TRANSIT

The June 2013 Newsletter of

NEXT MEETING, which may or may not be at Wynyard Planetarium

Friday 13 September 2013

Subject to be announced in the Summer Newsletter

Content

Editorial

Rod Cuff

Apologies for the later-than-usual *Transit* this month – it's been a busy time for me recently. Please note that this is the last issue before our summer break – look for the next issue round about the end of August / beginning of September, before our new season starts on Friday 13 September. Neil will be sending out his usual Summer Newsletter before then to let you know the meetings programme for the year ahead.

But, to fill up those empty summer days watching the rain, *Transit* is bigger than usual and with some distinctly different and very welcome articles this month (as well as an expanded quiz). I'll leave you to check them out yourself instead of trailing them here, but it has been great to get such a relative profusion of good articles (all unsolicited, too) after something of a famine earlier in the year. Even more thanks than usual to contributors this month. If you have an item you'd like to submit to *Transit* for the next issue, please let me have it by Tuesday 27 August if possible.

One more thing, for font geeks like me. This issue is set in Calibri rather than the previous Arial. I've been using it for another type of document that I regularly create – the concert programmes for the Cleveland Philharmonic Choir, of which I'm a member – and I think it's neater and more modern-looking. I hope you agree, but I'm sure you'll let me know if you don't …

And yet another thing – the most important of all, to remind you of the information that we recently emailed to most members. There will be an **Extraordinary General Meeting starting at 7:30pm on Monday 1 July at Wynyard Planetarium**. The agenda will be:

- to brief CaDAS members about the Planetarium situation as of the date of the meeting
- to decide whether CaDAS should negotiate an involvement in running the Planetarium
- to vote on a motion to move the Annual General Meeting from February to the summer period, probably in June.

This is an important meeting for ALL members to have their say in the future of the Planetarium, so please come along if you can. Please note that it will be a closed meeting for subscribed members of CaDAS only.

Have a great summer! Best wishes -- Rod

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Letters

Abundance of elements

from Ray Brown

With reference to the May issue of *Transit*: I am puzzled by one particular statement in Andy Fleming's review of Marcus Chown's book *The Magic Furnace*. Andy wrote:

> *'….the research of such notable scientists as Lavoisier, Hooke, Boyle, Dalton, Mendeleev, Davy, Faraday, Avogadro, Thomson, Curie, Rutherford, Chadwick, Einstein and Hoyle is all beautifully woven together to arrive at one inescapable conclusion: that all of the chemical elements*

from beryllium and boron to iron in the Periodic Table were exothermically cooked up in the cores of dying red giant stars and vomited into the interstellar gas once those stars died.'

My surprise is twofold:

1) Andy's assertion regarding beryllium and boron is a direct contradiction of the main message of my article that appeared in the April issue of *Transit*.

2) In his book, Marcus Chown specifically and explicitly excluded beryllium and boron from the list of elements formed in stars. I quote verbatim from page 201 of the 2000 edition of *The Magic Furnace*:

> A few elements remain whose abundances cannot be explained simply by nuclear reactions in the big bang or inside stars. For instance, beryllium and boron, the fourth and fifth lightest elements respectively, do not fit into this picture. They are produced in stars in minimal quantities and destroyed by temperatures lower than those involved in the fusion of hydrogen into helium. Yet they do exist in the universe.
>
> The clue to the origin of beryllium and boron comes from cosmic rays, super-fast nuclei that continually bombard the earth from space. Cosmic rays, probably the debris of violent supernovae explosions, contain a higher proportion of beryllium and boron than material either from the earth or the sun. The generally accepted explanation is that cosmic rays started off with the same element composition as any other matter, but that collisions between cosmic ray nuclei and protons floating in interstellar space caused some nuclei to break up *en route* to the earth. In this picture beryllium and boron are nothing but nuclear shrapnel.

So Chown's brief account of the nucleosyntheses of beryllium and boron is consistent with my article and in no way corresponds to the views on that subject attributed to him by Andy.

Ray Brown

<head–desk>

from Neil Haggath

I have commented several times on the apparent state of education today, and the fact that so many people are now staggeringly ignorant of the most elementary of facts. I have just been told of yet another horrifying example. Before you read what follows, you might recall Ray Worthy's story about the primary school teacher who told the children that the Moon 'only comes out at night'…

The following is an e-mail, received from a friend of mine in Derby:

> I heard something on Radio Derby at the weekend, which totally astonished me… Apparently, people had been phoning in baffled as to why they could see the Moon in the daytime!!! The fact that this is true for two weeks out of every four didn't register.
>
> The presenter of the radio show was equally surprised by this fact, but it gets worse… He later announced that someone in Australia had just told him that they could not see the Moon at that time (the fact that he was on totally the other side of the world didn't seem to register). The presenter invited listeners to phone in if they could understand this bewildering

phenomenon, that the Moon was visible from one point on the Earth and not from another. At this point, I switched off in utter disbelief!

I despair.

Neil Haggath

OBSERVATION REPORTS AND PLANNING

Skylights – Summer 2013

Here are some suggestions for websites that will highlight some of what to look out for in the night sky in the coming months. Not that it gets dark very early for a while …

- **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:

  www.telescopehouse.com/acatalog/Telescope-House-Monthly-Sky-Guide.html

- **Orion's** What's in the Sky – June:

  http://tinyurl.com/khwtxdh

- **Society for Popular Astronomy's monthly Sky Diary – download from the link at:**

  http://www.popastro.com/skydiary

A pretty picture and a bit of science

Rod Cuff

I can count on the fingers of one hand the number of occasions this year when I've been home on a clear night and able to get my 'scope out for a few hours without the clouds coming in. So even though the sky was too light to do much before 11 pm on 3 June, I set up on a balmy evening and stayed up until the dawn chorus started (only about 3–4 hours later!). I'd intended to take some video sequences of Saturn, but the seeing low down in the sky was not good at all. The lightish sky made looking at faint fuzzies a pretty sterile occupation, so I set my sights on things in our galaxy but outside the solar system. Increasingly this is what I'm drawn to, both visually and photographically: open and globular clusters, double stars and so forth. And something special on this particular night.

I ended up taking frames that resulted next day in a couple of images that for once I'm quite pleased with. One is for the globular cluster M10, and the other was the Special for the night – a nova that had been discovered in the constellation Aquila a few days earlier, on 31 May, and to which I'd been alerted by a bulletin from the Society for Popular Astronomy (SPA). I don't have time this month to write any more about this session and the subsequent processing , but I'll do so in the next issue, as it taught me several lessons about equipment and techniques, and, in the case of the nova, enabled me to do some potentially useful science by deriving a magnitude for the nova to two places of decimals and reporting it to the SPA as requested. For now I'll just print the images!

Capture & processing details:

- 8" Meade LX90 at f/6.3, alt-az mounted
- Meade DSI IIIc camera + IR cut filter
- 20 x 20-sec. (M10) & 25 x 20-sec. (nova) subs, unguided, + 30 darks
- Captured, derotated, and stacked in Nebulosity
- Post-processed in Nebulosity and Photoshop CS2

Photo 1: Globular cluster M10 in Ophiuchus

Photo 1: Nova J19150199+0719471 in Aquila, 4 June 2013 01:35 UT, mag. 10.89

GENERAL ARTICLES

Writing a book on astronomy

Barry Hetherington

My interest in astronomy developed while I was still at school. I was 12 years old when Sputnik 1 was launched in 1957. My education was quite undistinguished; I left school when I was 15 without any qualifications, and it was only afterwards that I attended adult educational courses with the Workers Educational Association and the Department of Extra Mural Studies of Durham University, which covered, among other subjects, astronomy, geology and natural history; but I never obtained any qualifications.

In 1963 I bought a 4" reflector by Charles Frank of Glasgow for £31/19/6d but I was never an enthusiastic observer. I would much rather read about the exploits and discoveries of others, which led me to an interest in the history of the subject. I became interested in the chronology of astronomy – the dates of discoveries and other events pertaining to the subject – so I started trawling through my books and listing in chronological order whatever I could find with a date attached. This covered not only events but also astronomers, observatories and equipment. I did not

restrict the time span in any way – the entries started with the date of the Big Bang and came up to the time I was writing.

As well as going through my own books, I used the local library and later joined Durham University Library. In the early stages the information was coming thick and fast and I soon filled an exercise book. I thereafter transferred the entries to a foolscap hardback notebook – putting the entries in chronological order and leaving spaces to accommodate subsequent finds.

By this time I was seriously thinking about trying to have my work published. In the early days I had simply listed the entries without quoting any references. I realised that a publisher would want a list of references for the finished work, so I had to retrace my steps to seek them out, not only providing a list of entries but referencing every one. Eventually the notebook proved inadequate as the number of entries increased. In 1971 I acquired two loose-leaf books in which I allocated a year to a page and laboriously transferred the information over.

I saw an advert in an astronomical magazine that asked for manuscripts, so in 1972 I sent some photocopied pages to the publisher David & Charles of Newton Abbot, Devon, telling them that the manuscript contained 5000 entries and asking if they would like to publish it. After a while I received the following letter from them:

> *We have discussed your suggestion with our adviser and we all feel that you probably have a very good idea. In principle, we should certainly like a fairly short book listing all astronomical discoveries and events from the year dot, and probably the main thing for us to discuss is the length of particular entries. Of course, the exact length of an entry must be a compromise, otherwise we could easily end up with a large tome....*
>
> *We should be most grateful if you could send us as many pages of the typescript as you have available so that we can get a clearer idea of your approach. Have you any idea, incidentally, how many entries there will be altogether, as clearly we must make some sort of estimate of the book's length; perhaps at the same time you could provide us with details about yourself? We look forward very much to hearing from you on this interesting project.*

I found this very encouraging, only to be disappointed when they declined to publish it as a book and suggested that they publish it in serial form in an astronomical magazine they were publishing – I declined their offer.

All the work up to this stage had been handwritten, but things improved markedly when in 1981 I bought my first computer and began transferring all the data onto it. This made life much easier, although it took a few months to transfer all the information.

By the time I had collected about 10,000 entries, I realised that any publisher would consider it too large to publish in a single volume, so the chances of it appearing on bookshelves was remote. I had to find a way of keeping the number of entries but reducing its size! I eventually decided to concentrate on naked-eye astronomy and restrict the number of entries from before 1609, when the telescope was first used to examine the sky. Once this had been decided, I made a concerted effort to concentrate on this period and try to make it as complete as possible. By this time the entries had reduced to a trickle, but I was still finding them. It was not an easy decision to finally put a stop to the research, as I

realised that there must still be events that I had not yet found. The revised manuscript now contained 3748 entries.

Another thought also worried me. I am not a person who can work to a deadline, so I realised that before I could submit the work to a publisher I would have to include the end-matter of the book, including the index. This would be difficult, as I didn't know which pages the indexed items would be on in the printed book. I solved this by indexing the entries to the year. I compiled two indexes: a name index with 1026 entries and a subject index with 480 entries. The book also contained 5817 references from 361 sources. I was now ready to seek a publisher.

First of all I felt obliged to submit the manuscript to David and Charles again, as they had encouraged me in the first place. So, in March 1990 I sent it to their office, 18 years after my first attempt. They returned it saying that it was not for them.

I was not disheartened by this, as I felt that they were not so heavily involved in astronomy any more. I went through all my astronomy books and those at the library and made a list of likely publishers. At the top of the list was Cambridge University Press, to whom I sent the manuscript in September 1991. They sent it back saying that it was a good book but not for them. They wished me success with the enterprise.

Next on the list was Oxford University Press, to whom I sent it in the same month. I got the same result from them – a good book but not for them. They suggested that I send it to Cambridge University Press! The further travels of the manuscript were as follows:

Faber & Faber	September 1991
Penguin Books	January 1992
Bloomsbury Publishing	February 1992
Chapman & Hall	February 1992
Elsevier Science Publishers	March 1992

They all replied saying that it was a good book but not for them! I felt that there must be someone out there who would like to publish a good book!

At this time I was in touch with Richard Stephenson (*right*), the historian of astronomy at Durham University[1]. I was in his office letting him know what was happening when he said that he knew of a publisher who might be interested. He phoned them immediately and they said they would like to see the manuscript.

So in April 1992 I sent the manuscript to Boydell & Brewer Ltd. They were interested in the work and asked me to supply them with the names of two referees who would read the manuscript and report back to them with their observations and recommendations; Richard Stephenson was one and he recommended a historian of astronomy from the United States to be the other. Unfortunately the American referee took over a year to respond and eventually, in December 1993, Boydell & Brewer declined to publish – back to square one. More travels of the manuscript followed:

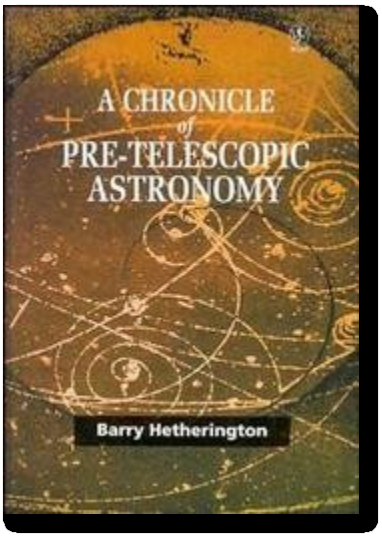
[1] [*Now Emeritus Professor in the Department of Physics. – Ed.*]

Pergamon Press	March 1994
Longman Information & Reference	March 1994
Ashgate Publishing Group	March 1994

In April 1994 I sent the manuscript to Springer-Verlag London Ltd. Having not received a response from them, in May 1994 I sent it off to John Wiley & Sons Ltd. of Chichester. On 19 May they informed me that they were interested in publishing the work and I responded accordingly. Then, on 31 May, I received a letter from Springer-Verlag, apologising for not replying sooner and saying that *they* were interested!! As John Wiley had responded first, I stayed with them.

By December 1994 I had received a publishing contract, so I sought out an agent to act for me. In December 1995 I signed the publisher's agreement giving me 10% of the proceeds of sales. I received a royalty of £400, less the agent's commission.

In October 1995 I received the proofs (278 printed pages unbound) for me to read, correct any errors, and return within a month. I was sent an illustration for the front cover, which I found disappointing as it was more suitable to particle physics than to the history of astronomy. However, I was informed that there was no time to design another illustration and if I was not prepared to go with their suggestion then the book would be published with a blank cover; I agreed with their suggestion.



The publisher fixed the retail price at £50/$80 a copy. I would have liked to see it go for a lower price but, as the publisher was financing the book, they would know at what price they would recover their outlay. The publisher sent me a list of their forthcoming titles, including mine. I was amused to see that all the other authors had a string of qualifications after their names whereas mine simply said 'Barry Hetherington, County Durham'.

The date of publication was 2 February 1996, and a week later I received nine complimentary copies from the publisher. The total print run was 850 copies, of which they eventually sold 427 (including review copies) – the rest were destroyed without reference to me.[2] The book ceased publication in May 2004. In total, between 1995 and 2002, I received the sum of £2032.34 for my efforts; not a vast sum for 30 years' research. In general the book reviews were very favourable and I was pleased to see it referred to in articles on the internet, including the NASA site.

Since then I have continued to collect information from 1610 to date, amounting to 7500 entries. At this time I have no plans to publish a second volume, but the research is currently being used to compile a list of centenaries for the following year that appears in the *Journal of the British Astronomical Association* each December[3].

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[2] [*Despite that, you can still buy a copy of Barry's book through Amazon or other direct suppliers. And Barry is too modest to mention that he's had two other books published – although Amazon.UK doesn't list them, Amazon.com does:* The Darlington Telescope: A documentary history *(published 1986) and* Search for Natural History: Origin of the Darlington and Teesdale Naturalists' Field Club *(1987). – Ed.]*

[3] [*And occasionally in* Transit *at round about the same time! – Ed.]*

Astronomy at tea-time

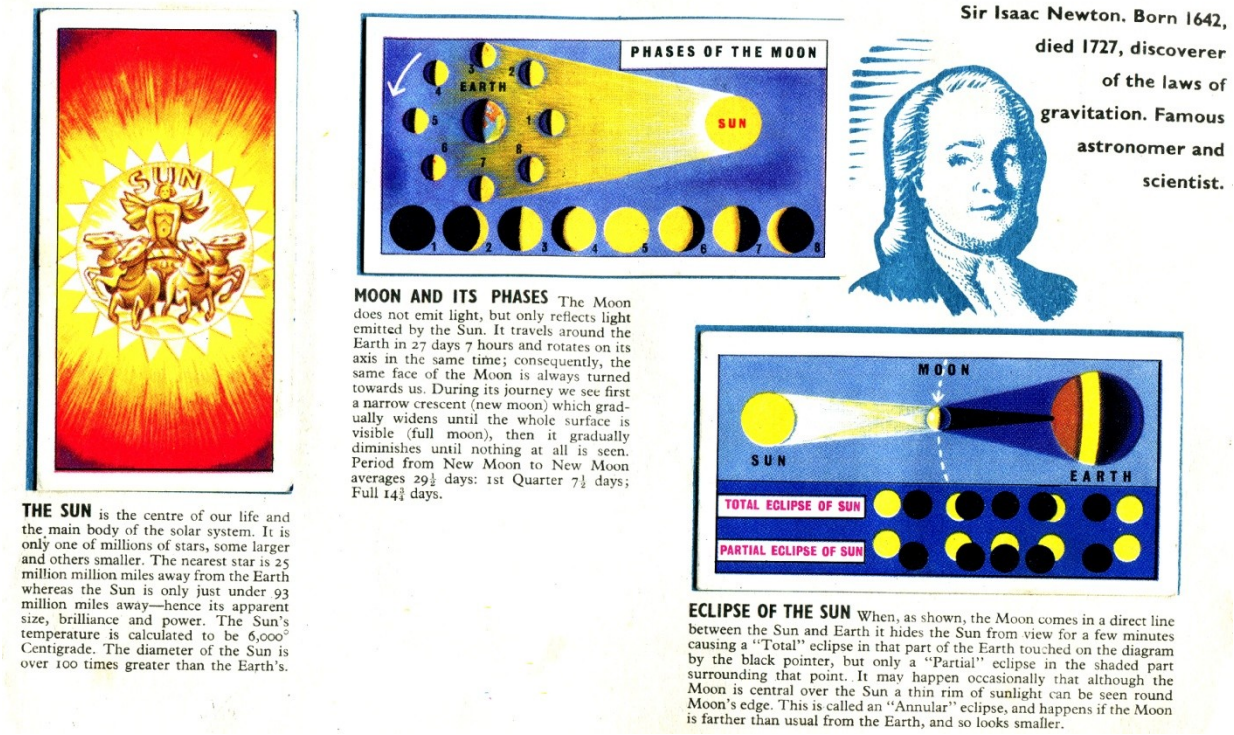
Dave Lewis

My Redcar cousin, Mike Sidgwick, recently sent me images of a series of cards entitled 'Out into Space' that he collected when they were given away with Brooke Bond tea packets in 1956 or thereabouts. The cards were approved by Dr Alan Hunter[4], Secretary of the Royal Astronomical Society. Mike managed to obtain the full set of 50 cards and bought the 'Out into Space' album for storage, price sixpence.

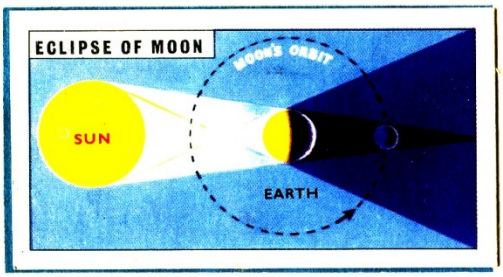
Mike commented:

> The information provided with the cards instigated an interest in astronomy which has stayed with me. The information [*from before the space race started in 1957*] is interesting. Pluto was not included as a planet, a decision which was made again 50 years later, and Mars portrays Percival Lowell's canals. Reading the 'Planets and their Moons' card shows what half a century of subsequent astronomical advances have achieved: Jupiter was then credited with 12 moons, Saturn 9, Uranus 5 and Neptune 2.

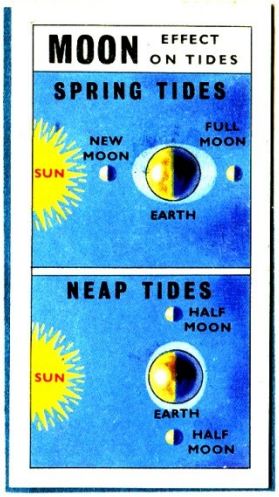
[This issue of Transit *shows the first 20 cards, all about the Solar System. We'll carry more of them in the September issue. – Ed.]*



[4] [*An obituary of Alan Hunter (1912–95) from the* Quarterly Journal of the Royal Astronomical Society *is at* http://articles.adsabs.harvard.edu/full/seri/QJRAS/0037//0000457.000.html . *– Ed.]*

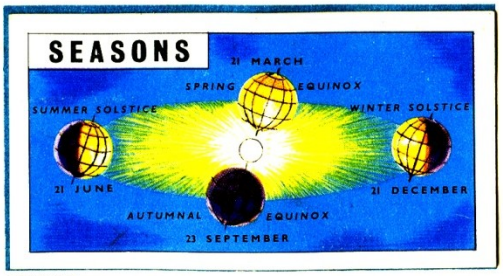


ECLIPSE OF THE MOON The Moon is eclipsed when the Earth is in a direct line between the Sun and Moon, and the Earth's shadow covers it. This can only occur at Full Moon. Even when the Moon is totally shadowed it may still be observed because sunbeams which have touched the edge of the Earth have been refracted by the Earth's atmosphere and turned *inwards* into the shadow, illuminating the Moon with a coppery colour. This is due to the great thickness of atmosphere through which sunbeams pass. Colour effects at sunset are from the same cause.

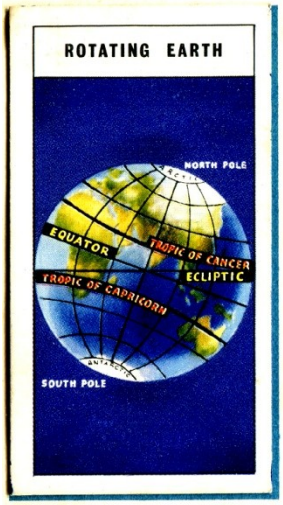


MOON—EFFECT ON TIDES The rise and fall of the sea is produced by the attraction of the Sun and Moon. The Moon is the principal factor. High water to high water is about 12 hours 25 minutes. The greatest or 'Spring' tides occur when Sun and Moon act together at New Moon or when the Earth is immediately between them at Full Moon. The smallest or 'Neap' tides occur when the Sun, Moon and Earth form a right angle. This is at Half Moon, when the Moon's pull acts against the Sun's, and causes tides then to be at minimum.

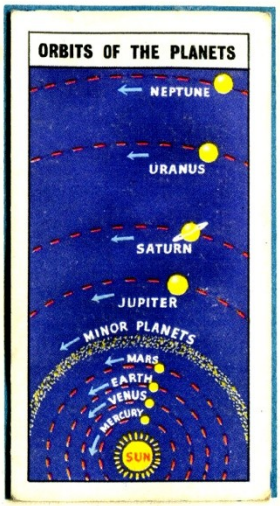
GALILEO. Born 1564, died 1642. The famous Italian astronomer, the first to use a telescope to examine the stars.



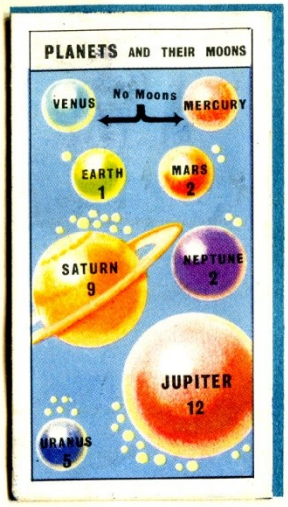
SEASONS These are the four quarters of the solar year, namely: Spring, beginning when the Sun enters the constellation of Aries, the Ram, at the time of the Vernal Equinox, March 21st; Summer (the Summer Solstice, June 21st) starting when it enters Cancer, the Crab; Autumn, when it enters Libra, the Balance, at the Autumnal Equinox, September 23rd; Winter (Winter Solstice, December 21st) when it enters Capricornus, the Goat. The difference between these seasons is caused by the varied angles the Earth's surface presents towards the Sun at different times of the year.



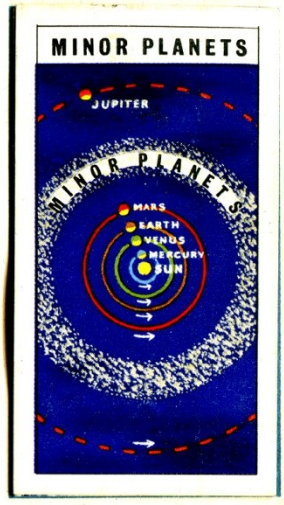
ROTATING EARTH The Terrestrial Equator is an imaginary circle around the Earth equidistant from the Poles, separating Northern from Southern hemisphere. The Celestial Equator is an extension of the Terrestrial Equator and is equidistant from the Poles of the heavens. The Ecliptic is the path of the Earth's revolution around the Sun, and is inclined to the Celestial Equator at an angle of 23° 27′, called "Obliquity of Ecliptic". Direction of the Earth's axis never varies. Tropics are circles on celestial sphere 23° 27′ on each side of Equator.



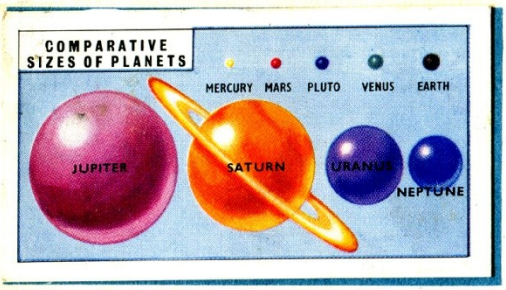
PLANETS—ORBITS All Planets revolve around the Sun anti-clockwise as seen from the north, and differ in size, speed, velocity of axial rotation, etc. Their paths or orbits are not circular but elliptic. The Sun is their focus. Every orbit lies within 7° of the plane of the Earth's orbit except Pluto's (too distant to include in picture), which is inclined at 17°. Mercury takes 88, Venus 224, Earth 365 and Mars 687 days to complete their orbits. Jupiter takes approx. 12 years, Saturn 29, Uranus 84 and Neptune 165 years. Pluto takes 248 years.



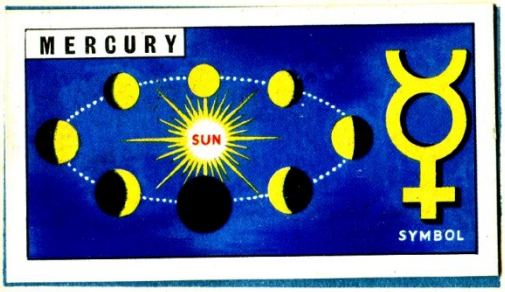
PLANETS AND THEIR MOONS All planets with the exception of Mercury, Venus and Pluto have their moons (or "satellites") which revolve around them. Each takes a definite time to complete its orbit. The period of the four largest Jupiter satellites is 2, 4, 7 and 17 days. Mars has two tiny moons, both approximately only 10 miles in diameter. One is approximately 6,000 miles from the planet and the other 15,000 miles. Although as telescopes have become more powerful, more satellites have been discovered attached to other planets, our Moon is the Earth's only satellite.



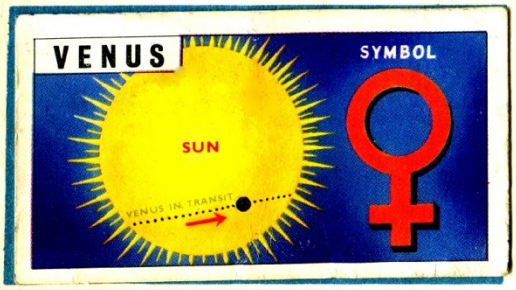
MINOR PLANETS or Asteroids
Thousands of very small bodies form a ring between Mars and Jupiter, the largest being only 480 miles in diameter. The smallest known are considered to be only a few miles across. They are mostly invisible to the naked eye and are called Minor Planets. The first minor planet to be discovered was Ceres, by Piazzi, on 1st January, 1801, and so named after the Goddess of Corn and Harvest. Vesta, the brightest, was discovered in 1807. Those now discovered number nearly 2,000. They may be parts of a larger planet, broken up or not yet formed.



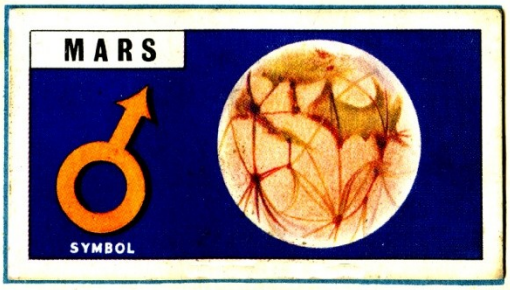
PLANETS—SIZES Of the nine Major Planets, Mercury, Venus, the Earth and Mars are known as Inner Planets; Jupiter, Saturn, Uranus, Neptune and Pluto as Outer Planets. The diameters of the planets in thousands of miles are approximately Mercury 3, Mars 4, Pluto 4, Venus 7½, the Earth 8, Neptune 28, Uranus 31, Saturn 75, Jupiter 88. Owing to their greater distance from the Earth, the big Outer Planets appear to be about the same size as the others. Mercury and Venus are also known as Inferior Planets. Others whose orbits are outside the Earth's are called Superior Planets.



MERCURY is 3,000 miles in diameter, a much larger globe than the Moon. First record of its observation was in 265 B.C. Owing to its proximity to the Sun, it is difficult to see, never appearing in a dark sky; but every few years it may be found near the horizon, an hour after sunset, in April-May. Often it is crescent-shaped like the Moon. Mercury takes about 88 days to revolve around the Sun at a mean distance of 35,750,000 miles. Its velocity varies between 23 and 35 miles a second, being quicker when nearer the Sun.

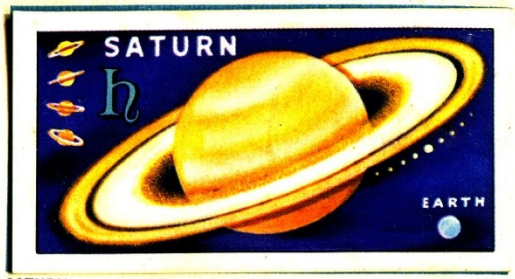


VENUS Named Lucifer (Morning Star) and Hesperus (Evening Star) by the Ancients, Venus comes nearest to the Earth and is the brightest planet. At its greatest brilliance it can be seen by the naked eye in full sunlight within an hour of noon. Venus is nearly the same size as the Earth, diameter 7,600 miles. Mean distance 67,000,000 miles from the Sun, around which it revolves in approximately 225 days. At rare intervals it can be seen in transit across the Sun and observations of its transit in 1769 resulted in the first accurate knowledge of the Sun's distance.

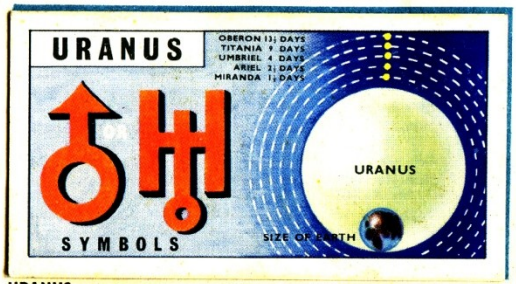


MARS Fourth Planet from the Sun. Distinguished from others by its reddish light. Mean distance from the Sun is approximately 141,500,000 miles. Nearest distance from the Earth is 34,500,000 miles. Diameter 4,200 miles. Revolves around the Sun in 687 days. Rotates on axis in 24 hrs. 37 mins. Possibility of life on Mars has always intrigued observers. Markings once thought to be continents and seas can be seen; some observers have seen long straight "canals". White patches near the poles are probably hoar-frost.

JUPITER An aeroplane travelling at 500 m.p.h. would take 90 years to reach Jupiter, the largest of planets. Its diameter is 88,000 miles and its bulk 1,250 times that of the Earth. It is 300 times heavier than the Earth. Jupiter takes nearly 12 years to complete its elliptic orbit around the Sun at a mean distance of 483,000,000 miles. Its surface is cloud-covered so cannot be seen, and it rotates on its axis in 9 hrs. 50 mins. Two of Jupiter's moons exceed Mercury in size and were first thought to be fixed stars not connected with the planet.

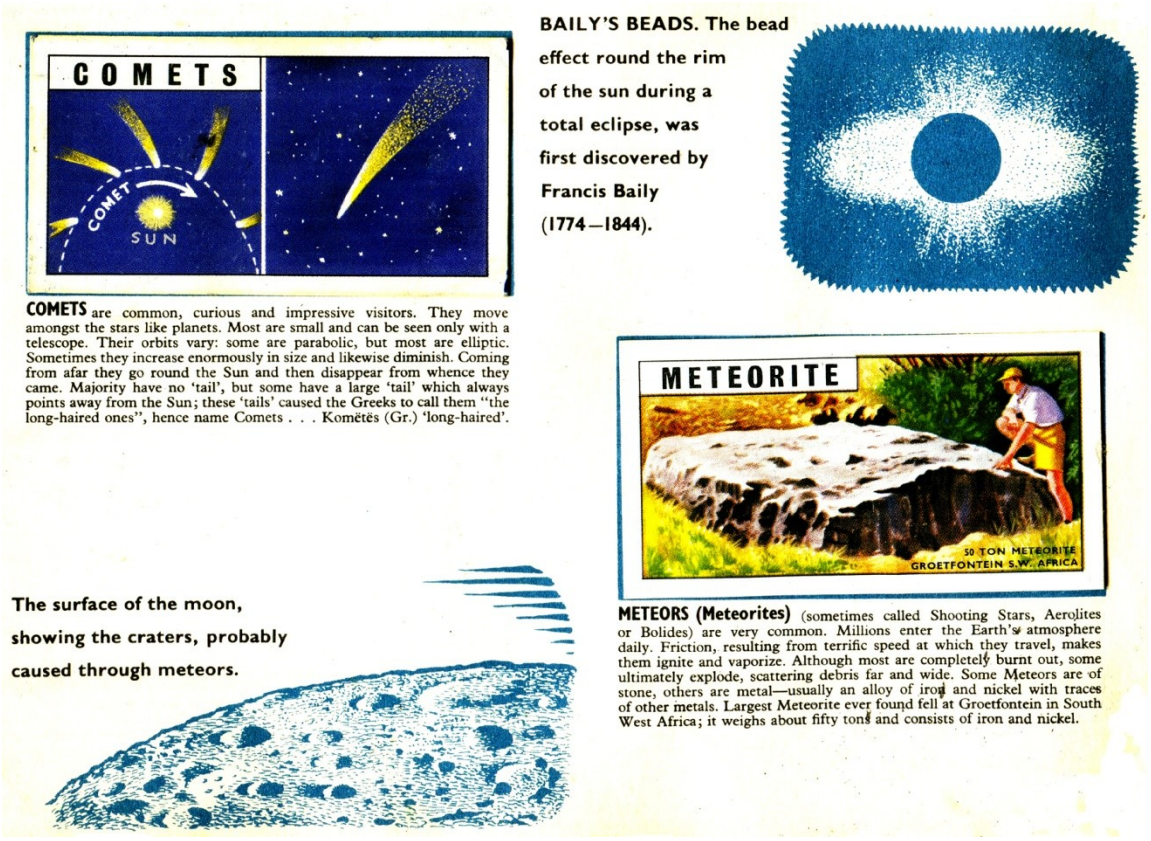


SATURN is a huge globe surrounded by three rings and has nine satellites or moons. The rings are composed of myriads of very small moonlets, the middle ring being the most brilliant. They form a circular band 40,000 miles wide with a thickness of 100 miles. Saturn is 887,100,000 miles from the Sun and takes 29 years to complete its orbit. During its course the rings are observed at various angles, being nearly invisible when the plane passes through the Earth and Sun. They are not visible to the naked eye, and were not known until the telescope was invented.



URANUS is rarely visible to the naked eye. Its diameter is four times greater than that of the Earth, and its volume about 64 times greater; but it is only 15 times as heavy because it is composed of lighter materials. Period of rotation is 10 hrs. 45 mins. and it takes 84 years to complete its orbit, the diameter of which is 3,600,000,000 miles. Its orbital speed is 15,110 m.p.h. approximately. The orbits of its satellites are unique in that they all lie in the same plane, nearly at right angles to the plane of the orbit of Uranus round the Sun.

NEPTUNE has a pale bluish hue. Its mean distance from the Sun is 2,793,000,000 miles. Seen from Neptune, the Sun would appear as large as Venus does when viewed from the Earth, but intensity of the Sun's light would be about a million times greater. Diameter of Neptune is 27,800 miles. Rotation time 15 hrs. 40 mins. Takes 164 years and 7 months to complete its orbit around the Sun travelling at about 12,080 m.p.h. Its orbit is more nearly circular than that of any planet except Venus. Neptune weighs about one 19,314th part of the Sun. Its density is less than half that of the Earth.



Close conjunctions of the planets

Michael Roe

A conjunction is when two objects have the same celestial longitude. Planets have conjunctions when one overtakes another in its path around the sky. The closest type is the very rare occultation by a planet as it covers one more distant:

- On 3 October 1590 Venus occulted Mars, an event observed by Michael Möstlin from Heidelberg.
- On 17 May 1737 John Bevis at Greenwich, probably using a telescope, observed Venus occulting Mercury.

No doubt a very satisfyingly perfect occultation by one planet centred exactly over a larger one is incredibly rare – probably we'll have to wait for that until after another dozen bright Milky Way supernovae have appeared!

However, close conjunctions of two planets, say within a telescopic field of 30', are visible every few years. I saw one in 1973, so close that the two planets – Venus and Jupiter, I believe – couldn't be separated with the naked eye, and even looked close through a 60mm refracting telescope at 100×, about 7' apart.

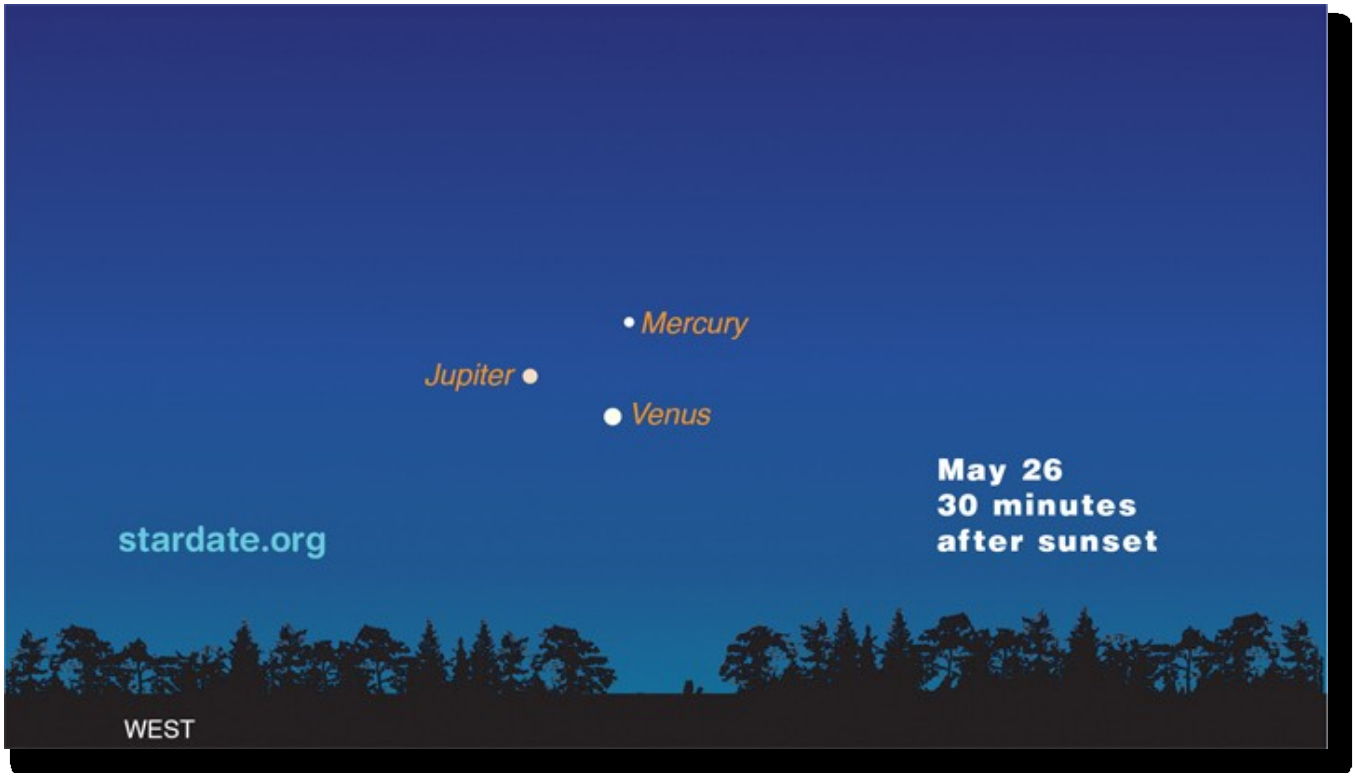
Usually a conjunction of two planets brings them no closer than a degree, often several degrees, apart. This is because the inclinations of planetary orbits vary by several degrees (17° for Pluto) as measured from the plane of the Sun's equator. As viewed from Earth, a planet can move further from

the ecliptic (our own yearly orbital path projected on the sky) at its closest approach, or can be nearer the ecliptic at the planet's furthest distance behind the Sun.

The orbital paths of any two planets intersect in two opposite parts of the sky. If one planet overtakes the other within a few arc-minutes of one of these positions, one may occult the other; but if they are still a few degrees from that position a close conjunction still happens. These points in the sky vary depending on where the Earth is positioned in its journey round the Sun, and the flat loops sometimes seen in planetary movements across the sky are caused by the changing angle of viewing from the Earth.

The most common close conjunctions involve the fast-moving Mercury and Venus, and are mostly difficult to observe. Mars is involved in rather fewer. The rarest conjunctions easily observable are those of Uranus and Neptune. One happened in February 1993, when the planets were about a degree apart; the next will be in over 200 years' time!

I saw a closer conjunction of Jupiter and Uranus on 9 January 2011, when they were about 40' apart; they had been even closer than that on 4 January. I've also seen a close conjunction of Jupiter and Saturn, which happens about every 20 years. Watching two planets approach closer every clear night is quite amazing!



(Credit: stardate.org) Schematic view of the triple conjunction in May of this year

[*http://en.wikipedia.org/wiki/List_of_conjunctions_%28astronomy%2 has a list of conjunctions from 2005–2020. – Ed.]*

The Memorial Museum of Cosmonautics

Peter Hanna

On a recent holiday in Moscow I took the opportunity to visit the Memorial Museum of Cosmonautics and, although negotiating the complexities of the amazing Moscow Metro to travel to the museum was quite a challenge, it was certainly well worth the effort.

The nearest Metro station to the museum is the 'VNDKh', and leaving the Metro the first thing you see is a soaring monument erected in 1964 (three years after Yuri Gagarin's orbit) to the 'Conquerors of Space' – one of the most amazing Soviet monuments (*see below*).

Its upper part is a vast slanting **obelisk** of steel and titanium that stretches to a height of 99 metres, topped by an 11-metre rocket pointed towards the heavens. The Russians believe with some justification that they won the 'space race', and this monument was an expression of pride and celebration. The Museum, located in the base, was opened on 12 April 1981, to commemorate the 20th anniversary of Gagarin's orbit.

Entrance to the Museum costs around £4 (200 roubles) plus another £4 if you wish to take photographs, which I did: 'photographers' were given yellow wristbands to wear, and anyone using a camera without a band was immediately challenged. Note, the cost for children up to 17 years old

was only around 50p, and the museum was very child-friendly, as there were lots of guides and facilities to keep younger ones interested. Children are also reminded of their space heritage in Moscow's riverside Gorky Park, where there is a space-shuttle prototype 'The Buran' (which never flew) offering 'a cosmic experience', including gyroscopic chairs to simulate zero gravity – unfortunately it only opens during the summer months, so I couldn't test this out! The actual *Buran*, which was the first space ship to fly and land automatically, was kept in a hangar, which collapsed in 2002, destroying the craft and killing eight workers.

The museum, which traces the history of rocketry and space exploration from the 1920s to the present day, is divided into ten sections. Exhibits included a mixture of mock ups (usually full-scale) and 'the real thing', so it was possible to see and touch actual space modules. Whilst the majority of the descriptions are in Russian, around 10% (the most significant exhibits) have English translations.

Sections 1 and 2: FOYER and INTRODUCTORY HALL (*above*) with some interesting art works based on early astronomical figures – Copernicus and Galileo etc.

Section 3: DAWNING OF THE SPACE ERA

This section covers the period from the late 1950s to the mid-1960s, with exhibits relating to a number of Russian 'firsts', including:

1957 The first artificial satellite, Sputnik 1.

The first dog in space (Laika)

1959 Luna 1, the first spacecraft to escape Earth orbit

Luna 2, The first manmade object to hit the Moon

Luna 3, the first photos from the far side of the Moon

1960 The dogs Belka and Strelka aboard Sputnik 5 were the first animals to return safely from orbit. They're now stuffed in two glass cases (*below*)!

Special note: This method of returning live 'animals' in a separate capsule from space orbit is still in use today!

1961 The first manned space flight (Yuri Gagarin)

1965 The first spacewalk

1966 Luna 9, the first spacecraft to achieve a soft landing on any planetary body other than Earth

Section 4: CREATORS OF THE SPACE ERA

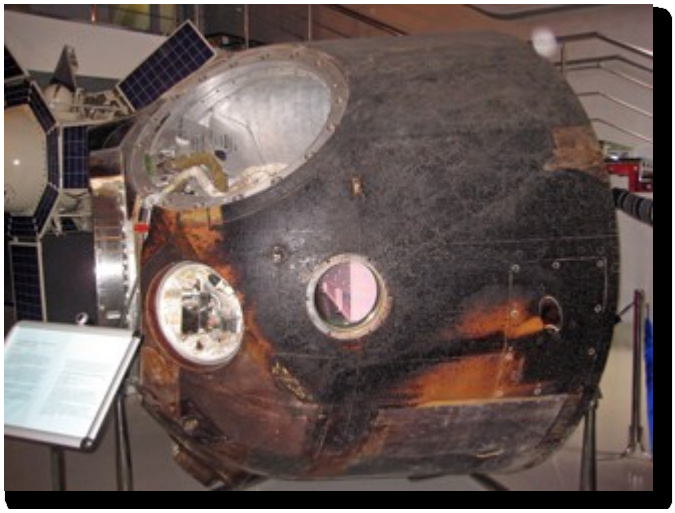
This section contains background and exhibits relating to early Russian space heroes such as Sergey Pavlovich Korolev (1907–66), the legendary Chief Designer responsible for many of Russia's space 'firsts' from the Sputniks onwards, and K. E. Tsiolkovsky (1857–1935) (whose statue sits at the base of the monument).

Tsiolkovsky famously said 'Earth is the cradle of humanity, but one cannot remain in the cradle forever'. Despite being deaf from the age of 10 from scarlet fever, he went on to publish many books (fiction and nonfiction) concerning rocketry and the investigation of outer space. Arguably his most important work was a 'rocket equation' that established the relationships between rocket speed, the speed of gas at exit and the mass of the rocket with its propellant, now called the Tsiolkovsky formula. There is also a crater on the far side of the moon named in his honour.

Section 5: MANNED COSMONAUTICS

This was the most interesting section for me and holds a number of the Soyuz series spacecraft, examples of the Salyut and Mir orbiters, and a very detailed mock-up of the International Space Station (ISS), which visitors can explore. The photo below on the left shows a Soyuz landing module.

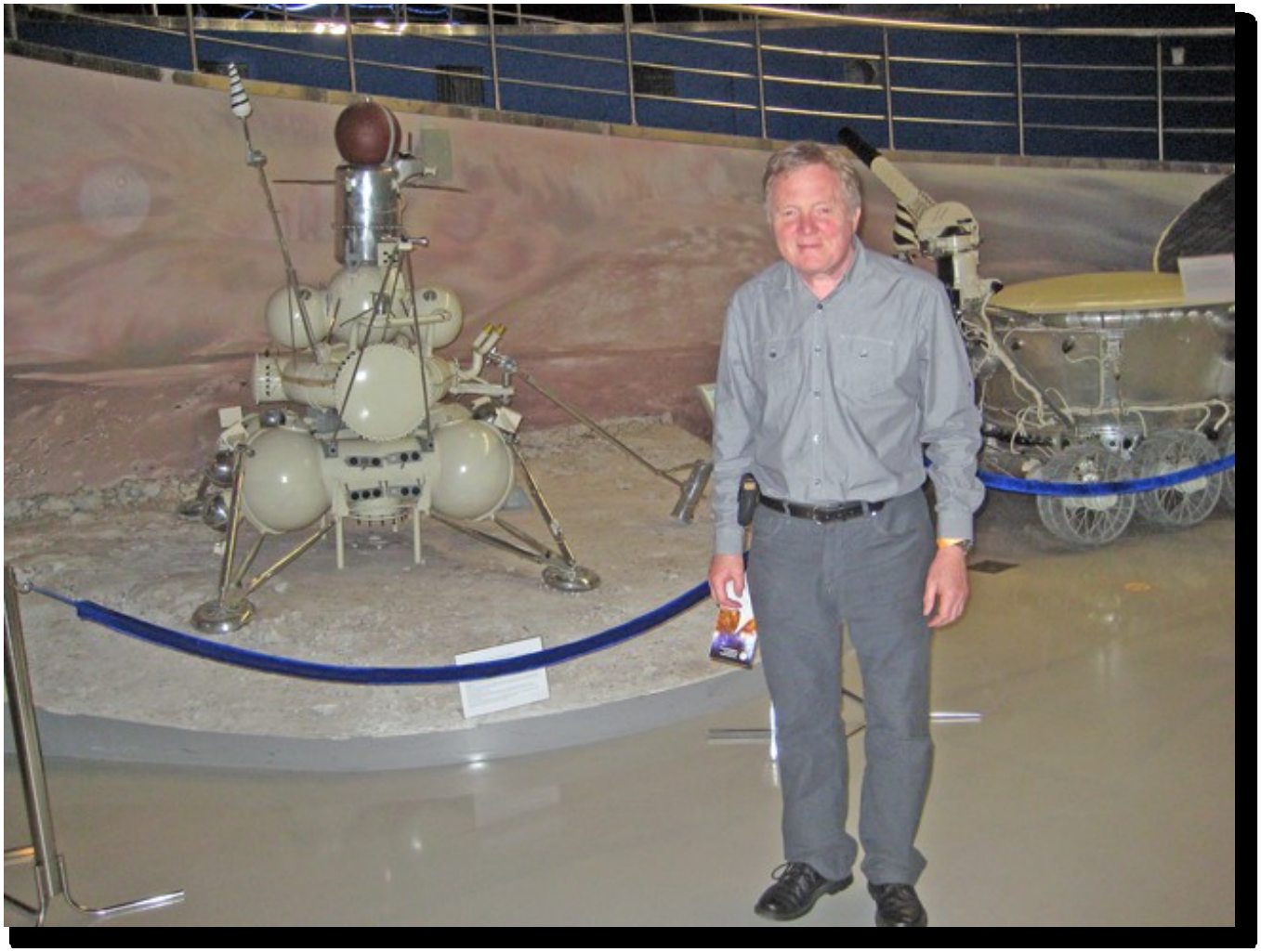
Looking through the exhibits brought home to me what a dangerous and some ways rather dated business space travel is now that the Space Shuttles have been retired: from being launched into orbit on top of a vast quantity of the some of the most explosive materials known to man, to being parachuted back to Earth to land in some very strange places. One of the most memorable exhibits (*below right*) shows cosmonauts having landed on Earth in very cold conditions sitting around an open fire waiting to be picked up.



Section 6: EXPLORATIONS OF THE MOON AND PLANETS

This section features the exploration of the Moon, Venus and Mars by space vehicles, and details the Russian successes.

The photo on the next page shows a mock-up of Luna 16, the first robotic probe to land on the Moon and return a sample of lunar soil to Earth, with an exhibit of actual Moon dust. Sorry about this picture, but I had to prove I was there!



I was surprised to see just how long ago they began sending probes to Venus:

Venera-1 : launched 12 February 1961

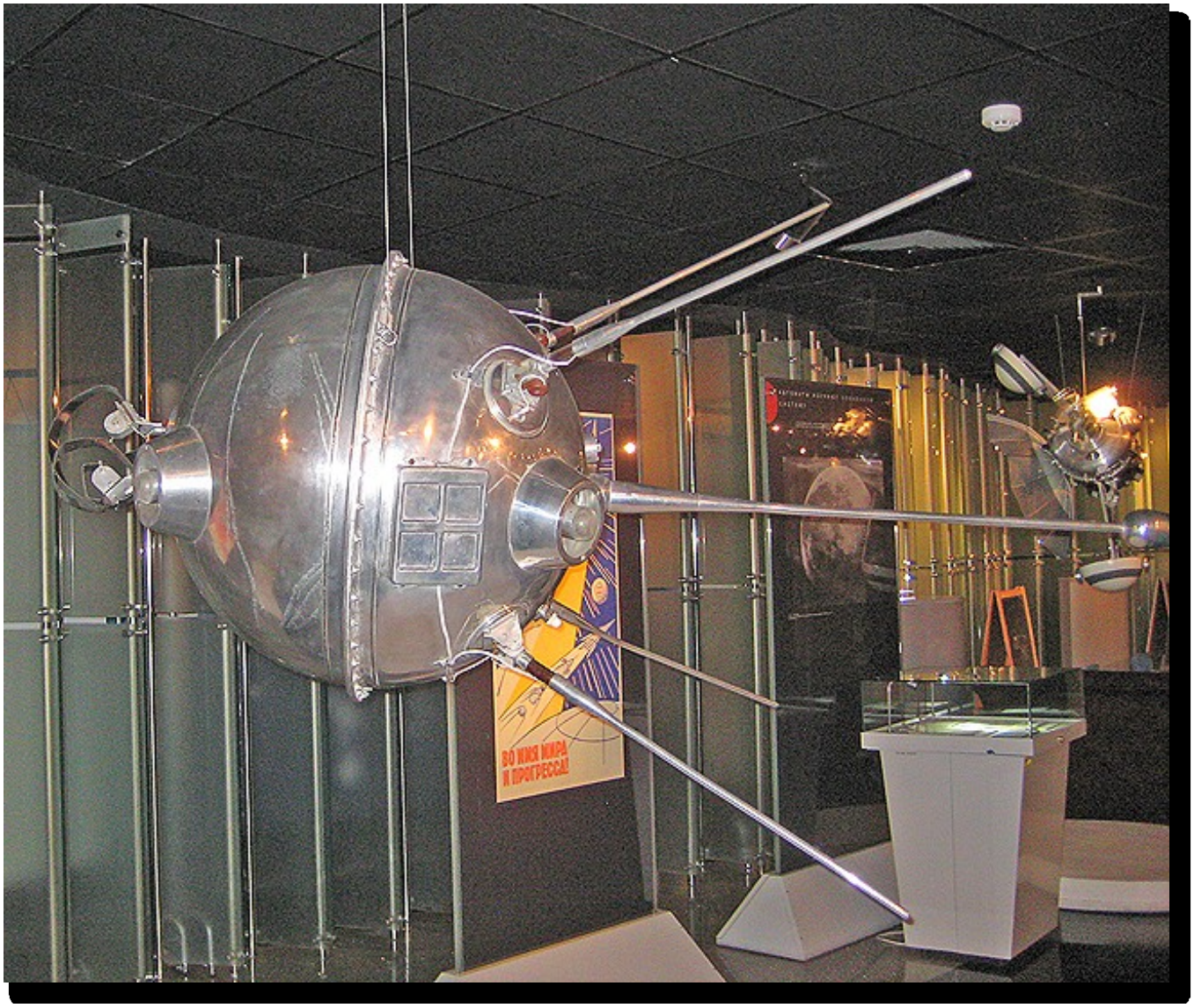
Venera-4 : first probe to enter Venus atmosphere, 1967

Venera-7 : first data transmission from the surface of Venus, 1970

Section 7: ARTIFICIAL EARTH SATELLITES

This is a complete section on the evolution of communication, weather forecasting, TV, GLONASS (their version of GPS) etc., all beginning with that very first Sputnik, of which they have a full-size mock-up (*below*) and an information panel:

It was launched from Baikonur Cosmodrome on October 4, 1957. It lasted 92 days and made approximately 1,400 orbits around Earth. It re-entered Earth's atmosphere and ceased to exist in January 1958. It was designed by Design Bureau OKB-1. It was put into orbit by Sputnik launch-vehicle.



Sections 8 & 9: INTERNATIONAL COOPERATION AND INTERNATIONAL SPACE FLEET

(Although most of the spacecraft were Russian)

These sections illustrate the fact that the use and exploration of space is now inconceivable without diversified international cooperation.

The Baikonur Cosmodrome is based in the now independent country of Kazakhstan and is leased to Russia until 2050. This complex is presently the only launch point from which cosmonauts, astronauts and space tourists can reach the ISS.

The returning cosmonauts also land on the Kazakhstan steppes. Kazakhstan is the largest land-locked country in the world and has a land area greater than western Europe!

Section 10: ART GALLERY with some astrophotography and examples of meteorites to touch!

All in all, a fascinating experience and if you're ever in Moscow I would recommend you make a visit. EasyJet fly to Moscow from Manchester – though you should note that, although flights are relatively

inexpensive, visas are essential (around £85 p.p. for a single-entry visa) and require support documents in advance from a hotel etc. which can take time, so start preparations early!
If you would like more information or advice on travel to Moscow, please email me at peterhanna@virginmedia.com .

Comments on May's issue of *Transit*

John Crowther

I found Sue and Pat's accounts of the Spring Meeting of the Society for the History of Astronomy to be full of interest, and certain questions came to mind.

- **Brian Donkin**, the inventor of steel nibs, would be at least one of the people responsible for 'pen knives' no longer fulfilling the job description implied by their name.
- The Franklin expedition, delayed amidst a maze of large Arctic islands, had no means of contacting Great Britain. This led to the leader's wife turning to spiritualism, which was popular in Victorian times.
- Well-preserved bodies from the expedition have been found buried in the permafrost of one of the islands. The explorers died from lead poisoning caused by the sealing material for tinned food in the early days of this process.
- **Russell W. Porter** was another Arctic explorer, as well as being an industrialist and an astronomer. Are details known about the large iron meteorite he failed to find in 1916? Where did it fall and why was it known to be made of iron?

  It seems strange that Porter, who had earlier experienced temperatures of –30°C down to –47°C, should be so troubled by those back in Vermont that he had a tunnel built leading from his house to his turret-style observatory. From the photograph, it would appear to be quite a long one.

  Porter died in 1949 and left an admirable quote:

  > *Nothing gives me more pleasure than that of knowing that I have helped people build their own telescopes and discover the wonder of the stars.*

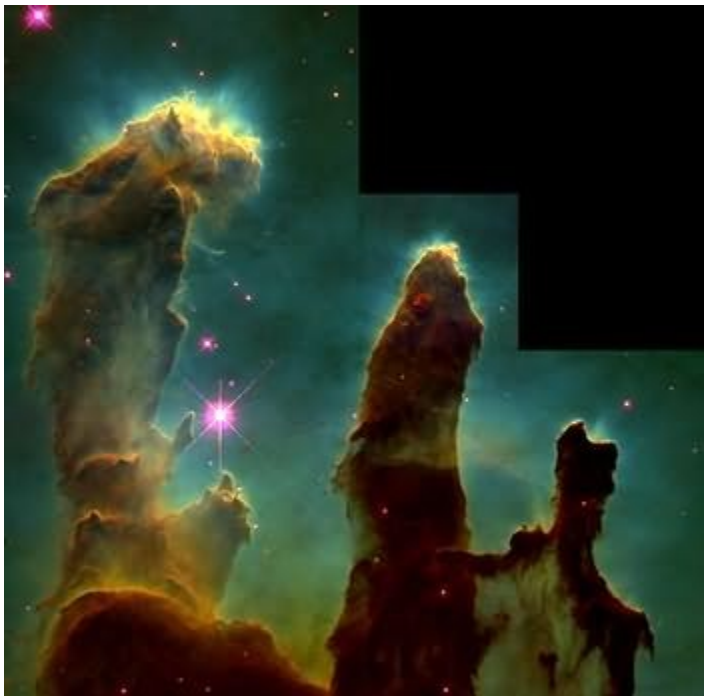
  People such as our President, Jack Youdale, and the late John Morley have also achieved this ambition, as have some present members of CaDAS.

On to Michael's article, 'How astronomy has changed in my lifetime'. I remember boys' books of the 1950s featuring stories about a Venusian jungle inhabited by dinosaurs and about jellyfish-like creatures that had evolved gas-filled bags and lived in the upper atmosphere of our planet. These were discovered by the pilot of a plane seeking an altitude record, who narrowly escaped from their stinging tentacles. Decades later these were imagined in Jupiter's upper atmosphere. But our present-day science has enough true wonders of its own to amaze and fascinate …

Answers to May's quiz

Every answer starts with the letter E.

1. The apparent yearly path of the Sun against the background stars. **Ecliptic**
2. The largest object situated at one astronomical unit (AU) from the Sun. **Earth!**
3. Types E0 to E7 in the Hubble classification of galaxies. **Ellipticals**
4. One of the divisions in Saturn's A-ring. **Encke, after its discoverer, Johann Franz Encke (1791–1865)**
5. The home of the Pillars of Creation. **Eagle Nebula** (*see right*)
6. The more modern name for what used to be known as the Kuiper belt. **Edgeworth–Kuiper belt, after Kenneth Edgeworth, who proposed it on theoretical grounds in 1949, two years before Gerard Kuiper independently did the same.**
7. The constellation of which Achernar is the brightest star. **Eridanus**
8. A bright, bluish planetary nebula in Gemini. In long-exposure photographs, it resembles a face surrounded by a fur hood. **Eskimo Nebula**
9. The first near-Earth asteroid to be discovered, in 1898. **Eros**



10. The first Mars-Trojan asteroid to be discovered, in 1990. **Eureka**

The summer's quiz

First of all, a question from Malcolm Bannister …

What's the significance of these stars? The answer is upside-down at the end of the magazine.

Alpheratz	(α Andromedae)	Enif	(ε Pegasi)
Acamar	(θ Eridani)	Fomalhaut	(α Piscis Austrini)
Achernar	(α Eridani)	Gienah	(Gamma Corvus)
Acrux	(α Crucis)	Menkar	(α Ceti)
Aldebaran	(α Tauri)	Menkent	(θ Centauri)
Alkaid	(η Ursae Majoris)	Mirfak	(α Pegasi)
Alphard	(α Hydrae)	Navi	(γ Cassiopeiae)
Alphecca	(α Coronae Borealis)	Nunki	(σ Sagittari)
Altair	(α Aquilae)	Peacock	(α Pavonis)
Antares	(α Scorpii)	Polaris	(α Ursae Minoris)
Arcturus	(α Boötes)	Procyon	(α Canis Minoris)
Atria	(α Trianguli Australis)	Rasalhague	(α Ophiuchi)
Canopus	(α Carinae)	Regor	(σ Puppis)
Capella	(α Aurigae)	Regulus	(α Leonis)
Dabih	(β Capricorni)	Rigel	(β Orionis)
Deneb	(α Cygni)	Sirius	(α Canis Majoris)
Denebola	(β Leonis)	Spica	(α Virginis)
Diphda	(β Ceti)	Vega	(α Lyrae)
Dnoces	(ι Ursae Majoris)		

Now for the regular quiz. Twice as many questions as usual this time, to tide you over the summer (or, in Neil's case, the first 5 minutes of the summer). Every answer starts with either F or G. The questions are in very rough order of increasing difficulty.

1. The first Astronomer Royal.

2. The collective name for the four largest satellites of Jupiter.

3. The largest satellite in the solar system.

4. Bright, irregular regions on the Sun, usually associated with sunspots.

5. Two fully automatic robotic 2-metre telescopes in Hawaii and Australia, built originally for British educational use over the internet.

6. The end of a solar eclipse.

7. The European Space Agency's first deep-space probe – and the first spacecraft to make close-range studies of two comets.

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.

9. The strongest absorption lines in the solar spectrum.

10. The intersection of the ecliptic with the celestial equator at the Sun's ascending node.

11. The original (English) name suggested for Uranus by its discoverer, William Herschel, in 1781.

12. Any crater that was subsequently flooded with lava, displaying just a ridge around the rim.

13. The first person to identify Neptune, based on calculations by Urban Le Verrier in 1846.

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.

15. The name that William Herschel gave to μ Cephei on account of its strong red colour.

16. American astronautics pioneer who flew the first liquid-propellant rocket, in 1926.

17. A region of dark nebulosity close to the Trapezium stars in the Orion Nebula.

18. Alpha Piscis Austrini. Its name means 'mouth of the southern fish'.

19. The first person to predict the existence of the cosmic background radiation.

20. The first person to safely observe a transit of Mercury, in 1631, based on a prediction by Kepler.

Answer to Malcolm's question: They were the navigation guide stars used by Apollo astronauts.