evening it looked like a fuzzy glow, could be mistaken for a comet hence it was put on Messier list?

Now on to the NGC objects which are not named for their fame! First object was NGC 2112, a loose and sparse Open Cluster (O C) to look at. The Flame nebula AKA NGC 2024 is an Emission nebula that is lit by the nearby star Alnitak (left belt star), I found it hard to make out, I knew something was

there but could not make out any detail at all maybe a filter would have helped? NGC 1662 has a 'C' shape of stars within this O C; it is very close to the border with Taurus and not far from the star Aldebaran. NGC 2022 is a Planetary nebula coming in at Mag 12.0 (which is about the limit for my telescope); it looked like an out of focus star? NGC 2169 is AKA as the '37 Cluster' as some of the stars within this O C has a resemblance to the numbers 3 & 7, think you need a bit of imagination to find these numbers! NGC 1999 is an R N and lit by the star V350, to me it looked like a fuzzy blob? NGC 1924 is a Barred Spiral Galaxy coming in at Mag 13.0 which I could not confirm whether I saw it or not, larger equipment would be required for that one? I knew the Horsehead nebula (IC421 or B33) would be a challenge, as it was I could not see it even with a Hydrogen Beta filter (required) attached to the eye piece!

That was it for the constellation of Orion thought I would have a go at some Caldwell (C) objects that I had not got from the winter sky. First object was C40; a Spiral galaxy in Leo, the galaxy looked like a faint fuzzy blob to me (usual for most of these galaxies in the sky!). As for the Rosette nebula (C49) in Monoceros I think I could make it out with the help of an OIII filter? In this area of sky there are five NGC's linked to the nebula, so it could be a bit confusing if you wish to see only one of them? There were no other C objects in the current sky that I have not ticked off so before I packed up I thought I would have a quick look at some of M objects around the Orion area. First object was M79 in Lupus; this is a bit of an odd ball as Globular clusters are normally to be found towards the Milky Way and not looking out of our galaxy? The O C in M41 just below Sirius looked good and it is not hard to find without GOTO equipment as it is about 4 ° below Sirius. Some other often overlooked M objects are M46 (a dim O C with lots of stars in it), M47 slightly brighter but more loose O C than M46 and M50, yet another O C which was nice to look at.

That was it for the evening; I had the gear packed up and ready to go home by 22:10, in the 105 minutes I was out viewing not a single car went past me☺, being a Sunday night might have helped?

Clear skies.

Peter Chappell

The Moon (through thin high cloud)

And Venus, similar conditions. Taken by Peter Chappell on 5th February.

Log January 2017
Tony Vale

76 variable star observations in January made it my second highest monthly total and brings the cumulative total to 1136. This was possible because of decent weather from the end of December through to the night of 24th January when I managed just one observation, with difficulty, in very poor conditions . That observation was of YZ Cancri an SU Ursa Majoris type of dwarf nova and the subject of a campaign organised through the AAVSO for researchers at the University of Southampton.

The Southampton team are seeking to organise observations of an entire outburst of a dwarf nova in wavelengths from X-ray to radio and are currently seeking suitable targets. During the autumn they observed RX Andromedae in X ray with the Chandra orbiting X-ray telescope (after seeking AAVSO assistance in triggering the observations) but found no evidence of X-ray emissions and they have now turned their attention to YZ Cnc. A superoutburst was expected over the Christmas period and the team were ideally targeting the first normal outburst after the superoutburst as the best chance of detecting X-rays using the Chandra telescope (see below for an explanation of normal and superoutbursts). I observed YZ Cnc at magnitude 12.3 at midnight on the night of 22nd - 23rd December and at magnitude 12.1 around 6.30am the following morning and raised an alert to warn that the superoutburst might be about to start. Subsequent observations confirmed that indeed it was a superoutburst and several observers in the US, the UK and Europe continued to follow the star over the Christmas period and into New year. Unfortunately, logistical problems meant that the observations were not triggered. The telescope then became unavailable for a time but is now back and YZ Cnc is again rising to a normal outburst, so the team have requested dense coverage over the next few weeks and hope to trigger the Chandra observations for this outburst or the next one.

Explanation of terms :

I'm sure anyone following these logs will by now be aware that a dwarf nova is a type of variable star system consisting

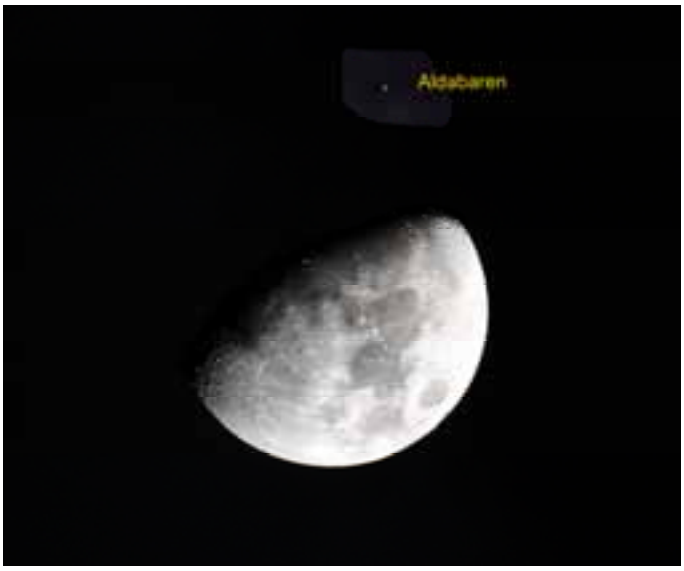
of a white dwarf primary and a red dwarf secondary from which material is being transferred to the white dwarf via an accretion disc. Differences in the mass transfer rate from the red dwarf and the accretion rate onto the white dwarf result in material accumulating in the accretion disc which heats up as its density increases. The heating results in ionisation of the hydrogen in the disc and interaction with the magnetic field of the white dwarf causing further heating and the outbursts which we observe. Increased viscosity and a loss of kinetic energy and angular momentum then cause the accretion rate onto the white dwarf to increase, the disc "empties" and the system returns to quiescence.

There are three sub classes of dwarf novae. Those which behave as in the previous paragraph are referred to as SS Cygni type, another class is Z Camelopardalis type (see my log for March 2016) and finally, the SU Uma type of which YZ Cnc is an example. After a number of normal outbursts (characteristic of each individual SU Uma system) there is a superoutburst which is brighter and of a longer duration than a normal outburst. These are believed to occur because a normal outburst fails to fully empty the disc, so material builds up through successive outbursts until the superoutburst occurs following which the disc returns to its minimum mass. The sequence of outbursts from one superoutburst to the next is called the supercycle. In addition, regular peaks in brightness occur during the superoutburst which are called superhumps. These are believed to occur because the outer regions of the full disc in a superoutburst are strongly influenced by the secondary. This induces a precessing elliptical shape with interacts with the secondary as it orbits the primary causing superhumps. YZ Cnc has normal outbursts every 7 to 10 days and superoutbursts every 100 to 110 days.

Tony.

Below. Orion 85mm lens, from Spreadeagle Hill. Andy.

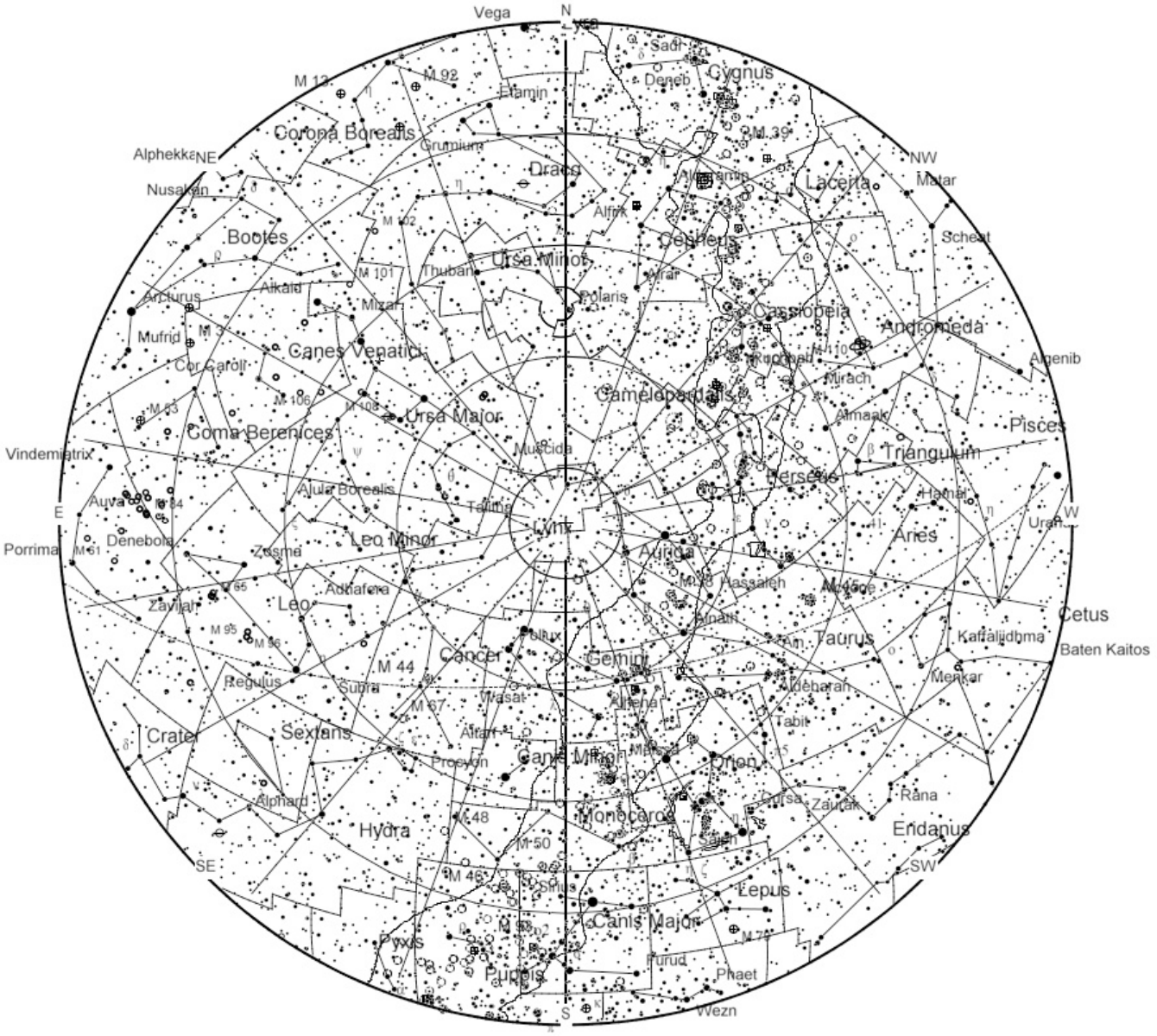
Sunday evening 5th Feb Aldebaran was due to graze the bright 60% Moon at 10:15-10:25pm. But it clouded up at the



wrong time so snapped this through varying cloud. DSLR on Televue 127 telescope.
An hour later it cleared so I snapped this through the window using a compact S9900 camera at nearly full zoom. Leaning the camera against the window to get 'something'.

Venus earlier on 20th January, using 4x powermate on 127 televue and DSLR. Not quite dark. Alll pictures Andy Burns. Compare with the more crescent shape on Peter's image on Sunday 5th Feb.

WHATS UP, FEBRUARY 2017



February 11 - **Full Moon.** The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 00:33 UTC. This full moon was known by early Native American tribes as the Full Snow Moon because the heaviest snows usually fell during this time of the year. Since hunting is difficult, this moon has also been known by some tribes as the Full Hunger Moon, since the harsh weather made hunting difficult.

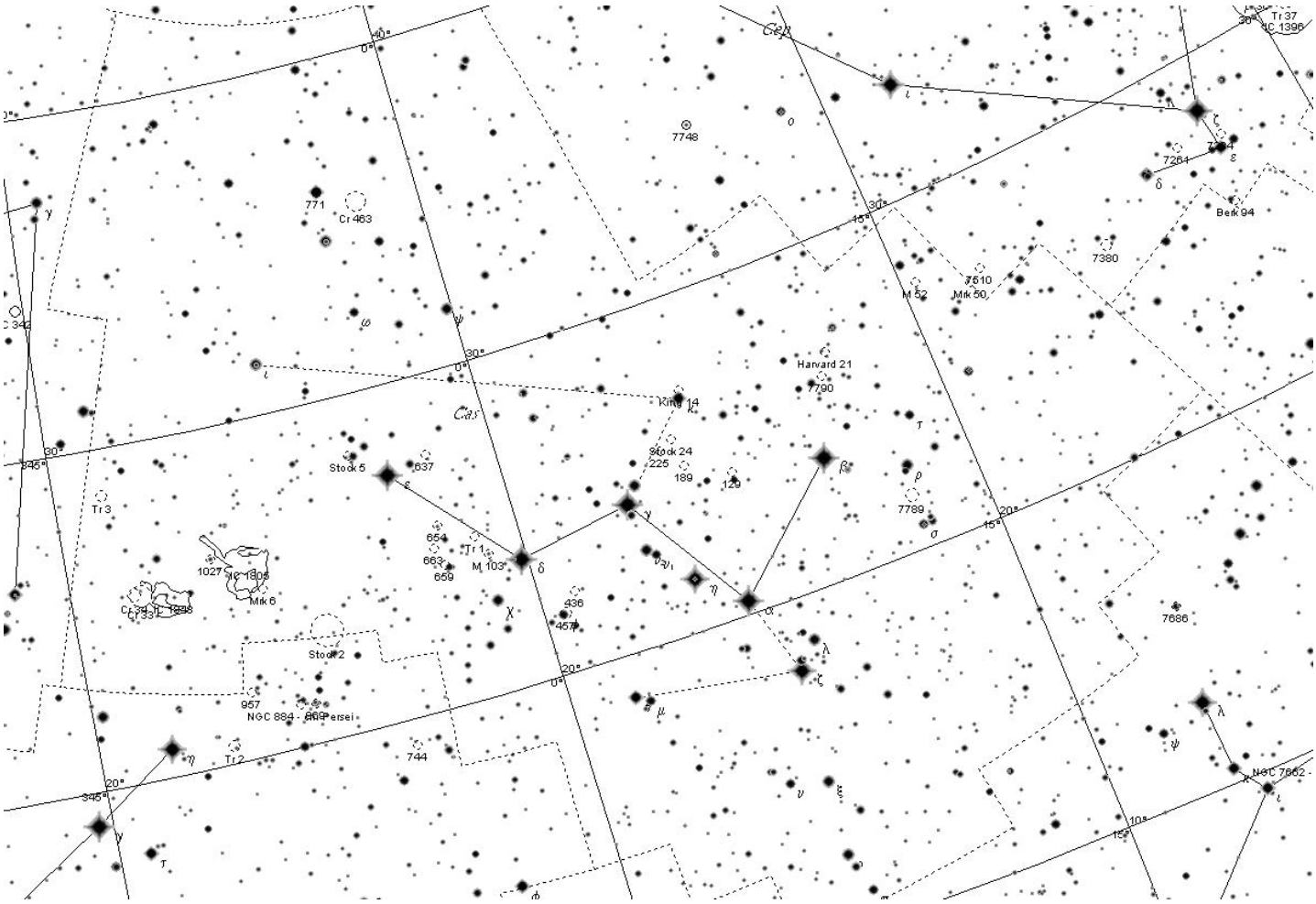
February 11 - **Penumbral Lunar Eclipse.** A penumbral lunar eclipse occurs when the Moon passes through the Earth's partial shadow, or penumbra. During this type of eclipse the Moon will darken slightly but not completely. The eclipse will be visible throughout most of eastern South America, eastern Canada, the Atlantic Ocean, Europe, Africa, and western Asia.

February 26 - **New Moon.** The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 14:59 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

February 26 - **Annular Solar Eclipse.** An annular solar eclipse occurs when the Moon is too far away from the Earth to completely cover the Sun. This results in a ring of light around the darkened Moon. The Sun's corona is not visible during an annular eclipse. The path of the eclipse will begin off the coast of Chile and pass through southern Chile and southern Argentina, across the southern Atlantic Ocean, and into Angola and Congo in Africa. A partial eclipse will be visible throughout parts of southern South America and southwestern Africa.

See Jonathan Gale's Binocular views for February in the main newsletter.

CONSTELLATIONS OF THE MONTH: Cassiopeia



In the 2nd century CE, Greek-Egyptian astronomer Claudius Ptolemaeus (aka. Ptolemy) compiled a list of all the then-known 48 constellations. This treatise, known as the *Almagest*, would used by medieval European and Islamic scholars for over a thousand years to come, effectively becoming astrological and astronomical canon until the early Modern Age.

One of the most famous of these constellations is Cassiopeia, which is easily recognized by its W-shape in the sky. As one of the 48 constellation included in the *Almagest*, it is now one of the 88 modern constellations recognized by the IAU. Located in the norther sky opposite of the Big Dipper (Ursa Major), it is bordered by Camelopardalis, Cepheus, Lacerta, Andromeda and Perseus.

Name and Meaning:

In mythology, Cassiopeia the wife of King Cepheus and the queen of the mythological Phoenician realm of Ethiopia. Her name in Greek means “she whose words excel”, and she was renowned for her beauty but also her arrogance. This led to her downfall, as she boasted that both she and her daughter Andromeda were more beautiful than all the Nereids – the nymph-daughters of the sea god Nereus.

Cassiopeia in her chair, as depicted in Urania’s Mirror. Credit: Sidney Hall/United States Library of Congress

This led the Nerieds to unleash the wrath of Poseidon upon the kingdom of Ethiopia.Accounts differ as to whether Poseidon decided to flood the whole country or direct the sea monster Cetus to destroy it. In either case, trying to save their kingdom, Cepheus and Cassiopeia consulted a wise oracle, who told them that the only way to appease the sea gods was to sacrifice their daughter.

Accordingly, Andromeda was chained to a rock at the sea’s edge and left there to helplessly await her fate at the hands of Cetus. But the hero Perseus arrived in time, saved Andromeda, and ultimately became her husband. Since Poseidon thought that Cassiopeia should not escape punishment, he placed her in the heavens in such a position that, as she circles the celestial pole, she is upside-down for half the time.

History of Observation:

Cassiopeia was one of the traditional constellations included by Ptolemy in his 2nd century CE tract, the *Almagest*. It also figures prominently in the astronomical and astrological traditions of the Polynesian, Indian, Chinese and Arab cultures. In Chinese astronomy, the stars forming the constellation Cassiopeia are found among the areas of the Purple Forbidden enclosure, the Black Tortoise of the North, and the White Tiger of the West.

Chinese astronomers also identified various figures in its major stars. While Kappa, Eta, and Mu Cassopeiae formed a constellation called the *Bridge of the Kings*, when combined with Alpha and Beta Cassiopeiae – they formed the great chariot *Wang-Liang*. In Indian astronomy, Cassiopeia was associated with the mythological figure Sharmishtha – the

daughter of the great Devil (Daitya) King Vrishparva and a friend to Devavani (Andromeda).

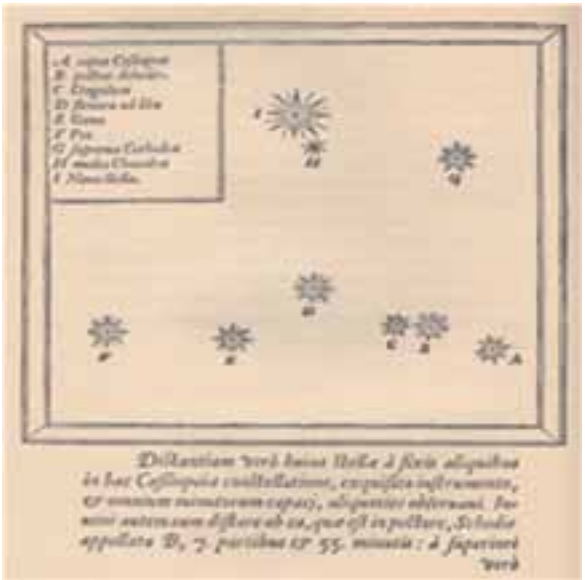
Kappa Cassiopeiae and its bow shock. Spitzer infrared image (NASA/JPL-Caltech)

Arab astronomers also associated Cassiopeia's stars with various figures from their mythology. For instance, the stars of Alpha, Beta, Gamma, Delta, Epsilon and Eta Cassiopeiae were often depicted as the "Tinted Hand" in Arab atlases – a woman's hand dyed red with henna, or the bloodied hand of Muhammad's daughter Fatima. The arm was made up of stars from the neighboring Perseus constellation.

Another Arab constellation that incorporated the stars of Cassiopeia was the Camel. Its head was composed of Lambda, Kappa, Iota, and Phi Andromedae; its hump was Beta Cassiopeiae; its body was the rest of Cassiopeia, and the legs were composed of stars in Perseus and Andromeda.

In November of 1572, astronomers were stunned by the appearance of a new star in the constellation – which was later named Tycho's Supernova (SN 1572), after astronomer Tycho Brahe who recorded its discovery. At the time of its discovery, SN1572 was a Type Ia supernova that actually rivaled Venus in brightness. The supernova remained visible to the naked eye into 1574, gradually fading until it disappeared from view.

The "new star" helped to shatter stale, ancient models of the heavens by demonstrating that the heavens were not "unchanging". It helped speed the the revolution that was already underway in astronomy and also led to the production of better astrometric star catalogues (and thus the need for more precise astronomical observing instruments).



Star map of the constellation Cassiopeia showing the position (labelled I) of the supernova of 1572. Credit: Wikipedia Commons

To be fair, Tycho was not even close to being the first to observe the 1572 supernova, as his contemporaries Wolfgang Schuler, Thomas Digges, John Dee and Francesco Maurolico produced their own accounts of its appearance. But he was apparently the most accurate observer of the object and did extensive work in both observing the new star and in analyzing the observations of many other astronomers.

Notable Features:

This zig-zag shaped circumpolar asterism consists of 5 primary stars (2 of which are the most luminous in the Milky Way Galaxy) and 53 Bayer/Flamsteed designated stars. It's brightest star – Beta Cassiopeiae, otherwise known by its traditional name Caph – is a yellow-white F-type giant with a mean apparent magnitude of +2.28. It is classified as a Delta Scuti type variable star and its brightness varies from magnitude +2.25 to +2.31 with a period of 2.5 hours.

Now move along the line to the next bright star – Alpha. Its name is Schedar and its an orange giant (spectral type K0 IIIa), a type of star cooler but much brighter than our Sun. In visible light only, it is well over 500 times brighter than the Sun. According to the Hipparcos astrometrical satellite, distance to the star is about 230 light years (or 70 parsecs).

Continue up the line for Eta, marked by the N shape and take a look in a telescope. Eta Cassiopeiae's name is Achird and its a multiple is a star system 19.4 light years away from Earth. The primary star in the Eta Cassiopeiae system is a yellow dwarf (main sequence star) of spectral type G0V, putting it in the same spectral class as our Sun, which is of spectral type G2V. It therefore resembles what our Sun might look like if we were to observe it from Eta Cassiopeiae.

Mosaic image of Cassiopeia A, a supernova remnant, taken by the Hubble and Spitzer Space Telescopes. Credit: NASA/ JPL-Caltech/ STScI/ CXC/ SAO

The star is of apparent magnitude 3.45. The star has a cooler and dimmer (magnitude 7.51) orange dwarf companion of spectral type K7V. Based on an estimated semi major axis of 12″ and a parallax of 0.168 mas, the two stars are separated by an average distance of 71 AU. However, the large orbital eccentricity of 0.497 means that their periapsis, or closest approach, is as small as 36 AU.

The next star in line towards the pole is Gamma, marked by the Y shape. Gamma Cassiopeiae doesn't have a proper name, but American astronaut Gus Grissom nicknamed it "Navi" since it was an easily identifiable navigational reference point during space missions. The apparent magnitude of this star was +2.2 in 1937, +3.4 in 1940, +2.9 in 1949, +2.7 in 1965 and now it is +2.15. This is a rapidly spinning star that bulges outward along the equator. When combined with the high luminosity, the result is mass loss that forms a disk around the star.

Gamma Cassiopeiae is a spectroscopic binary with an orbital period of about 204 days and an eccentricity alternately reported as 0.26 and “near zero.” The mass of the companion is believed to be comparable to our Sun (Harmanec et al. 2000, Miroschnichenko et al. 2002). Gamma Cas is also the prototype of a small group of stellar sources of X-ray radiation that is about 10 times higher that emitted from other B or Be stars, which shows very short term and long-term cycles.

Now move over to Delta Cassiopeiae, the figure 8. It’s traditional name is Ruchbah, the “knee”. Delta Cassiopeiae is an eclipsing binary with a period of 759 days. Its apparent magnitude varies between +2.68 mag and +2.74 with a period of 759 days. It is of spectral class A3, and is approximately 99 light years from Earth.

Gamma Cassiopeiae. Credit & Copyright: Noel Carboni/ Greg Parker, New Forest Observatory

Last in line on the end is Epsilon, marked with the backward 3. Epsilon Cassiopeiae’s tradition name is Segin. It is approximately 441 light years from Earth. It has an apparent magnitude of +3.38 and is a single, blue-white B-type giant with a luminosity 720 times that of the Sun.

Finding Cassiopeia:

Cassiopeia constellation is located in the first quadrant of the northern hemisphere (NQ1) and is visible at latitudes between +90° and -20°. It is the 25th largest constellation in the night sky and is best seen during the month of November. Due to its distinctive shape and proximity to the Big Dipper, it is very easy to find. And the constellation has plenty of stars and Deep Sky Objects that can be spotted using a telescope or binoculars.

First, let’s begin by observing Messier 52. This one’s easiest found first in binoculars by starting at Beta, hopping to Alpha as one step and continuing the same distance and trajectory as the next step. M52 (NGC 7654) is a fine open cluster located in a rich Milky Way field. The brightest main sequence star of this cluster is of mag 11.0 and spectral type B7.

Two yellow giants are brighter: The brightest is of spectral type F9 and mag 7.77, the other of type G8 and mag 8.22. Amateurs can see M52 as a nebulous patch in good binoculars or finder scopes. In 4-inch telescopes, it appears as a fine, rich compressed cluster of faint stars, often described as of fan or “V” shape; the bright yellow star is to the SW edge. John Mallas noted “a needle-shaped inner region inside a half -circle.” M52 is one of the original discoveries of Charles Messier, who cataloged it on September 7, 1774 when the comet of that year came close to it.

For larger telescopes, situated about 35′ southwest of M52 is the Bubble Nebula NGC 7635, a diffuse nebula which appears as a large, faint and diffuse oval, about 3.5×3′ around the 7th-mag star HD 220057 of spectral type B2 IV. It is difficult to see because of its low surface brightness. Just immediately south of M52 is the little conspicuous open cluster Czernik 43 (Cz 43).

Now let’s find Messier 103 by returning to Delta Cassiopeiae. In binoculars, M103 is easy to find and identify, and well visible as a nebulous fan-shaped patch. Mallas states that a 10×40 finder resolves the cluster into stars; however, this is so only under very good viewing conditions. The object is not so easy to identify in telescopes because it is quite loose and poor, and may be confused with star groups or clusters in the vicinity.

But telescopes show many fainter member stars. M103 is one of the more remote open clusters in Messier’s catalog, at about 8,000 light years. While you are there, enjoy the other small open clusters that are equally outstanding in a telescope, such as NGC 659, NGC 663 and NGC 654. But, for a real star party treat, take the time to go back south and look up galactic star cluster NGC 457.

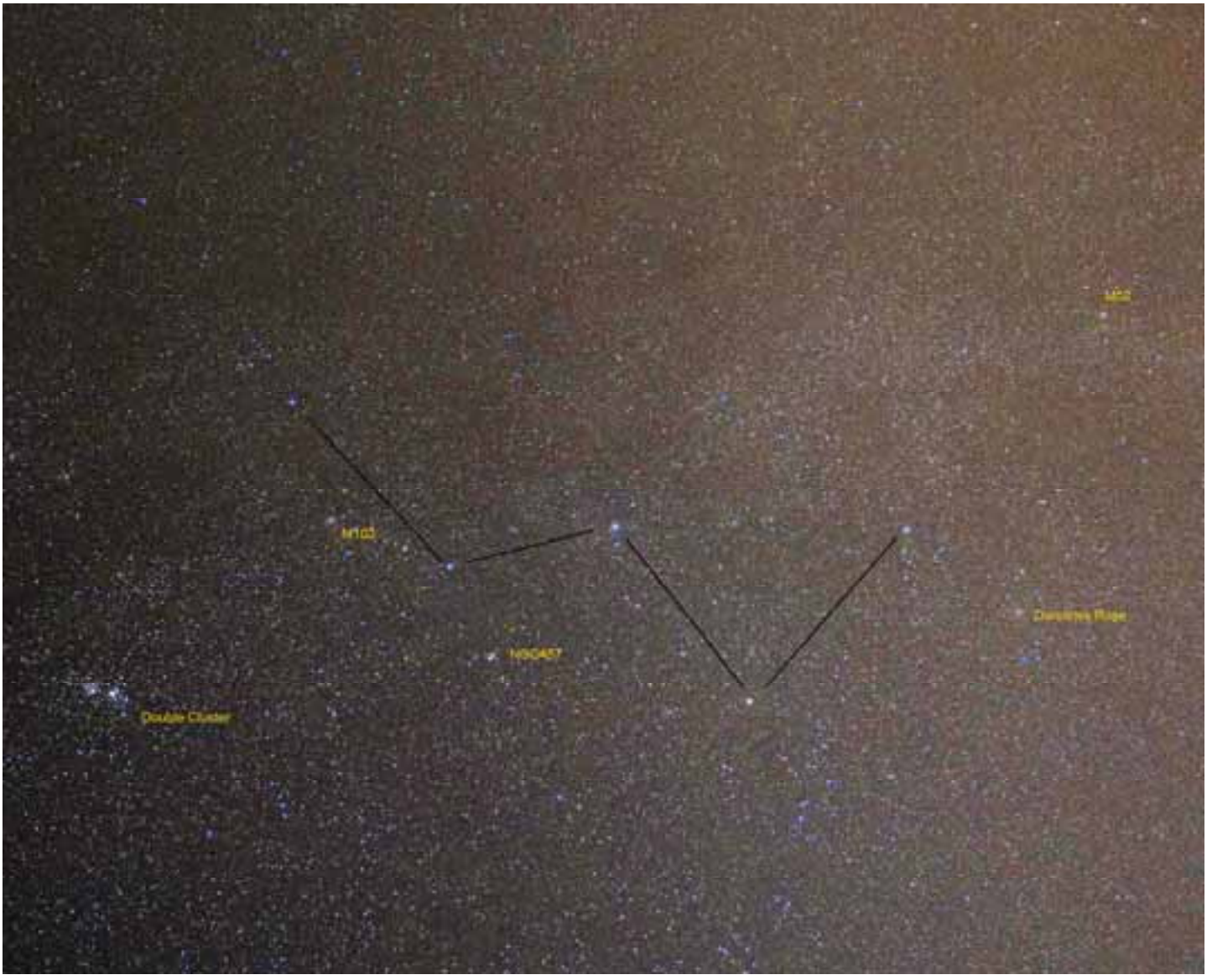
It contains nearly one hundred stars and lies over 9,000 light years away from the Sun. The cluster is sometimes referred by amateur astronomers as the Owl Cluster, or the ET Cluster, due to its resemblance to the movie character. Those looking for a more spectacular treat should check out NGC 7789 – a rich galactic star cluster that was discovered by Caroline Herschel in 1783. Her brother William Herschel included it in his catalog as H VI.30.

This cluster is also known as “The White Rose” Cluster or “Caroline’s Rose” Cluster because when seen visually, the loops of stars and dark lanes look like the swirling pattern of rose petals as seen from above. At 1.6 billion years old, this cluster of stars is beginning to show its age. All the stars in the cluster were likely born at the same time but the brighter and more massive ones have more rapidly exhausted the hydrogen fuel in their cores.

Are you interested in faint nebulae? Then try your luck with IC 59. One of two arc-shaped nebulae (the other is IC 63) that are associated with the extremely luminous star Gamma Cassiopeiae. IC 59 lies about 20′ to the north of Gamma Cas and is primarily a reflection nebula. Other faint emission nebulae include the “Heart and Soul” (LBN 667 and IC 1805) which includes wide open star clusters Collider 34 and IC 1848.

Of course, no trip through Cassiopeia would be complete without mentioning Tycho’s Star! Given the role this “new star” played in the history of astronomy (and as one of only 8 recorded supernovas that was visible with the naked eye), it is something no amateur astronomer or stargazer should pass up!

While there is no actual meteoroid stream associated with the constellation of Cassiopeia, there is a meteor shower which seems to emanate near it. On August 31st the Andromedid meteor shower peaks and its radiant is nearest to Cassiopeia. Occasionally this meteor shower will produce some spectacular activity but usually the fall rate only averages about 20 per hour. There can be some red fireballs with trails. Biela’s Comet is the associated parent with the meteor stream.



Upcoming Astronomy Events.

European Astrofest.

10 & 11 February 2017 •

Kensington Conference & Events Centre.

Friday 10th February 2017
Session one (10AM-12:50PM)

The Intimate Universe
Marek Kukula
Royal Observatory Greenwich

Cassini: the conclusion
Andrew Coates
Mullard Space Science Laboratory

Particle physics and the Universe
Tara Shears
University of Liverpool

Landing on Mars
Andrea Accomazzo
Flight Director, European Space Agency

FRIDAY 10TH FEBRUARY 2017
SESSION TWO (2:30-5:30PM)

Space rocks on ice: hunting for meteorites in Antarctica
Katherine Joy
University of Manchester

Gravitational waves detection
Martin Hendry
University of Glasgow

Pluto and the Kuiper Belt of objects beyond Neptune
Scott Sheppard
Carnegie Institution for Science

Of Comets, Ferrets, and Nebulae: Charles Messier, his Discoveries and his World
Allan Chapman
Oxford University

Saturday 11TH FEBRUARY 2017
SESSION THREE (10am-12:50pm)
(Sorry, this session is now fully booked)

The Dynamic Cosmos
Will Gater
Author and astrophotographer

The Proxima b planet
Guillem Anglada-Escudé
Queen Mary University of London

Alien hunters: searching for life in the cosmos
Louisa Preston
Birkbeck, University of London

Voyager 40th anniversary
Garry Hunt
Voyager Imaging Team (1972-90)

SATURDAY 11TH FEBRUARY 2017
SESSION FOUR (2:30-5:30pm)
(SORRY, THIS SESSION IS NOW FULLY BOOKED)

ExoMars and the search for life
Peter Grindrod
Birkbeck, University of London

Beyond Pluto: The hunt for a massive Planet X
Scott Sheppard
Carnegie Institution for Science

The Exoplanet Super League
Jon Culshaw
Impressionist and exoplanet aficionado

Landing Rosetta on comet 67P
Andrea Accomazzo
Flight Director, European Space Agency

Exact timings to be announced. Stay tuned for additional information. Programme is provisional and subject to change

Confirmed exhibitors for 2017

365Astronomy/PrimaLuce Lab
Astrograph Ltd
Astronomy Now
Astroshop/Omegon/Universe2go
Atik Cameras
AWR Technology
British Astronomical Association
The British Interplanetary Society
Cambridge University Press
Campaign for Dark Skies
Celestron @ The Widescreen Centre
Dark Skies Jewellery
Galaxy on Glass
Ian King Imaging
International Astronomy Show
London Stereoscopic Company
MSG-Meteorites
North West Astronomy Festival
nPAE Precision Astro Engineering
Open University
Optical Vision Ltd
Orion Optics UK
Peak2Valley Instruments
Pulsar Observatories
Queen Mary University of London
The Society for Popular Astronomy
Softica
Solarsphere
Springer Nature
Starlight Xpress Ltd.
Starmus
University of Central Lancashire
Virtual Image Publishing
The Widescreen Centre

ISS PASSES For January to Mid Feb 2017 From Heavens Above website maintained by Chris Peat

Date	Brightness	Start			Highest point			End		
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
08 Feb	-3.4	18:25:05	10°	W	18:28:22	87°	N	18:30:18	23°	E
08 Feb	-0.8	20:01:36	10°	W	20:02:57	21°	W	20:02:57	21°	W
09 Feb	-3.2	19:09:07	10°	W	19:12:22	62°	SSW	19:12:43	56°	SSE
10 Feb	-3.3	18:16:39	10°	W	18:19:56	79°	SSW	18:22:33	15°	ESE
10 Feb	-1.1	19:53:19	10°	W	19:55:12	23°	WSW	19:55:12	23°	WSW
11 Feb	-2.2	19:00:42	10°	W	19:03:48	39°	SSW	19:05:05	26°	SSE
12 Feb	-2.7	18:08:10	10°	W	18:11:24	56°	SSW	18:14:37	10°	ESE
12 Feb	-0.8	19:45:20	10°	WSW	19:47:22	16°	SW	19:47:44	15°	SSW
13 Feb	-1.2	18:52:23	10°	W	18:55:05	24°	SSW	18:57:46	10°	SSE
14 Feb	-1.8	17:59:42	10°	W	18:02:44	35°	SSW	18:05:45	10°	SE
15 Feb	-0.4	18:44:31	10°	WSW	18:46:12	13°	SW	18:47:53	10°	S
04 Mar	-0.6	05:26:52	10°	S	05:28:59	16°	SE	05:31:07	10°	E
05 Mar	-2.1	06:09:10	10°	SW	06:12:17	40°	SSE	06:15:25	10°	E
06 Mar	-1.6	05:17:16	13°	SSW	05:19:40	27°	SSE	05:22:31	10°	E
07 Mar	-1.1	04:26:45	18°	SSE	04:27:05	18°	SE	04:29:26	10°	E
07 Mar	-3.0	05:59:50	10°	WSW	06:03:06	62°	SSE	06:06:23	10°	E
08 Mar	-2.5	05:08:46	24°	SW	05:10:23	45°	SSE	05:13:33	10°	E
09 Mar	-1.8	04:18:04	30°	SE	04:18:04	30°	SE	04:20:40	10°	E
09 Mar	-3.3	05:50:41	10°	WSW	05:53:56	84°	SSE	05:57:14	10°	E
10 Mar	-0.1	03:27:19	11°	E	03:27:19	11°	E	03:27:36	10°	E
10 Mar	-3.2	04:59:56	35°	SW	05:01:08	68°	SSE	05:04:25	10°	E
11 Mar	-2.1	04:09:08	39°	ESE	04:09:08	39°	ESE	04:11:35	10°	E
11 Mar	-3.3	05:41:45	12°	W	05:44:44	85°	N	05:48:03	10°	E
12 Mar	-0.1	03:18:18	12°	E	03:18:18	12°	E	03:18:40	10°	E
12 Mar	-3.4	04:50:54	42°	WSW	04:51:54	87°	SSE	04:55:12	10°	E
13 Mar	-2.1	04:00:02	41°	E	04:00:02	41°	E	04:02:21	10°	E
13 Mar	-3.3	05:32:39	13°	W	05:35:31	87°	N	05:38:49	10°	E
14 Mar	0.0	03:09:09	12°	E	03:09:09	12°	E	03:09:28	10°	E
14 Mar	-3.4	04:41:46	46°	W	04:42:38	85°	N	04:45:57	10°	E
15 Mar	-1.9	03:50:53	38°	E	03:50:53	38°	E	03:53:03	10°	E
15 Mar	-3.3	05:23:29	14°	W	05:26:13	78°	SSW	05:29:31	10°	ESE
16 Mar	0.0	03:00:00	11°	E	03:00:00	11°	E	03:00:10	10°	E
16 Mar	-3.4	04:32:37	52°	W	04:33:20	89°	NNW	04:36:38	10°	E
17 Mar	-1.7	03:41:45	33°	E	03:41:45	33°	E	03:43:43	10°	E
17 Mar	-3.1	05:14:22	16°	W	05:16:49	55°	SSW	05:20:03	10°	ESE

END IMAGES, OBSERVING AND OUTREACH

Mare Frigorium, Crater John Herschel (below the valentine heart shaped crater Anixi-mander…

Sinus Roris with Harpalus crater isolated, into the Mons Jura and the superb Sinus Iridium.

3x Barlow on 127 Televue.

Imaging Source DMK 52AU.

Andy Burns

9th January 17

Date	Moon Phase	Observing Topic
2017		
Friday 24th February	Waning crescent (sets 3pm)	Deep Sky
Friday 24th March	Waning crescent (sets around 2pm)	Deep Sky
Friday 28th April	Waxing crescent (sets 11pm)	Deep Sky & Lunar targets
Friday 26th May	Waxing crescent (sets around 10pm)	Deep Sky & Lunar targets

OUTREACH ACTIVITIES

Still awaiting clear Thursday to tie in with Chippenham Scouts.

Paragon School, Bath February 10th 6pm set up.