



TRANSIT

The September 2013 Newsletter of



NEXT TWO MEETINGS, each at 7.15 pm

Friday 13 September 2013 at Wynyard Planetarium

The Sun and global warming

Dr John McCue, Founder & Honorary VP of CaDAS

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Friday 11 October 2013

**Thomas Wright Trophy quiz contest
at Grindon Parish Hall, Thorpe Thewles**

**A CaDAS team of three is urgently required! Please volunteer to
Neil Haggath (neil.haggath@ntlworld.com; 07900 653213)**



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Editorial

Rod Cuff



Welcome back to the start of a new observing season, and the start of another excellent set of speakers planned by our Meetings Secretary, Neil Haggath, for the year ahead. For the next few months at least, we believe that we can hold our monthly meetings at Wynyard Planetarium as usual (not October's, though, as that's the annual quiz against Durham & the University of Durham, for which we need the space in the village hall in Thorpe Thewles). Representatives from your committee have spent the summer preparing for and engaging in discussions with Stockton Borough Council over the future of the Planetarium, and we'll report on that as soon as there is a concrete proposal. This is likely to involve another Emergency General Meeting, so please watch your incoming email for announcements on that front.

In my June editorial, I talked about the need to 'fill up those empty summer days watching the rain', but it certainly didn't turn out that way, and I hope you were able to take advantage of all the sunshine. One who certainly did was Keith Johnson, whose latest fabulous mosaic of the Sun in hydrogen- α light is in these pages. This gained the accolade of being Solar Picture of the Day on the internet on 2 September.

No more space to bang on this month, but I'm pleased to say that there's now a nice backlog of articles crowding for space in future issues, so if yours isn't in this time, it soon will be. (More articles are always welcome, of course!) Many thanks to contributors, as ever. October's issue will have to be earlier than usual, as I'll be away on holiday soon afterwards, so watch out for it before the end of the month.

Finally, a warm welcome to new members who've joined in recent months – Simon Gotch and Phil & John Burton.

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Letter

Another Moscow museum

from Neil Haggath

I enjoyed reading Peter Hanna's fascinating account in the June issue of his visit to the Memorial Museum of Cosmonautics in Moscow. For the record, I would like to point out that this is not the same museum that I visited five years ago, and wrote about in the June 2008 issue.¹



The Memorial Museum of Cosmonautics, as Peter tells us, is within the city of Moscow, and is open to the public. Alas, I wasn't able to visit it during my trip, as it was closed for renovation. I saw the monument, but everything below it was a big building site!

The museum that I visited, which has as its pride and joy the actual capsule in which Yuri Gagarin flew, is the private one of the Energia Corporation – or to give it its full name, the S.P. Korolev Energia Rocket and Space Corporation. This is located within the company's headquarters in the small town of Korolev, 12 miles north of Moscow.

¹ [Given the frailty of human memory, the number of new members who have joined CaDAS in the past 5 years, and the intrinsic interest of Neil's 2008 article, we've reprinted it in this issue – see page 11. – Ed.]

Did anyone else get Malcolm's 'teaser' question, about the stars used for navigation by the Apollo astronauts? I knew it immediately, simply because I was familiar with three obscure names in the list, and the story behind them.

There are three 'proper' names of stars in the list that are definitely not traditional, and that you won't find in any star atlas! They are Dnoce (ι Ursae Majoris), Navi (γ Cassiopeiae) and Regor (σ Puppis). (The first two do actually have 'real' proper names, but they're rarely used.)

These 'fake' names were assigned to the stars as a joke by the Apollo 1 crew – Gus Grissom, Ed White and Roger Chaffee, who were tragically killed in the launchpad fire – and were formed by spelling parts of their own names backwards. Regor, obviously, is Roger; Navi is Ivan, Grissom's middle name, and Dnoce is Second, for Edward H. White II!

The later Apollo crews continued to use these joke names, in memory of their dead colleagues.

Neil Haggath

OBSERVATION REPORTS AND PLANNING

Websites – September 2013

Here are some suggestions for websites that will highlight some of what to look out for in the night sky this month.

- **HubbleSite:** a **video** of things to see each month:
http://hubblesite.org/explore_astronomy/tonights_sky
- **Night Sky Info's** comprehensive coverage of the current night sky:
www.nightskyinfo.com
- **Jodrell Bank Centre for Astrophysics** – The night sky:
www.jodrellbank.manchester.ac.uk/astronomy/nightsky
- **Telescope House** monthly sky guide:
<http://tinyurl.com/pzzpmsx>
- **Orion's** What's in the Sky – September:
<http://www.telescope.com/Whats-In-the-Sky-September/p/103353.uts>
- **Society for Popular Astronomy's monthly Sky Diary** – download from the link at:
<http://www.popastro.com/skydiary>

While we're on the subject of websites: let me recommend two I came across recently:

- Astrotips.com – A huge list of useful computer programs, apps and so forth of potential interest to the amateur astronomer.
- *A Beginner's Guide to Astronomy* at www.learnastronomyhq.com/beginners-guide-to-astronomy.html.



The Sun in hydrogen-alpha light

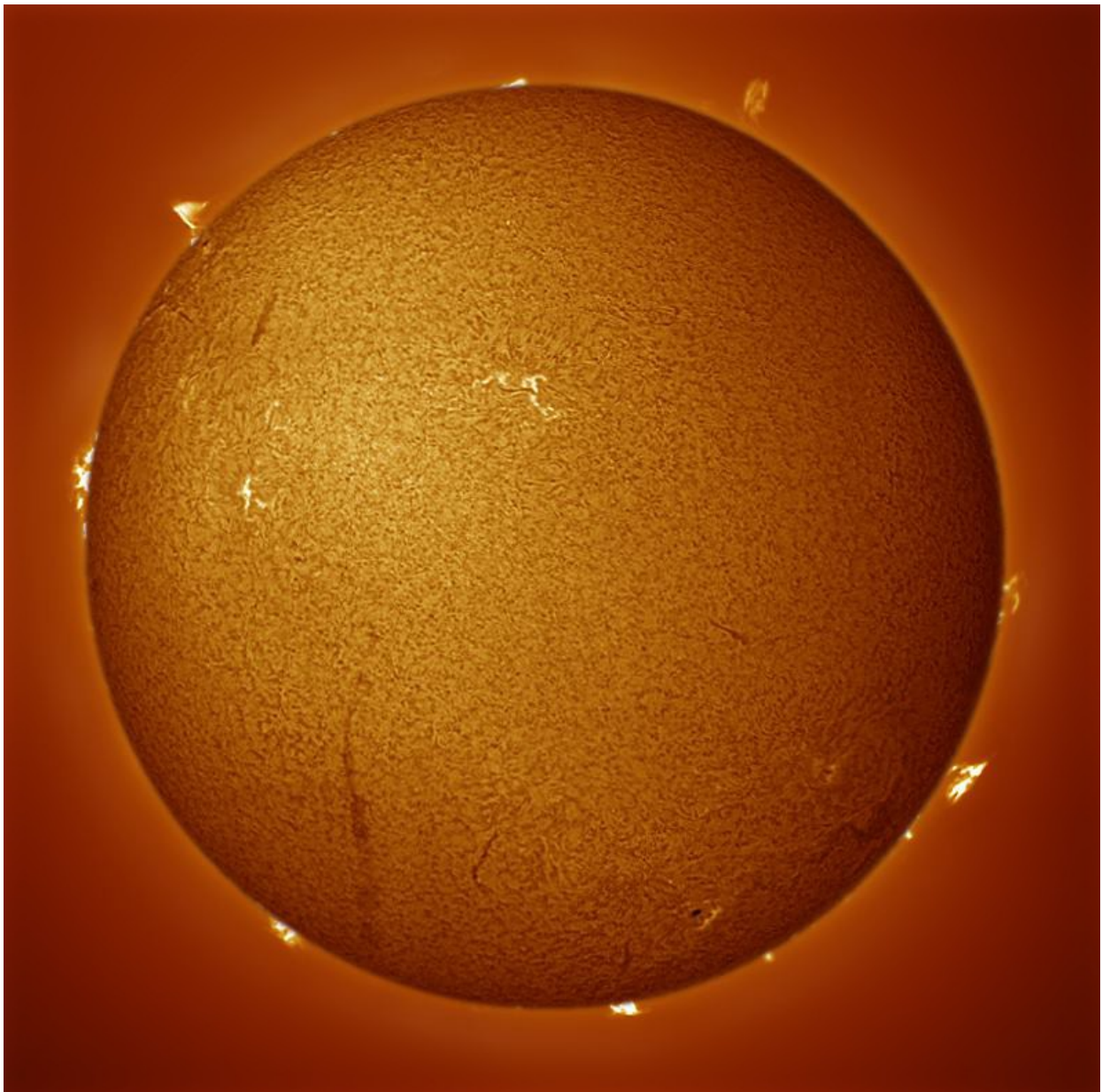
Keith Johnson

On Bank Holiday Monday, 26 August, the Sun was showing a lot of activity, including many prominences and filaments and a sunspot. I captured the data for the image below while on holiday in the Lake District. Equipment used:

- Lunt LS35THa Deluxe hydrogen- α solar telescope
- HEQ5 Pro mount
- DMK USB II mono camera.



Using Lucam Recorder professional image acquisition software, I recorded five video sequences (AVIs) for the prominences and seven for the disc. All were aligned and stacked using Autostackert II, and wavelets applied to the disc image in Registax v6. Using Adobe Photoshop CS2, the two stacked images of the disc and the prominences were combined, and finally false colour was applied.





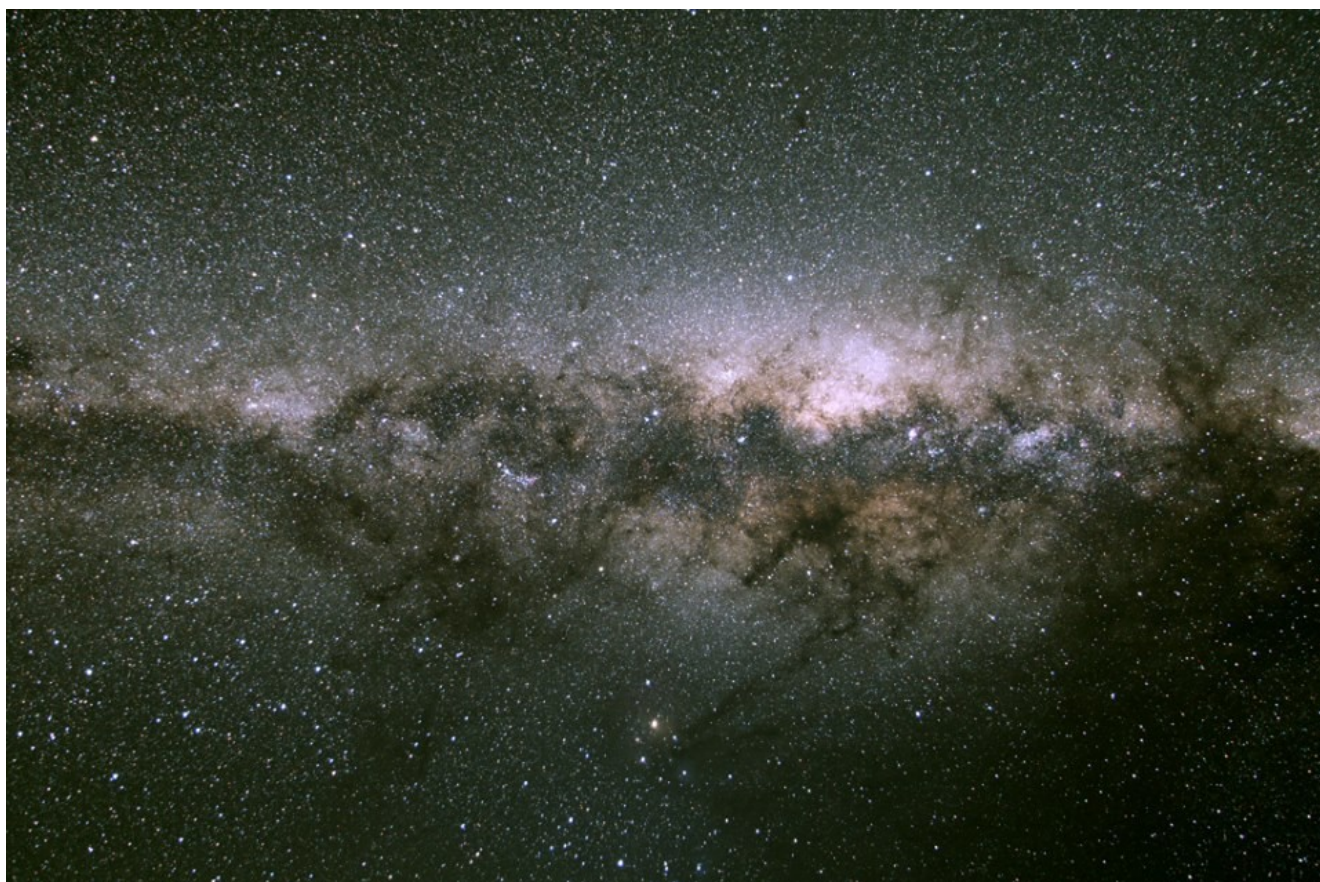
The chairman goes south ...

p.p. Jürgen Schmoll

Many people will know that our chairman, Dr Jürgen Schmoll, is a [Research Associate in the Department of Physics at Durham University](#) and a skilled and well-known instrumental optics expert. At the time of writing, he's part of a team installing new equipment at the Southern African Large Telescope (SALT) in Sutherland, South Africa. The kit is the High Resolution Spectrograph (HRS), described in full on the website of the [Durham University Centre for Advanced Instrumentation](#). The installation team is running a [blog](#) of how the work is going.



When Jürgen is outside under the very dark skies above SALT, he's been taking fabulous wide-field images of the Milky Way and the Large and Small Magellanic Clouds, and putting the results on Facebook. For the technically inclined, he's using a Canon EOS40D with a 17mm f/4.5 lens at ISO 1600, on an AstroTrac 320TT tracking mount. The captured data is reduced with DeepSkyStacker and Canon Digital Professional. Below is a wonderful shot of the galactic centre region of the Milky Way (it looks even more wonderful at full resolution). This is the stacked result from twelve 5-minute exposures.



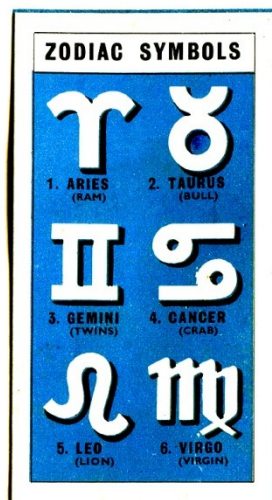
Astronomy at tea-time (part 2)

Dave Lewis

In the last issue we printed 20 of a series of cards entitled 'Out into Space' that Dave's cousin collected when they were given away with Brooke Bond tea packets in 1956 or thereabouts, and that carried the approval of Dr Alan Hunter, Secretary of the Royal Astronomical Society. Here are the remaining 30 cards from the set. – Ed.



ZODIAC (Path of Creatures) is a zone or girdle extending round the heavens, including all the heavenly bodies within eight degrees on each side of the Sun's path. It contains twelve constellations called the Signs of the Zodiac. The Northern Signs are: (1) Aries, the Ram; (2) Taurus, the Bull; (3) Gemini, the Twins; (4) Cancer, the Crab; (5) Leo, the Lion; (6) Virgo, the Virgin. The Southern Signs are: (7) Libra, the Balance; (8) Scorpio, the Scorpion; (9) Sagittarius, the Archer; (10) Capricornus, the Goat; (11) Aquarius, the Water-carrier; (12) Pisces, the Fishes.



ZODIAC SYMBOLS (Northern) It is considered that the science of Astronomy was born of Astrology. For carrying out their 'trade', soothsayers and magicians had gained knowledge of the Signs of the Zodiac. On this knowledge, mathematicians and other scientifically-minded men laid the foundation of Astronomy. The soothsayers had invented symbols as a sort of shorthand for the twelve Zodiac signs. These are still used, immediately recognised and accepted by astronomers. This card shows the symbols of Aries, Taurus and Gemini (Spring signs) and Cancer, Leo and Virgo (Summer signs).

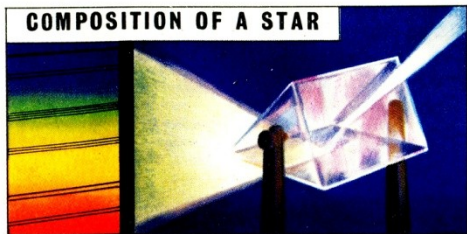


ZODIAC SYMBOLS (Southern) The six Southern Zodiac signs, like the Northern ones, are divided into two groups of three. Each has its symbol originating in astrology. Libra, Scorpio and Sagittarius are Autumn signs, Capricornus, Aquarius and Pisces Winter signs. Capricornus is also known as a Tropical and Libra as an Equinoctial sign. Astrology was practised in Babylonia as far back as 3000 B.C. and in Greece in the 4th Century B.C. and, although we may not now take it seriously, let us remember that to its scientific offspring, Astronomy, we owe our present wide and useful knowledge of the heavens.

A spiral nebula,
a vast cloud
of stars like
our Milky Way.

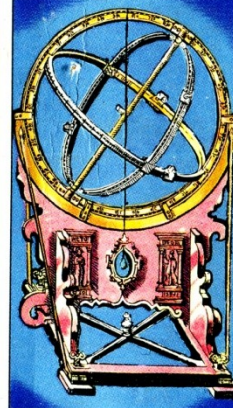


COMPOSITION OF A STAR



COMPOSITION OF A STAR To find out what the stars are made of, we study their light. Starlight is studied by using a spectroscope, in which it is passed through a glass prism and broken up into a coloured band like a rainbow. Dark lines which have absorbed certain colours. By comparing the colours with those produced by known chemical substances in the laboratory, it has been found that stars consist almost entirely of hydrogen, with small amounts of gaseous iron, chromium, nickel, and other metals.

ASTROLABE



ASTROLABE One of the earliest instruments used by astronomers. Originally they were spherical in shape and consisted of divided metal circles corresponding to ecliptic, meridian, etc., with which the position of the Sun, Moon and Stars could be measured with fair accuracy. Hipparchus, Greek Astronomer, used one before 100 B.C. Tycho Brahe, Danish astronomer who died in 1601, had one similar to that illustrated. Portable astrolabes varying in size from two inches to a foot were first made in the East in 15th Century and later were used in India, Persia and Arabia.

ARIES



ARIES "The Ram" is mentioned by Eudoxus (4th Century B.C.); in Mythology it is said to be the Ram with Golden Fleece sacrificed to Zeus who placed it in the Heavens as a constellation. It is the first sign in the Zodiac. Only main stars, easy to identify, are illustrated, but over 50 can be seen unaided and even thousands by using a powerful telescope. North of Aries is Triangulum, Cetus is South, Pisces is on the West and Taurus East. The bright star Hamal is used for navigation.



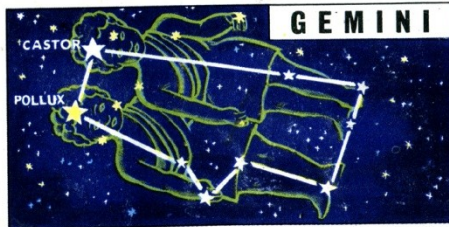
GREENWICH OBSERVATORY. The famous English astronomical observatory, now moved to Herstmonceux, Sussex.

TAURUS



TAURUS (Bull), second of the Zodiacal Signs, has two main groups of stars in the constellation. One is Hyades, a V-shaped group; the other is the Pleiades cluster. According to fable, the Pleiades are the seven daughters of Atlas turned to stars with their sisters, the Hyades, on account of their virtues and mutual affection. The red star Aldebaran (Follower) so named for following the Pleiades, is principal star in Hyades group, and a navigation star. Mythology says that the god Jupiter took the shape of a bull when he abducted Europa and carried her to Crete.

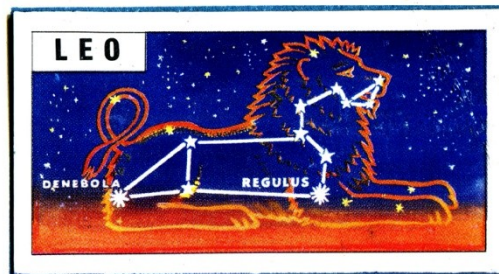
GEMINI



GEMINI (Twins), third Zodiacal sign, is between Taurus and Cancer. It contains several double stars, and is represented on most Celestial maps by male twins of mythology . . . Castor and Pollux. Castor is a binary or 'double star' consisting of two white stars of approximately same magnitude, but appears as one very bright star, except when seen through a telescope. Pollux is a navigational star. Castor, Pollux and other principal Gemini stars are very noticeable, because the adjoining areas of Cancer and Lynx constellations have few stars of great magnitude.



CANCER (Crab) is fourth sign, and first of Summer Signs, of Zodiac. The sun enters Cancer on 21st June, giving the Northern Hemisphere their longest day and the Southern their shortest. The Sun, reaching its greatest height in the North, moves backward along ecliptic, which accounts for the Crab being used as symbol for this sign. Cancer contains several 'double' stars and a 'triple' star. Over 90 stars can be seen with the naked eye. One cluster of over 150 stars of sixth and lower magnitudes was known to ancients as Praesepe or Beehive.



LEO (Lion), fifth sign of the Zodiac, is bounded on the West by Cancer, on the East by Virgo. It is easy to locate . . . a straight line from the Pole Star to Plough Pointers leads to Leo. February to end of June is good time for viewing, but evenings in March and April are best. Principal and very prominent star is Regulus . . . also known as Cor Leonis (Lion's Heart) or Royal Star. Regulus, Gamma Leonis and several smaller stars form a group shaped like a sickle. From near these stars most of November meteor showers known as Leonids radiate.



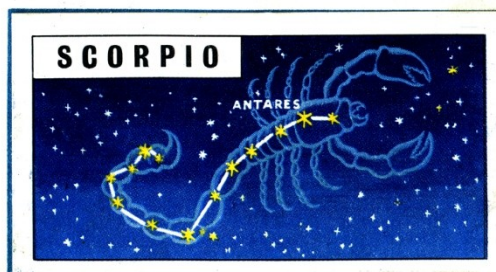
VIRGO (Virgin) sixth Sign of the Zodiac, is bounded on East by Libra, West by Leo, North by Bootes, and on South by Corvus and Hydra. Best seen from April to July. Virgo was sometimes represented as Ceres (Goddess of Corn and Harvest) or as an angel holding ears of corn in her hand, because the Sun enters this sign when cereal crops are ready for harvesting. Over 180 stars are visible to naked eye. Most brilliant is Spica (Ear of Corn), a navigational star of first magnitude, easy to locate because of its isolated appearance.



LIBRA (Balance), seventh Sign of the Zodiac, and first Autumnal Sign. The Sun enters this part of Ecliptic at Autumnal Equinox when days and nights are equal in length—hence its name. Libra is bounded by Virgo on the West, Scorpio on the East, Serpens on the North and Centaurus on the South. It is an inconspicuous constellation, having no stars of great magnitude, although there are several double and triple stars; also two clusters in one of which Herschel observed 200 different stars of eleventh and less magnitude.



Sir Isaac Newton's original Reflecting Telescope, the first of its kind, made in 1668.

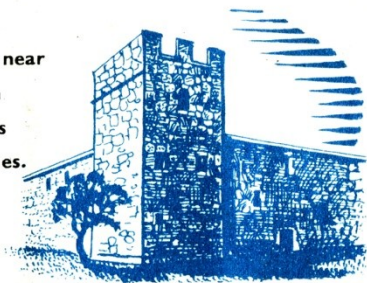


SCORPIO (Scorpion) is the eighth Sign of the Zodiac. Not large but a brilliant constellation. Can be seen in Europe only in June and July owing to its low altitude. Bounded on the West by Libra, on the East by Sagittarius, on the North by Serpens, and on the South by Lupus and Ara. Most prominent star is Antares, known also as Cor Scorpii (Heart of Scorpion), its diameter being over 400 times as large as that of our Sun, but its density very small. Ancient astrologers deemed Scorpio accursed—a source of war, discord and universal evil.

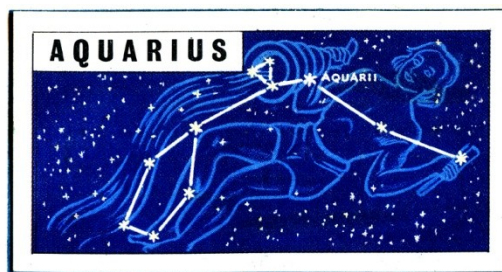


SAGITTARIUS (The Archer) The ninth Sign in the Zodiac and third of the Southern Signs, symbolized by the Centaur, part man and part beast, shooting an arrow. The main part of the group lies in the Milky Way. Old astrologers considered it a lucky sign. Nunki, the uppermost and brightest star, and Kaus Australis, are navigational stars. Can be seen in July and August and in early evening in September, but not well as it is low on the horizon.

GALILEO'S TOWER, near Florence in Italy, from which Galileo made his astronomical discoveries.



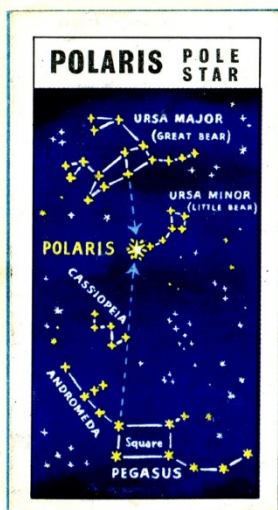
CAPRICORNUS (Sea Goat), tenth sign of the Zodiac and fourth Southern Sign, is bounded on the West by Sagittarius, on the East and North-East by Aquarius, on the North by Aquila, and on the South by Piscis Austrinus. It was mentioned by Eudoxus in 4th Century B.C. The two main stars are Alpha and Beta Capricorni. Ancients represented it sometimes as a goat but mainly as a creature having forepart of a goat and hind-part of a fish, probably because of amount of rain at this season. Capricornus is seen from August to October.



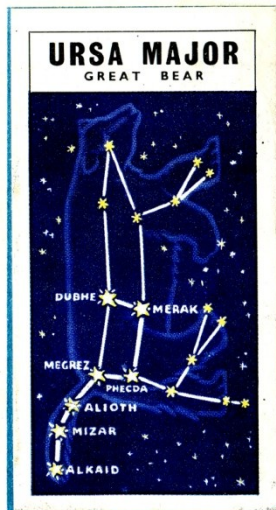
AQUARIUS (Water-carrier), 11th Sign of the Zodiac, is seen from August to October. Bounded on the East by Pisces and Cetus, on the West by Aquila, on the North by Pegasus and Equuleus, on the South by Piscis Austrinus. About 150 stars are visible to the naked eye. When the Venerable Bede changed the names of the Zodiac signs to those of Saints, he called Aquarius 'John the Baptist', probably because it marked the rainiest of months. Principal star Alpha Aquarii, a pale yellow double star of 3rd magnitude, is known as King's Lucky Star.



PISCES (Fishes) is the twelfth Sign of the Zodiac. Greek legend states Aphrodite and Eros jumped into the Euphrates when surprised by Typhon and were changed into two fishes. Bounded on North by Andromeda, on South by Cetus, on West by Pegasus and Aquarius, and on East by Aries and Triangulum. Pisces was mentioned by Eudoxus (famous Greek astronomer and mathematician 4th Century B.C.). Alpha Piscium, a close double star of 3 and 4 magnitude—pale green and blue in colour—is its largest star.



POLARIS (Pole Star) though not the most brilliant, is the most important star in the heavens owing to its situation close to the Celestial North Pole, and it has become known as the Pole Star. In the Northern Hemisphere it is always visible and is used by astronomers and navigators. Stars near the Pole seem to move slowly around it and those far away quickly; this is because they have to cover much larger circles in the same time. At the North Pole, the Pole Star is exactly overhead, but as one travels south it sinks downwards towards the horizon.



URSA MAJOR (The Great Bear) main part of which is also known as The Dipper, Plough, David's Car, Bier of Lazarus and Charles' Wain, is always visible in Great Britain. It is a guide to other constellations. It seemingly makes a complete circuit of the sky around Polaris (the Pole Star) in 23 hours 56 minutes; this is actually due to the Earth's rotation. The Plough consists of seven white stars. Dubhe and Merak are pointers to Polaris.



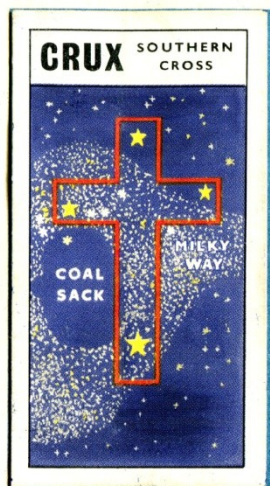
URSA MINOR (The Little Bear) Like Ursa Major, though smaller, it is easily distinguished by seven main stars. It contains Polaris (North Pole Star), a yellow star of second magnitude of utmost use to mariners and astronomers. To ordinary observers, Polaris appears to be the only star which never changes position; actually it does so very slightly, describing a circle of $2^{\circ} 25'$ daily about the true Pole. Illustration shows position of Little Bear at 11.30 p.m. on first day of the month indicated. Thales, Greek astronomer in 7th Century B.C., recommended its use for navigation.



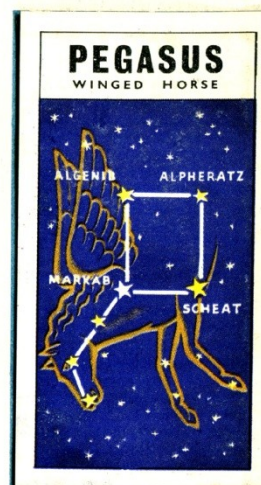
CANIS MAJOR (The Great Dog) Old legends say Canis Major was 'the hound of Orion when hunting'. It is visible from December to March, below Orion on the horizon. Its main star is Sirius (Dog Star), brightest of all stars, and one of the nearest to the Earth, being only about nine light years distant. Sirius means 'sparkling' and appears to change colour quickly as it sparkles... mainly a blue-white. Eastern nations looked to its rising as the precursor of great heat, hence 'the dog days', Sirius being overhead in our dog-days, though invisible.



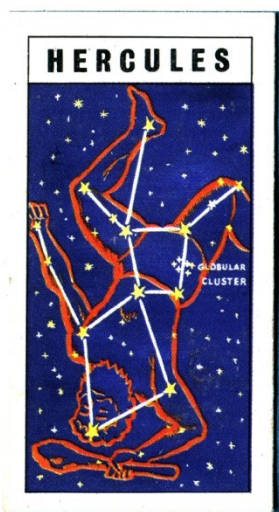
CYGNUS (The Swan) A Northern Hemisphere constellation (known also as the Northern Cross) in the Milky Way, directly east of the Lyre, and nearly on the same meridian as the Dolphin. Seen from May to December. Its brightest star, Deneb, is in the tail of the Swan, and always above the horizon in England. One named 61 Cygni (a small variable star in this constellation and almost invisible to the naked eye), was the first to have its distance from the Earth determined—50 billion miles.



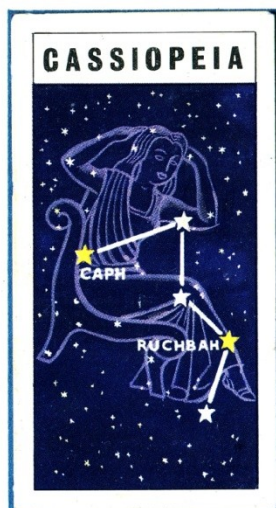
CRUX (Southern Cross) One of the smallest constellations consisting of few stars visible to naked eye; yet it is most attractive, so varied are the coloured stars contained therein. Situated in the Southern Hemisphere, it is always visible at Cape Town and in Australia. It stands out from the Milky Way, and is near a hollow region, destitute of stars, known as 'Coal sack' because of its seeming blackness. Upper and lower stars in centre of the cross point downwards to position of the South Pole, which is approximately $27^{\circ} 38'$ from lowest star.



PEGASUS (The Winged Horse) is seen upside down in our latitudes. Only half of Pegasus is illustrated in celestial maps—one star, Alpheratz, forming part of the adjoining constellation of Andromeda. It is prominent on the meridian at midnight in September. There are many small stars within and in clear atmosphere over 100 may be observed. Markab, a white star of second magnitude, is a navigational star. Scheat is a deep yellow star also of second magnitude. According to mythology Bellerophon tried to ride to heaven on Pegasus' back and was thrown off.



HERCULES This is a summer constellation and is best seen May to October. It is large and very interesting although containing no star of greater than 3rd magnitude; within it there are numerous double stars, clusters and nebulae. One great cluster is estimated to contain over 1,500 stars concentrated into a very small space in a roughly globular form, and has always been of intense interest to astronomers. Kneeling figure of Hercules, son of Jupiter, is seen upside down. This constellation was mentioned by Eudoxus (4th Century B.C.).



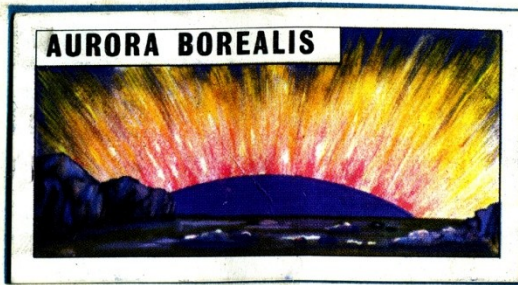
CASSIOPEIA is on the opposite side of the Pole Star from The Plough. It consists notably of a group of five very bright stars forming a W. Two of these, Ruchbah and Caph, are navigation stars. This constellation contains about 60 stars visible without the aid of a telescope. It is named after Cassiopeia, wife of Cepheus, King of Ethiopia, and mother of Andromeda who was saved from a sea monster by Perseus (Greek Mythology).



PERSEUS This Northern Hemisphere constellation is called after the Greek legendary hero, Perseus, son of Jupiter, who rescued Andromeda, daughter of Cassiopeia, from the sea monster. He records 136 stars visible therein without telescopic aid. Its main stars are Mirfak, a navigational star, and Algol—a star which varies from second to fourth magnitude, then back to second in about seven hours, and remaining at its greatest lustre for nearly 3 days. Perseus is in the Milky Way, north of Taurus, south of Cassiopeia, east of Triangulum and west of Auriga.



THE MILKY WAY called by the Greeks 'Galaxy' and by the Latins 'Via Lactea' on account of its colour and appearance, is a soft zone of luminous misty light forming a broad but very irregular girdle around the heavens. It covers about one tenth of whole sky. This light is formed by myriads of tiny faint stars, mostly too small to be observed independently (even with powerful telescopes), with a scattering of larger, brighter stars shining here and there. Dark spaces in it are not due to absence of stars, but to dark nebulous matter veiling the stars beyond.

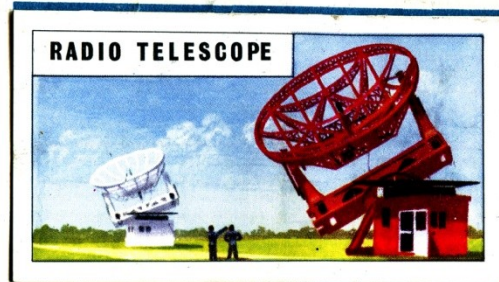


AURORA BOREALIS The Aurora Borealis is a phenomenon of the night sky. In the atmosphere are seen long quivering streamers of light, usually seeming to radiate from an arc. These bands of light are often white, but sometimes red, green, or yellowish. It is most frequently seen between 65 degrees and 80 degrees northern latitude and is believed to be caused by discharges of electricity in the rare upper atmosphere, travelling along the lines of magnetic force which point towards the magnetic North Pole. A similar phenomenon in the Southern hemisphere is known as the Aurora Australis.

Edmund Halley. Born 1656, died 1742. Famous English Astronomer who predicted the return of Halley's Comet.



Halley's Comet, which has appeared every 76 years since the third century B.



RADIO TELESCOPES for study of the heavenly bodies have been in use for some time, and a giant one is being erected in Cheshire to transmit and receive ultra-short-waves. These waves are picked up by a large curved wire mesh in a framework, shaped like a bowl, which can be pointed anywhere; they are then focused on to an aerial. Disturbances on the sun (sun-spots etc.) emit short radio waves. These affect ordinary radio transmissions by disturbing the upper atmosphere but such interferences may be obviated through discoveries made by Radio Telescopes.



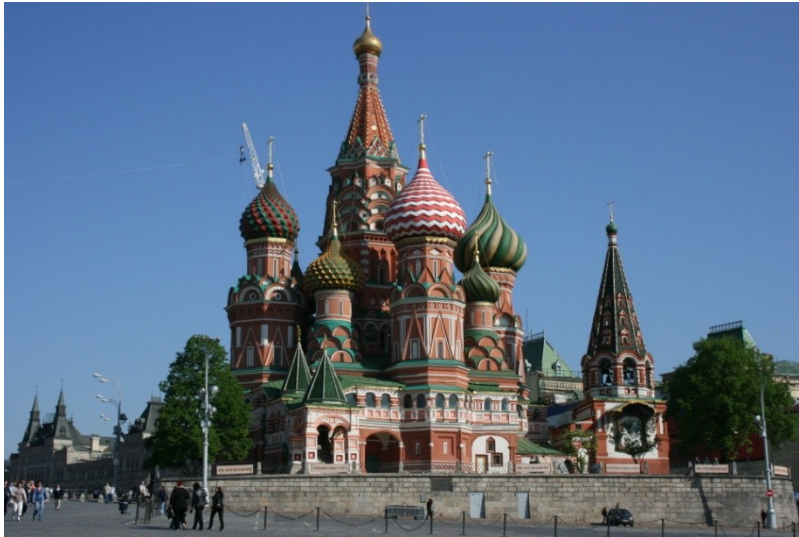
A trip into space history: my Moscow adventure²

Neil Haggath

At the beginning of May [2008], I spent three days in Moscow. The way in which I did this – I booked my own flights and hotel through the Internet, found my own way from the airport to the hotel, and walked around the city alone for my sightseeing – is a sign of the 'new Russia'! Up to about 1990, no-one was allowed to visit the former Soviet Union, except through the official government tourist agency; you had to be chaperoned everywhere, and got to see exactly what they wanted you to see. Thankfully, things are now very different.

Naturally, I did all the 'standard' sightseeing, such as Red Square and St Basil's Cathedral (*next page*) – but you won't be surprised to learn that the primary purpose of my visit was very much space-related! I planned to visit several places connected with Russian space history – but in some of these, I was disappointed.

² [This is a slightly edited reprint of Neil's Transit article from June 2008 – see footnote 1 on page 2. – Ed.]



The first failure was in Red Square itself. In the Soviet era, when people died who had been given the ultimate honour of 'Hero of the Soviet Union', their ashes were placed in the Kremlin Wall, on the side facing Red Square and near Lenin's tomb. Usually, this meant politicians and generals – but some of the early cosmonauts also received this honour. Yuri Gagarin himself is there (he was killed in a plane crash in 1968); so are Vladimir Komarov, the first man to be killed on a space mission – on Soyuz 1 in 1967 – and the three cosmonauts who died in the Soyuz 11 accident in 1971. Also there is Sergei Korolev, the 'Chief Designer', about whom I'll say more later.

I hoped to find these burial places – but I couldn't, as that side of the Square was closed off because of preparations for the May Day parades.



On Prospekt Mira (Peace Avenue) in the suburbs of Moscow is the Monument to the Conquerors of Space (*left*), erected in 1964; it's a pretty impressive sculpture, 300 feet tall!

Below it is the Memorial Museum of Cosmonautics, which was originally another of my objectives. Unfortunately, the Museum is currently closed for renovation; I knew this before I went, but not until after I had booked the flight and hotel!

But the highlight of my trip came on the third day, with a visit to another museum – the private one of RSC Energia, the company that builds many of Russia's spacecraft and rockets. This museum, located in the company's headquarters, is certainly *not* open to the public; it can only be visited by prior arrangement and through organised tours.

I discovered this museum during my initial internet research before I booked the trip. I also discovered a specialist Moscow-based tour company called Rusadventures (www.rusadventures.com), which runs a variety of space-related tours – after you make your own way to Moscow.

Some of their offerings truly justify the 'adventures' in the name; if you have about US\$5000 to spare, they can actually take you to Baikonur to witness a Soyuz launch! On a more modest scale, they take private group bookings to visit the RSC Energia Museum, on any working day of your choice.

Their standard price for this activity is based on groups of three or more. I initially booked my own private tour with them; I'm not going to tell you the price they were going to charge me as a single person, but it could fairly be described as extortionate, even for a man of my far from modest earnings. But I was willing to pay it, for such a once-in-a-lifetime experience. (It had to be paid in cash on the day, in US dollars.)

Then I had a stroke of luck. Just a few days before I left for Moscow, Rusadventures e-mailed me; they said that two people from Switzerland had asked to do the tour on the same day for which I had already booked, and asked whether I would mind sharing the tour with them – which would bring the price down to the standard 'group of three or more' price per head. As this reduced the price to only 40% of what I had been expecting to pay, I replied that I didn't mind at all!

So the group consisted of myself, this young Swiss couple, Markus and Lucia, and our guides from Rusadventures, Sergei and Lydia. Lydia spoke excellent English; Sergei was extremely knowledgeable about the space programme, and Lydia translated for him. We were picked up at our hotels and driven to the Energia headquarters, in a small town called Korolev, about 12 miles outside Moscow.

The full name of the company is Raketno-Kosmicheskaya Korporatsiya Energiya imeni S.P. Koroleva – the S.P. Korolev Energia Rocket and Space Corporation. Sergei Pavlovich Korolev, for whom both the company and the town are named, was the genius behind Russia's early space programme; he began his career by building ballistic missiles, then persuaded the government that the rockets could be adapted to launch satellites. He led the team that gained the Soviet Union the lead in the early Space Race, and which came remarkably close to achieving their own Moon landing – but he never received the fame or recognition due to him during his lifetime. During those early years of Cold War paranoia, he was known to the outside world, and to the Russian people, only as 'The Chief Designer'; as daft as it seems today, his identity was kept secret, because of fears that the Americans might try to assassinate him! Only after his premature death in 1966 was his identity revealed; then he was declared a Hero of the Soviet Union, and his ashes were placed in the Kremlin Wall.

We were shown around the Museum by Aleksandr, one of the Energia staff, who also spoke excellent English. He was very witty, with lots of stories and anecdotes, and taught me quite a few details that I hadn't previously known.

We began with the unmanned spaceflight gallery, which contains replicas of some of the historic early satellites and probes (obviously replicas, as the real things never returned to Earth). These include Sputnik 1 itself, and Sputnik 2, which carried poor Laika the dog on her one-way mission. Also represented are Luna 2, the first probe to impact the Moon; Luna 3, which gave us the first pictures of its far side; and Luna 9, which achieved the first soft landing.



But far more impressive are the manned spaceflight exhibits. As well as various mock-ups, including one of the Mir space station, there are on display several real descent modules from the early manned missions – the actual capsules that flew and returned to Earth. The Museum's pride and joy is the Vostok 1 capsule (*left*) – the actual spacecraft in which Yuri Gagarin flew! Now that's what you *call* a piece of history! We all approached

it with an air of reverence; this, for me, was a moment to rank alongside shaking the hands of men who walked on the Moon! (Needless to say, I delighted in telling my hosts that I had done that!)

Also on display are the Vostok 6 capsule, which carried Valentina Tereshkova, the first woman in space, and the capsule that carried Belka and Strelka, the first two dogs to be flown and returned to Earth.

But while Gagarin's capsule is the truly iconic exhibit, the most fascinating are the actual capsules from the two Voskhod missions. Twenty years ago, I would never have believed it possible that I would one day see these with my own eyes.

For the uninitiated, Voskhod was a mysterious programme that followed the Vostok missions, in 1964–65. There were only two flights, both of which achieved spectacular 'firsts' for the Soviet Union. Voskhod 1 was the first 'multi-man spacecraft', carrying three cosmonauts before the Americans had flown their two-man Gemini. Voskhod 2 was the mission on which Alexei Leonov made the first spacewalk.

At the time, no details or photos of the Voskhod spacecraft were released to the West; the details were kept secret for the next two decades. Only in 1985, when the Russians finally came clean, under Gorbachev's new policy of openness, did we find out why; both missions had been done purely for the political propaganda value of 'beating the Americans to it', and had been done in such a crude and dangerous manner that the cosmonauts were lucky to come back alive.



The Voskhods were nothing more than modified Vostoks. The 'first three-man spacecraft' consisted of three men crammed into a capsule designed for one – with the huge risk of flying without spacesuits. Voskhod 2 carried two men with spacesuits; Leonov's spacewalk was done by means of a crudely improvised inflatable airlock, attached to the outside of the hatch (*left*). The story is now well known; Leonov's scheduled EVA lasted only 12 minutes, but he then spent twice as long struggling to get back into the spacecraft, as his spacesuit had expanded, preventing him from squeezing back into the airlock. He managed it only by deflating his suit to a dangerous level, and then performing contortions to turn around inside the airlock; he was very lucky to get away with it.

The Voskhod 2 exhibit in the Museum consists of the real capsule – but fitted with a replica of the airlock, as the original was jettisoned after use. Even though I was familiar with the story, it was quite an eye-opener to see close-up just how Heath-Robinsonish this contraption really was!

Lydia, the lady from Rusadventures, is slightly older than me – so like me, she grew up with the Space Age. Unlike me, she is just old enough to remember Gagarin's flight; she was a very small girl at the time, whereas I wasn't born until a few months later. When I told her that we in the West had not known any details of the Voskhod missions for twenty years after the events, she replied, 'Neither did we!' The Russian public were never told any more than we were; the Americans always knew more, through their intelligence, about what was going on in the Soviet space programme, than the Russian people did!



The Museum's biggest exhibit is a full-scale mock-up of the Apollo-Soyuz Test Project (ASTP) of 1975 (*left*). This was the first political exercise in space cooperation, in which an American Apollo spacecraft docked with a Soviet Soyuz and the crews visited each other's spacecraft. The Russian crew was commanded by Alexei Leonov, of first-spacewalk fame – who, by the way, had been scheduled to command the first Soviet Moon landing mission, before the programme was cancelled.

The black structure between the two spacecraft was a special docking module, carried into orbit by the Apollo. This served two purposes. Firstly, of course, it enabled the two vehicles, with incompatible docking mechanisms, to be linked. But it was also a compression/decompression chamber, which was necessary for the crews to be able to transfer between the two spacecraft. The Apollo was pressurised with pure oxygen at low pressure, while the Soyuz used normal air – so if the cosmonauts had gone directly from their vehicle into the Apollo, they would have got the bends! Transferring in either direction was a lengthy process, involving a couple of hours in the chamber.

The exhibit also includes the actual capsule of Soyuz 19, the Russian half of the ASTP (*below*).



Striking a balance

John Crowther

Perhaps I'm too critical of those who know nothing about astronomical basics such as where the cardinal compass points are. But I'm in good company, along with Neil in his <head-desk> letter in June's issue of *Transit*. Most of us are gobsmacked at times, and we all have our prime examples that we repeat to amazed listeners. Mine is the



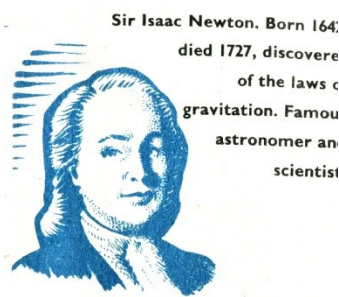
Evening Gazette's inability to distinguish east from west when printing a photo of sunrise at Saltburn and claiming it was a sunset.

Probably modern technology spoils us by making knowledge instantly available with little effort, and as easily forgotten. More and more of us get sometimes snared by such things in the World Wide Web. And not just the Web – witness a headline in the *Daily Express* of 18 June:

We drove 270 miles to board a ship to Spain ... but the sat-nav put us on a river ferry.

You can imagine ...

Enough of grumbling – here is some praise for the recent 24-page *Transit*, with original articles by different members. But I wouldn't have recognised Sir Isaac Newton from the drawing of him on the Brooke Bond Tea cards (*see below*) and Galileo looked younger and more relaxed than how we usually think of him.



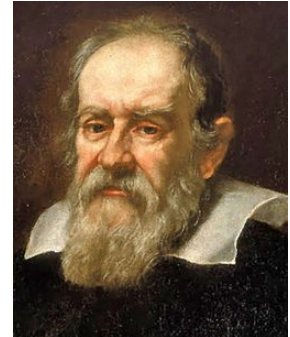
Newton



GALILEO. Born 1564, died 1642. The famous Italian astronomer, the first to use a telescope to examine the stars.



Galileo



Also, Pluto's satellite Charon wasn't known about, according to the *Planets and their moons* card, and – more up to date (!) – that 'planet' wasn't on the card either.

The article on the Memorial Museum of Cosmonautics was very interesting. What are the two star-shaped pillars near the museum for? Stonehenge seems to appear in the first photo and poor Belka (or perhaps Strelka) in the second. They're better preserved than Lenin or King Tut, but of course a little bit younger than both of those ...



The discoveries of Victorian astronomers

The reign of Queen Victoria (1837–1901) was a time of great change in astronomy, partly because there were many well-off people interested in it who had the money and spare time to pursue their interest. A few ordinary people were amateur astronomers – for instance, perhaps some in the Temperance Movement indulged in small-telescope astronomy instead of wasting their money on the Demon Drink.

Michael Roe



Little is known about working-class astronomers in the 19th century. The people we do know about tended to be wealthy landowners, industrialists, doctors, clergymen, teachers and others of the middle to upper classes. The few professional astronomers were mostly concerned with measuring

accurate positions of the stars from Greenwich and a few other observatories. I'll confine my attention here just to British Victorian astronomers.

Two of the most famous, with the best telescopes, were John Herschel (son of William) and William Lassell, a rich brewery owner. John Herschel was famous for the discovery of nebulae in the Southern Hemisphere, while Lassell just failed to discover Neptune but did discover its largest satellite, Triton, with his huge telescope. Unlike the case today, the night sky then was full of objects still to be discovered, and amateurs with fairly large telescopes and a great deal of patience could find such objects as asteroids, comets, variable stars and even a few nebulae that William Herschel had missed. Constant observations of the Moon and planets could reveal new features on them.

I find the recognition of asteroids of particular interest in that age of visual celestial discovery. Some were first discovered from Britain. John Russell Hind, director of [George Bishop's Observatory](#) in Regent's Park, London, discovered ten asteroids in the 1850s and was also the first person in England to identify Neptune. Only a few asteroids had been discovered before that time: Ceres, Pallas, Vesta and Juno from 1807 to 1807, then Astraea in 1845 by Karl Henke in Germany, after a long gap in time.

At about that time, new maps had been published in Germany of stars close to the ecliptic and down to 12th magnitude. This made asteroid discoveries easier, although surely professional astronomers who charted all these stars must have unknowingly included a few asteroids. Before then, astronomers had to draw their own star maps or use existing ones that didn't show stars faint enough to be useful when looking for new asteroids. (I've looked for asteroids myself, and even with known positions it can be difficult if your telescope reveals many stars fainter than shown in the star atlas you're using – though I did identify Ceres earlier this year.)

So those interested would scan the region of the ecliptic hour after hour, checking each star field against the maps. Their patience was occasionally rewarded if they chanced upon one of those from 10th to 12th magnitude that still awaited discovery.

The first photographic discovery of an asteroid was made in 1891, but it would be fascinating to know when the last visual discovery was made.

Other discoveries were of comets. These were easier to distinguish from stars, being fuzzy objects. Years before the Victorian era, Charles Messier plotted 103 nebulae as objects for the comet-hunter to avoid. A few years later, William Herschel discovered thousands more nebulae, but no comets. Someone should check Herschel's list against known objects – maybe he missed one or more comets!

Both asteroids and comets reveal themselves by movement, often in a few hours. Halley's Comet never appeared in Victoria's reign, but other more spectacular comets did, such as one in 1882. John Russell Hind discovered two comets, but these and others discovered from Victorian Britain were relatively faint – the really bright comets of the 19th century were discovered from Europe and Australia.

Beyond the solar system, new double and triple stars were being discovered. William Rutter Dawes was a discoverer of many double stars, using a 7.5" refractor. Other observers searched for novae and variable stars, including a few very red ones.

At the end of the Victorian era, photography using glass plates had to a large extent taken over as a means of discovery. For a century, comets were still to be discovered visually – [Roy Panther](#) was the last person in Britain to detect a comet in this way as the sole discoverer.

In fact, here in the 21st century few astronomers observe visually and draw celestial objects – I appear to be one of the last. The main reasons are light pollution (remember that in the 1850s Hind could discover faint asteroids from Regent's Park) and the continual scanning of the sky by robotic telescopes. I rather envy the Victorian astronomers scanning dark skies with so much to be discovered. Perhaps the lack of dark skies in so much of the country is the main reason fewer people are interested in astronomy now compared with even 20 years ago.

NEWS and CaDAS ANNOUNCEMENTS

Mirror-making workshop

As part of our commitment to make members aware of astronomy-related issues and events, here are details (repeated from an email circulated during the summer) of a one-day seminar on mirror making, to be held in Billingham on Sunday 22 September from 10am to 4pm. The tutor is John Nichol, whom many of you will know. The cost of the seminar is £30.

John will cover the following:

- Mirror-making materials
- Curve generation
- Making and using a grinding tool
- Pitch laps and polishing
- Figuring and testing

John says, 'By the end of the day, you will have had experience of all areas of mirror making and will be equipped to go away and make your own mirror.'

For more information, please see www.nichoptical.co.uk/seminar.htm and book direct with John on john_nichol@hotmail.com.



Nova Delphini 2013

[The information below is edited from a bulletin from the Society for Popular Astronomy (SPA). Some members may want to try viewing or imaging the nova's surrounding starfield and estimating the nova's magnitude. Nova Delphini should reach its maximum altitude of about 50° at about 11pm BST. Do please send me any observing reports, images, magnitude estimates etc – I'd be glad to include them in October's issue. – Ed.]

A bright nova has been discovered in the constellation of Delphinus. The discovery was made by Koichi Itagaki in Yamagata, Japan, using an 18cm reflector and CCD. The nova was confirmed on frames taken on August 14.750 UT using a 0.60-m f/5.7 reflector and unfiltered CCD after discovery at magnitude 6.3.

No star was visible on previous frames taken by the discoverer on 2013 August 13.565 UT to magnitude 13.0. The position of the nova is 20h 23m 30.68 +20 46 03.8 (2000.0).

Magnitude estimates reported to the AAVSO database reveal that the nova increased in brightness to around magnitude +4.5 by Aug 16.5 UT, making it (at this time) the brightest nova visible in the Northern sky since Nova Aql 1999 (V1494 Aql, which peaked at magnitude +4.0), and a possible naked-eye object to many observers.

A finder chart, images and spectrum details of the nova can be found on the web pages of the Variable Star Section at www.britastro.org/vss.

Observers are asked to report their observations – both visual and CCD – to the relevant secretaries. Contact details can be found on the VSS web page.

THE TRANSIT QUIZ

Answers to the summer's quiz

Every answer starts with the letter F or G.

1. The first Astronomer Royal. **John Flamsteed (1646–1719)**
2. The collective name for the four largest satellites of Jupiter. **Galilean satellites, after their discover, Galileo Galilei (1564–1642)**
3. The largest satellite in the solar system. **Ganymede, a moon of Jupiter that is bigger than Mercury**
4. Bright, irregular regions on the Sun, usually associated with sunspots. **Faculae**
5. Two fully automatic robotic 2-metre telescopes in Hawaii and Australia, built originally for British educational use over the internet. **Faulkes telescopes**
6. The end of a solar eclipse. **Fourth contact**
7. The European Space Agency's first deep-space probe – and the first spacecraft to make close-range studies of two comets. **Giotto, named after the painter Giotto di Bondone (c.1267–1337), who depicted Halley's Comet as the 'Star of Bethlehem'**
8. A largely unknown but hugely massive object that is pulling our Local Group of galaxies (and other nearby clusters) towards a point in the constellation of Leo. **Great Attractor**
9. The strongest absorption lines in the solar spectrum. **Fraunhofer lines, after their discoverer, Joseph von Fraunhofer (1787–1826)**
10. The intersection of the ecliptic with the celestial equator at the Sun's ascending node. **First Point of Aries (actually now in Pisces!)**
11. The original (English) name suggested for Uranus by its discoverer, William Herschel, in 1781. **Georgian Planet, after King George III**
12. Any crater that was subsequently flooded with lava, displaying just a ridge around the rim. **Ghost crater**
13. The first person to identify Neptune, based on calculations by Urban Le Verrier in 1846. **Johann Gottfried Galle (1812–1910)**
14. The principal conceiver of inflation theory, which postulates faster-than-light expansion of the universe in the first 10^{-37} seconds after the Big Bang. **Alan Harvey Guth (1947–)**
15. The name that William Herschel gave to μ Cephei on account of its strong red colour. **Garnet Star**

16. American astronautics pioneer who flew the first liquid-propellant rocket, in 1926. **Robert Hutchings Goddard (1882–1945), after whom the Goddard Space Flight Center is named**
17. A region of dark nebulosity close to the Trapezium stars in the Orion Nebula. **Fish's Mouth**
18. Alpha Piscis Austrini. Its name means 'mouth of the southern fish'. **Fomalhaut**
19. The first person to predict the existence of the cosmic background radiation. **George Gamow (1904–68)**
20. The first person to safely observe a transit of Mercury, in 1631, based on a prediction by Kepler. **Pierre Gassendi (1592–1655)**

September's quiz

Every answer starts with the letter H. The questions are in very rough order of increasing difficulty.

1. Dark nebula seen in silhouette against the emission nebula IC 434.
2. The second Astronomer Royal.
3. Discover of Saturn's largest moon, Titan.
4. Discoverer of Mars's two moons, Phobos and Deimos.
5. The first person to show that sunspots are cooler than the surrounding chromosphere.
6. A bright reflection nebula produced by outbursts from Eta Carinae, beginning in 1843.
7. Irregular, brightly 'knotted' objects thought to be pre-main-sequence stars building mass via an accretion disk.
8. The path on a Hertzsprung–Russell diagram followed by a pre-main-sequence star as it evolves onto the main sequence.
9. Alpha Arietis.
10. The largest single meteorite known.

