

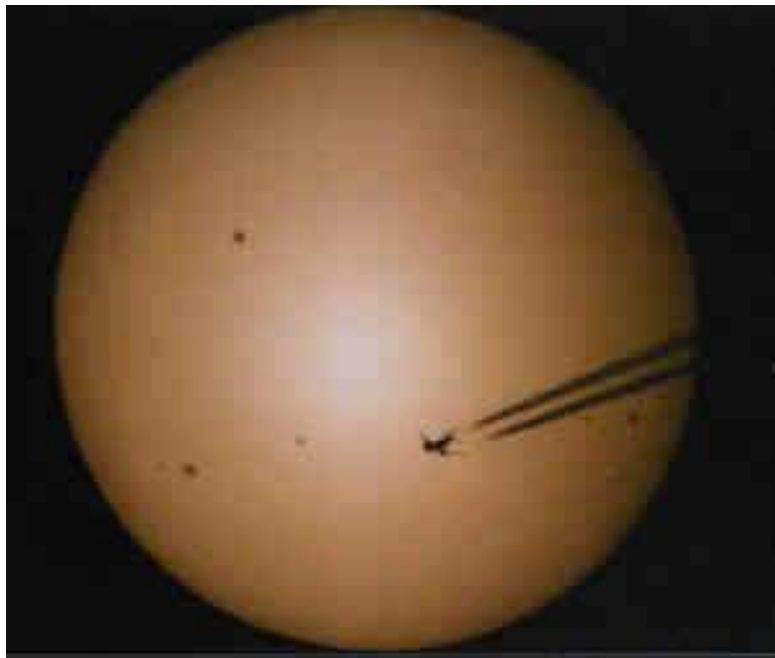


# TRANSIT

The Newsletter of



9th January, 2004. Julian Day 2453014



So you are quietly looking at the Sun and taking a few pictures and this one comes along!  
Or is it a computer-generated fake? We will never know but it looks good, doesn't it?

**Editorial**

**The Society Book Project.** The score has now moved on to thirteen, with the hope of receiving all those wonderful creations, written while not watching boring Christmas television programmes. Will we have to produce a mini-book, with lots of famous names missing??

**Keith Johnson’s Astropictures.** The “Sky at Night” astro-pictures competition finals was judged on the 4th January, 2004 programme. We will announce the result at the Member’s Night on 9<sup>th</sup> January.

**December meeting.** Jurgen Schmoll gave us a wonderful insight into the forefront of astronomical technology with his beautifully illustrated talk. Not only does he make complex equipment for measuring spectra, he travels the World using it.

**January meeting. Member’s Night, January 9<sup>th</sup>, 2004.** There are three items planned so far – contact Neil if you want to do something.

**Subscriptions.** Your £6 is now due and should be paid to Ian as soon as possible. Don’t let your opportunity of superb lectures and a regular Newsletter pass by.

**Beagle 2.** At the time of going to press, no signals have been received from Mars to indicate a safe landing. There must be thousands of astronomers willing the probe to spring to life and fulfill the inventors’ wonderful dream.



**A Matter Of Time**

By Neil Haggath

A few months ago, a prominent member of our Society made a rather embarrassing mistake; I won’t embarrass him further by saying who it was! On the day of the transit of Mercury, he arrived at the observatory an hour too early – while it was still dark – because he had read the times for the event, and forgotten to convert them from UT to British Summer Time. D’ohhh!

I mention this, not to take the Mick, but to draw attention to something which should concern us all, when communicating astronomy to the public.

When astronomical publications and web sites publicise forthcoming events, such as eclipses, the timings are almost always given in Universal Time ( UT ) – which for any practical purpose is the same thing as Greenwich Mean Time. This is done regardless of where in the world the event is happening, and where the information originates. Timings are often also given for the appropriate local time zone, but always primarily in UT.

The reason, of course, is to avoid ambiguity. If all timings are given in UT, then no matter where the event is taking place, or where in the world the reader may be, we are all “singing from the same hymn sheet”, and everyone can make the necessary conversion to their own time zone.

The trouble is – while we astronomers understand all this, other people might not. Most members of the public probably never give a thought to time zones, apart from altering their clocks twice per year, on the dates when we are told to do so by the media. Some, I suspect, are incapable of even understanding the concept – the kind who, when going on holiday, are baffled as to why the flight from A to B apparently takes four hours, but coming back takes six!

In the run-up to this year’s annular eclipse, it seems that many of the public were given incorrect information, which may have led to them getting up an hour earlier than necessary – as if the correct time wasn’t early enough! I personally managed to save at least one person from making this mistake.

As you know, my failed observation attempt was made from Orkney. A couple of days before the eclipse, I was dining in a pub restaurant in Stromness, when I overheard a lady a couple of tables away, who was talking to the people at the next table, mention the eclipse. She was in Orkney for some other reason, but had heard about the eclipse, and was interested in seeing it. She told her listeners that it would occur “at quarter to four in the morning”.

At this point, I politely intervened, and informed the lady that it was, in fact, an hour later. She told me that she had been given her information by the Orkney Tourist Board. So it appears that the Tourist Board had obtained the timings from whatever source, failed to realise that they were given in GMT, and forgotten to add an hour for the benefit of their visitors. D’ohhh! indeed; I wonder how many non-astronomers were caught out?

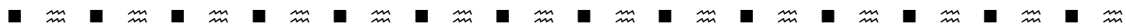
When I told the lady that I was an astronomer, she took my word for it about the timings. I couldn’t remember the precise timings off the top of my head, but did of course have them written down at my guest house. So the lady gave me her mobile phone number, and I later texted to her the precise details, for which she was very grateful.

The moral of this story is that we all need to be careful, when informing the public about astronomical events, to ensure that our meaning is clear. Conventions such as specifying times in UT are obvious to us, but may not be to Joe Public. Without a little care in such matters, confusion will reign.



## **The Sun’s not that Energetic**

Here’s one of those “I don’t believe it” statements. The heat production of the Sun is a small fraction of that of the human body, kilogramme for kilogramme. Mass of Sun =  $1.898 \times 10^{30}$  kg, solar heat output  $3.9 \times 10^{26}$  watts. Watts per kg  $2 \times 10^{-4}$ . Mass of human body 75 kg, heat output 200 watts, hence watts per kg 2.7. So there.



## **A Dialogue for Member’s Night**

By John Crowther

*John has written this playlet as a contribution to member’s night on January 9<sup>th</sup>, 2004. The Editor thought it was such a good idea that it was worthy of being published so that those who can’t make it to the meeting can also enjoy it. Perhaps even perform it on some suitable occasion? I have to confess that I have never read “The Dialogue on Two Systems”, although I once owned a copy of both volumes in Italian – perhaps we all should do so, it is such an important event in the history of astronomy.*

*Galileo was a fascinating character, who made all manner of scientific discoveries. An account of his dealings with Bellarmine and the Church authorities is given in John*

Gribben's "Science, A History, 1543-2001". With the example of Giordano Bruno to give him pause, it may be that Galileo's most important achievement was to escape Bruno's fate. Not an atmosphere conducive to open scientific enquiry!

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The following short play is taken from "Galileo's Daughter" by Dava Sobel, shortened and slightly simplified.

**Narrator:** Galileo Galilei is in the Chambers of the Holy Office. It is 12<sup>th</sup> April, 1633. Paintings of this event show many people present but, as shown on the television documentary "Galileo's Daughter", just two officials and a secretary are present. Also contrary to some of the paintings, the elderly Galileo was allowed to sit, as in the television documentary.

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**Inquisitor:** *By what means and how long ago did you come here?*

**Galileo:** I arrived in Rome the first Sunday in Lent and I came in a litter.

*Did you come of your own accord, or were you called or ordered? If you were called or ordered who did this?*

In Florence, the Father Inquisitor ordered me to come to Rome and present myself at the Holy Office.

*Do you know or can you guess why you were so ordered?*

I imagine that the cause of the having been ordered to come before the Holy Office is to give my account of my recently printed book. I suppose this because of the order given to the printer and to myself, a few days before I was ordered to come to Rome, not to issue any more of those books and similarly, because the printer was ordered by the Father Inquisitor to send the original manuscript of my book to the Holy Office in Rome.

*What is there in the book which you think would cause you to be so ordered?*

It is a book written in dialogue and it treats of the constitution of the world or rather of the two chief systems - that is, the arrangements of the heavens and of the elements.

*Would you recognise the said book and do you recognise that every word in this book is yours?* (The book is handed to Galileo).

I know this book shown to me very well. It one of those printed in Florence and I acknowledge all it contains as having been written by me.

*When and where did you compose this book and how long did it take you?*

As to the place, I composed it at Florence, beginning ten or twelve years ago and I was occupied on it for about six or eight years, though not continuously.

*Were you in Rome at an earlier time?*

I was in Rome in 1616 and afterwards I was here in the second year of the pontificate of His Holiness Urban VIII and lastly I was here three years ago on the occasion of my wish to have my book printed. The occasion for my being in Rome in the year 1616 was that, hearing questions raised about the opinion of Nicolas Copernicus concerning the motion

of the Earth and stability of the Sun and the order of the celestial spheres in order to assure myself against holding any but holy and Catholic opinions. I came to hear what was proper to hold concerning this matter.

*In 1616 you were invited to discuss the opinion of Nicolas Copernicus with five Cardinals?*

In 1616 I came to Rome of my own accord, without being summoned, and for the reason I told you. In Rome I treated of this business with some Cardinals who governed the Holy Office at that time, in particular with Cardinals Bellarmino, Aracoeli, San Eusebio and d'Ascoli.

*What did you discuss with these Cardinals?*

The occasion for discussing with these Cardinals was that they wished to be informed of the doctrine of Copernicus, his book being very difficult to understand for those outside the mathematical and astronomical profession. In particular they wanted to know the arrangements of the celestial orbs under the Copernican hypothesis, how he places the Sun at the centre of the planets' orbits, how around the Sun he places next the orbit of Mercury, around the latter that of Venus, then the Moon around the Earth and around this Mars, Jupiter and Saturn. In regard to motion, he makes the Sun stationary at the centre and the Earth turn on itself and around the Sun, that is on itself with the diurnal motion and around the Sun with the annual motion.

*What was the outcome of those discussions?*

Concerning the controversy that went on about the said opinion of the stability of the Sun and the motion of the Earth, it was determined by the Holy Congregation of the Index that this opinion, taken absolutely, is repugnant to Holy Scripture and it is to be admitted only *ex suppositione*, the way in which Copernicus takes it.

*What did the most Eminent Bellarmino tell you about the decision?*

Lord Cardinal Bellarmino informed me that the said opinion of Copernicus could be held hypothetically, as Copernicus himself had held it. His Eminence knew that I held it hypothetically, namely in the way that Copernicus held it, as you can see from an answer by the same Lord Cardinal to a letter of Father Master Paolo Antonio Foscarina, Provincial of the Carmelites. I have a copy of this and in it one finds these words: 'I say that it seems to me that your Reverence and Signor Galilei are proceeding prudently by limiting yourselves to speaking hypothetically and not absolutely'. This letter by the said Lord Cardinal is dated April 1615. Moreover he told me that otherwise, namely taken absolutely, the opinion could neither be held nor defended.

*What decision was made and then notified to you in the month of February, 1616?*

In the month of February 1616 Lord Cardinal Bellarmino told me that since the opinion of Copernicus, taken absolutely, contradicted Holy Scripture, it could not be held or defended but that it might be taken and used hypothetically. In conformity with this, I keep a certificate by Lord Cardinal Bellarmino himself, made in the month of May, on the 26<sup>th</sup>, 1616, in which he says that the opinion of Copernicus cannot be held or defended, being against the Holy Scripture.

*Have you heard more about this matter?*

I do not remember that I was told anything else, nor can I know whether I should recall what was then said to me even if it were read to me. I say freely what I do recall because I claim not to have contravened in any way the precept. That is, not to have held or defended the said opinion of the Earth and the stability of the Sun on any account.

*Do you recall anything else which was said?*

I was presented with an injunction in the presence of witnesses saying that I cannot in any way whatever, hold, defend or teach my opinions. I was ordered in the name of His Holiness the Pope and the whole body of the Holy Office that my opinion that the Sun is the centre of the Universe and that the Earth moves must be entirely abandoned. If I did not do this the Holy Office would proceed against me.

*So did you seek permission from the Master of the Sacred Palace before you had your book printed in Italian and here in Rome?*

I did not happen to discuss that command with the Master of the Sacred Palace when I asked for the imprimatur, for I did not think it necessary to say anything because I had no doubts about it. For I have neither maintained nor defended in that book the opinion that the Earth moved and that the Sun is stationary but have rather demonstrated the opposite of the Copernican opinion and shown that the arguments of Copernicus are weak and inconclusive.

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**Narrator:** The last phrase of Galileo's testimony encapsulates the agony of his position. It would be easy to accuse him of equivocating. Surely by the end of that day's questioning he appreciated the danger he faced and may have seen good reason to hedge in self defence. Ambassador Niccolini had even warned him to be submissive and assume whatever attitude the inquisitors seemed to want of him. But Galileo did not lie under oath. He was a Catholic who had come to believe something Catholics were forbidden to believe. Rather than break with the Church, he had tried to hold - and at the same time not to hold - this problematic hypothesis, this image of a mobile Earth. His comment on the deposition recalls the duality he expressed in his 'Reply to Ingoli' when he describes how Italian scientists had come to appreciate all the nuances of Copernicanism before rejecting the theory on religious grounds. That Galileo believed in his own innocence and sincerity is clear from letters he wrote before, during and after the trial.

The prosecutors, hearing Galileo's response, however, may well have gasped at it. Why had this case been referred to the Holy Office in the first place, if not because Urban's hired panel deemed the 'Dialogue' an over-enthusiastic defence of Copernicus? The prosecutors could have questioned Galileo closely here on suspicion of deceit. But instead they said nothing. Perhaps they too understood the complexity of the situation. Or they took him at his word, or both.

With this the deposition ended and he was assigned a certain room in the dormitory of the officials, located in the Palace of the Holy Office, in lieu of prison, with the injunction

not to leave it without special permission under penalty to be decided by the Holy Congregation and he was ordered to sign below and was sworn to silence.

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## **Transits of Venus**

by Neil Haggath

In a previous issue of *Transit*, Alex reminded us of the forthcoming transit of Venus, in June 2004, and posed the following questions:

“Perhaps one of our experts can tell us why a transit of Venus seems to be given more importance than that of Mercury. And why are transits important anyway?”

Transits are not of any scientific importance these days, but they *were* considered vitally important a couple of centuries ago, for reasons which I’ll come to shortly.

Transits of Venus are considered much more interesting than those of Mercury, simply because they are much rarer! Transits of Mercury happen every few years – 13 or 14 times per century – so that every amateur astronomer who so wishes has a good chance of seeing at least one or two during his lifetime; many of us saw one on 7 May this year.

But transits of Venus are among the rarest of all astronomical phenomena; only six of them have occurred since the invention of the telescope. (And only five have been observed, as no-one knew about the first). The reason why there is so much excitement about this year’s transit is very simple; as the last one occurred in 1882, no human being currently alive has ever seen one! No doubt many British astronomers will be travelling to sunnier climes for the event; Don and I certainly intend to do so.

If we miss it, there’s another in 2012 – though it won’t be visible from Europe – but after that, we’ve had it until 2117.

Transits of Venus always occur in pairs, eight years apart; the intervals between the pairs alternate between 105.5 and 121.5 years, i.e. they recur at successive intervals of 8, 105.5, 8 and 121.5 years. I’ll have to leave it to John to explain exactly *why* this happens! The six transits which have occurred since the invention of the telescope took place in the following years: 1631, 1639, 1761, 1769, 1874, 1882. And the next pair, as I’ve said, are in 2004 and 2012.

So why were they previously considered so important? The first transit to be predicted and observed was that of 1639; it was observed by a grand total of two people, Jeremiah Horrocks and George Crabtree, in Cheshire.

After that, it was discovered that the next pair would occur in the 1760’s. Then no less a person than the young Edmond Halley realised that these events could be used for a very important purpose. If a transit was observed from a number of different longitudes around the world, and its contacts timed very accurately, the difference in its apparent position from different observing sites – i.e. its parallax – could be used to determine the distance of the Earth from the Sun more accurately than had been done by any other method up to that time. And that would lead to an equally accurate determination of all planetary distances, by Kepler’s Third Law.

While transits of Mercury are much more common, those of Venus are much more suitable for this purpose, as Venus is closer to Earth, and therefore exhibits a bigger

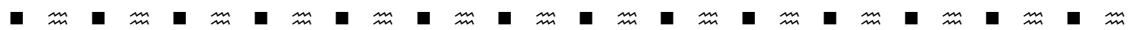
parallax. Though Halley would not live to see the next transit, he issued the challenge to a future generation of astronomers.

Come the 1760's, the challenge was taken up with a vengeance. Both the British and French governments sent a number of expeditions to observe the transits from far-flung places ( by Sod's Law, they weren't visible from Europe ). One British astronomer, Charles Green, sailed with Captain James Cook aboard *Endeavour*; the primary objective of one of Cook's round-the-world voyages was to observe the 1769 transit from Tahiti. The project was considered so important that Britain and France signed a treaty, agreeing to allow each other's astronomers the right of passage through their territories, and to cooperate in processing the data afterwards – even though they were engaged in a major war!

Also in connection with these expeditions, many of you will have heard and/or read my story of Legentil, the unluckiest astronomer who ever lived – but I won't go into that again here!

Sadly, all that effort proved to be in vain; the method didn't work! There was nothing wrong with Halley's maths, and the theory behind it was perfectly sound – but it proved not to be so easy in reality. A strange optical effect of atmospheric "seeing", now known as the *black drop*, meant that it was practically impossible to judge the exact moment of each contact, and therefore to make the timings with the required accuracy.

Since then, of course, planetary distances have been measured by much more accurate methods, and the 19<sup>th</sup> Century transits didn't have anything like the same importance. But this time around, they have attracted a degree of scientific interest once again. Some professional astronomers plan to use next year's transit to test some advanced photometric techniques, which they hope to use to detect planets of other stars – by measuring the minute reduction in the star's light as a planet transits across it.



Still on the subject of the Transit of Venus this year, here is a piece sent by Ray Worthy some time ago. It is an extract from the communications with his Planetarium colleagues. The piece is written by an American, with an American slant, but the ideas and information apply to everyone, I think. It also shows how much effort is being put into using the Transit of Venus as an educational event.

From: [bueter@rad-inc.com](mailto:bueter@rad-inc.com) <mailto:bueter@rad-inc.com>

Subject: Transit of Venus

Dear Planetarium Friends,

The June 8, 2004, transit of Venus - an event that has not been witnessed by any human now alive - is an educational gold mine in multiple disciplines. In preparation for this celestial spectacle, I and others are building a collection of materials for the planetarium community. Below are four related items.

First, we are compiling images and information at the Paper Plate Education website at <http://analyzer.depaul.edu/paperplate/>, which is hosted by DePaul University and its broker/facilitator affiliation with the Office of Space Science. I encourage you to bookmark the site and visit repeatedly, for new material is frequently added. (Click the "What's New? navigation button.).



Second, we are currently storyboarding a planetarium program with components to be distributed at a minimal cost. By announcing this now we hope you begin scheduling for the transit. Regarding the planetarium program, which is targeting mid-sized and small facilities, I welcome your comments on unique ways to distribute resources effectively. For example, would you prefer a complete program, with script, slides, narration tape, CD, etc., for which we are seeking grants? Or would you simply prefer a sample script for ideas and a CD with images that you can selectively have made into slides for your own program? Please be cost-conscious. For both of these projects I solicit your active participation. I invite you to share related materials that either a) are copyright free (public domain) or b) come with permission from the owner/creator to use and include the name of the person or institution to whom it should be credited. Suggested related material that you can share includes historical documents, images, activities, links, observing aids, games, quotes, diagrams, articles, etc. What you send will be availed through the website to assist your colleagues, other educators, and the public. If you know of online material that is useful but for which you cannot obtain permission to use, please at least send a link to that site. (Please send images in high resolution for use by other planetarians. For now, though, they will appear on the transit page in smaller versions.) This call for your support is also listed in the Project Sharing section of the NASA Space Science Portal at

<http://cfa-www.harvard.edu/seuforum/wateringhole/sharing.htm>. The Portal was created by NASA in response to questionnaires to which planetarians replied. If you haven't visited the online watering hole, I encourage you to visit it and to have a role in the initiative.

Third, NASA, too, is promoting the transit of Venus. Lou Mayo, a project coordinator for NASA's transit programs, told me they hope to reach ten million people and over 25,000 teachers through multiple offerings. Below is an excerpt from Bulletin #34 of the American Astronomical Society, 2002: "The NASA Sun Earth Connection Education Forum, in partnership with the Solar System Exploration Forum, DPS, and a number of NASA space missions, is developing plans for an international education program centered around the June 8, 2004 Venus transit...We will use a series of robotic observatories including the Telescopes In Education network distributed in latitude to provide observations of the transit that will allow middle and high school students to calculate the A.U. through application of parallax. We will also use Venus transit as a probe of episodes in American history (e.g. 1769: revolutionary era, 1882: post civil war era, and 2004: modern era). Museums and planetariums in the US and Europe will offer real time viewing of the transit and conduct educational programs through professional development seminars, public lectures, and planetarium shows. We are interested in soliciting advice from the research community to coordinate professional research interests with this program." Lou Mayo was very generous in specifically inviting the planetarium community to flood him with calls as NASA plans coordinated transit programs. Lou may be reached at [lmayo@pop600.gsfc.nasa.gov](mailto:lmayo@pop600.gsfc.nasa.gov)

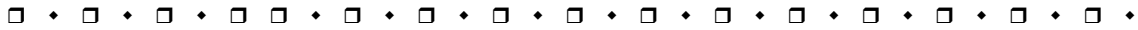
Fourth, I want to thank all of you astronomy enthusiasts who have supported the Paper Plate Education website. Since April, 2002, the website has been averaging over 600 distinct visitors per day who are accessing over 20,000 files daily. If you are a new visitor to the site, I recommend you at least check out the pages listed at the navigation buttons across the top. New material is always welcomed, and there is clearly an audience

for your work. You never know how someone else may adapt something simple for a productive, educational use.

Please feel free to contact me about your role in any of these endeavors. I and your planetarium colleagues thank you in advance.

Chuck Bueter

[bueter@rad-inc.com](mailto:bueter@rad-inc.com) <mailto:bueter@rad-inc.com>



**A Mid-Winter Puzzle - Sunrise and Sunset**  
**From Alex Menarry**

There's something which has always puzzled me and, despite consulting lots of references, I still don't have the explanation. I feel sure someone in the Society will have the answer. The latest time of sunrise and the earliest time of sunset, occurring round about mid-winter, do not occur on the same day. The days on which they do occur are about two weeks apart. Doing the same exercise for mid-summer shows that the earliest sunrise and the latest sunset are separated by about a week. I expected that the sunrise and sunset times, and the length of the days, would be controlled by the declination of the Sun. Hence at midwinter the latest sunrise/earliest sunset/shortest day would all occur on December 21<sup>st</sup>, or thereabouts, when the declination is at a minimum and similarly for midsummer.

My Nautical Almanac gives the following times for midwinter: latest sunrise 08h.16m.1s on December 29<sup>th</sup> and earliest sunset 15h28m0s on December 14<sup>th</sup>. The shortest day is on December 21<sup>st</sup>, at 7 hours and 16 minutes, when the Sun's declination is at its minimum of -23 deg 26.2min. For midsummer, the figures are earliest sunrise 3h17m15s on June 18<sup>th</sup> and latest sunset 20h33m41s on June 28<sup>th</sup>, with the longest day at 17 hours and 16 minutes on June 21<sup>st</sup>, Sun's declination at a maximum of +23deg 26.2min. Why?

Not understanding these fundamental facts about something so basic as the rotation of the Earth around the Sun has been a bit humbling. If anyone can give me the explanation, I should be very grateful.



**Transit Tailpiece**

**Quote/Unquote**

If an elderly but distinguished scientist says that something is possible, he is almost certainly right but if he says that it is impossible he is very probably wrong.

*Arthur C. Clarke*

That's what I like about Lord Young. While you all bring me problems, he brings me solutions.

*Margaret Thatcher*

I'm not young enough to know everything.  
*J.M.Barrie*

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## **Book Review**

### **Full Moon by Michael Light**

Published in 1999 by Jonathon Cape, there were piles of copies of this book in Ottakers before Christmas 2002. It is a sort of small coffee-table book, consisting almost entirely of NASA photographs taken during the Moon exploration between 1967 and 1972.

Michael Light is an artist and photographer, based in San Francisco. He was entrusted with the complete NASA archive of 17,000 hand-held and 15,000 automatic orbital photographic images from which to choose his selection of 128. As the author explains, the astronauts spent a lot of time studying photography before they went on their Moon trips. Once NASA was convinced of the need for a photographic record, they did it properly. I hadn't noticed before reading this book that each astronaut has a camera attached to the front of his space suit.

The resulting book of photographs is a feast of a few previously-published classics (the imprint of the astronaut's boot in the Moon dust, the view from the lunar module as it came in to land) and lots I hadn't seen before. They are arranged in a narrative order, telling the story as it unfolded. There is a short commentary by the author and a short description of each photograph but the other 128 pages are sumptuous photographs. For any Moon buff (Michael Roe, do you have a copy of this book?) this book is a must. For any astronomer it is a joy to turn the pages slowly and try to put yourself in the position of the photographer.

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CaDAS Website Now at [www.planetarium.btinternet.co.uk](http://www.planetarium.btinternet.co.uk) and the society email address is [planetarium@btopenworld.com](mailto:planetarium@btopenworld.com). Everyone is encouraged to visit the site and tell your friends about it. There is now an opportunity on the site to find that piece of equipment you were looking for or to advertise the things you want to sell.

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Post and Email If anyone wishes to change the way they receive their Transit, please let me know. If any member is not receiving a copy, or has changed their address, please let me know.

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Articles Wanted! Please send contributions for the newsletter to Alex Menarry, 23, Abbey Road, Darlington, DL3 7RD, 01325 482597 or to John McCue, 01642 892446 ([john.mccue@ntlworld.com](mailto:john.mccue@ntlworld.com)). Copy deadline date is the 1<sup>st</sup> of each month

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The Back Page Picture(s)

The January Portrait Gallery



Michael Roe



David Bayliss



Pat Duggan



Webmaster Ed Restall

Four more members who have appeared in The Interview. .