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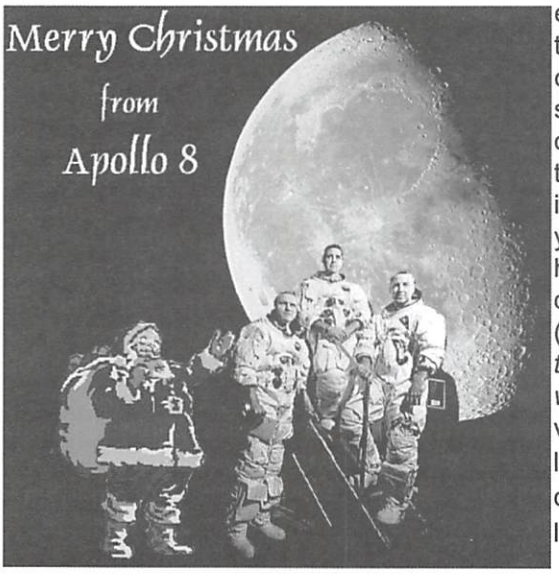
All my eye and Betty Martin's Moon landing

It's always nice to have a laugh at Christmas. Some correspondence during the last few weeks coincided with a piece of nostalgia that Peter Grego sent for this issue of *Gnomon*. His comments on the event commemorated in the Christmas message below are on page 2. It started with a short note from Steve Ibbotson, who had recently visited a school that had just acquired Science College status. He found that there were a "worryingly high number" of kids believing that the Moon landings were a hoax. When he made further inquiries, it turned out that the history teacher was the source of this information. So much for the status of a Science College.

Pete Bassett reacted immediately, saying that he had come across this "nutty situation" before, and now has a page dedicated to the Moon Hoax on his website. There are many other places where the hoax theory is pushed. One is the UFO Museum at Blackpool (about 100yds from the Tower). Check out what Pete has to say on **www.astronomyroadshow.com**

Bob Mizon wrote: In most of my presentations, I show the famous photo of Aldrin on the Moon with Armstrong reflected in his helmet, and make the point that, when Armstrong stepped down [*the steps of the LEM*], he disappeared from view(!) into the blackness of the shadow. Then he got his lines wrong (whatever NASA might have said afterwards).Only reality allows such glorious cock-ups. Hoaxers would have got it right!

Dr Robin Catchpole, Senior Astronomer at The Royal Observatory Greenwich commented: I come across this one in my work and of course it is always tied up with a conspiracy theory. The result is that no amount of explanation will convince the listener. So I say; "Of course you will consider *me* as part of the conspiracy, so I will leave you with one thought. Consider all the thousands of people who were involved in the lunar missions, do you seriously think that it would have been possible to keep the deception secret for so long? (*even ignoring the small fortune that the press would pay to any whistleblower. Ed.*).The most convincing data that came out of the lunar missions as far as I am concerned, is the dating of various lunar surfaces that has allowed ☞



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These are at the equinoxes and the solstices, that is four times a year. Copy deadlines are six weeks before these dates,

☞ a calibration of the cratering rate on the Moon.

There are a number of dedicated websites, most linked to each other, that deal in detail with every one of the so-called mistakes that the movie makers made while faking the Moon landings. They also contribute much positive evidence for the missions. A good starting point would be Bad Astronomy - Fox TV and the Apollo Moon Hoax, Phil Plait's thorough response to the television special on the subject at 💻 **www.badastronomy.com**. A site for the pro-hoax fans is 💻 **www.primeline-america.com**.

Comment

After 40 years in science journalism, you editor has long since lost most respect for the so-called science correspondents and science editors of the non-specialist media. The conspiracy story has been the easiest way to fill a column, or an hour of television, or whatever, since Bernstein and Woodward (whose investigations and subsequent copy were about the last genuine exposé to rate any real respect!).

The Moon landing hoax story, which spawned prime time programmes on US television and has, like all feeble rumour mongering, spread until able to take in a presumably respectable history teacher. Either that, or the teacher in question has a political agenda and should not be in that job.

Apart from the total ignorance of even basic science that Moon hoax advocates display, the claim begs the question "Why?" What had the producers fake Moon landings films on a Nevada, or Hollywood set, got to gain? Why keep going long after public interest had virtually died. More important, if the whole exercise was political one-upmanship over the USSR by the USA, what would the result be when such an impossibly staggering fraud was exposed.

Then there are the questions like how did astronauts return not only with bits of the Moon for everyone to examine, but with bits of an earlier Moon-lander (Surveyor 3) that had been exposed to the Moon's environment? Was that a fake too? What will the World's reaction be when someone finally returns to the Moon to pick up all those magnificent Hasselblads scattered about the Moon's surface, and finds no Apollo lunar module descent stages, no lunar rovers, and no footprints?

The whole story simply echoes the growing scorn for science and mathematics which is infiltrating through our educational system to the despair of those who can foresee the inevitable delerious long-term effects on our country, and many others. Just one familiar example puts it in a nutshell. Why does University Challenge quizmaster Jeremy Paxman laugh scornfully when one of the contestants does not know the answer to, say, an historical question, but is full of admiration when a contestant answers a comparatively simple question on science? In a recent quarter final, an answer was given to a mathematical question in which the contestant (wrongly, as it happened) gave the answer "an imaginary number". With the correct answer in front of him, the quizmaster could easily declare this wrong - but his querulous echoing of "imaginary?" followed by a laugh showed he had no idea such things exist, and are commonplace in science and engineering. It is not his ignorance and partisan approach that is depressing so much as this example from a "serious" journalist of how uncool science and mathematics have become.

Richard Knox

The men in the Moon

The Christmas period has a special link with the Apollo programme. Apollo 8 marked the first manned trip round the Moon: it took place at Christmas 1968 (see the greetings card on page 1) about seven months before the first manned Moon landing. Apollo 17 was the last visit by humans to the Moon, and took place just before Christmas 1973.

The Apollo 8 astronauts Frank Borman (pilot), James Lovell (navigator) and William Anders (engineer), blasted off on 21 December 1968. They were the first people to ride the mighty Saturn V rocket. All the spacecraft systems performed extremely well, and after three hours in Earth orbit, the command was given to ignite the SIV-B stage. After the burn, the three astronauts became the fastest people in history, travelling at 39,000km/h for a while as they left the Earth orbit.

At 34,000km from the Earth, Lovell reported that he could see most of South America, the Yucatan peninsula and Florida state. The view through the porthole was remarkably clear. On Earth, television viewers shared selected moments of the historic flight with the astronauts as they made regular broadcasts with a 2kg video camera (2kg was tiny in those days).

About 62,000km from the Moon the craft began to react to the lunar gravitational pull, and gradually accelerated from its cruising speed, which had steadily dropped to 3,500km/h. As it neared the Moon small reaction control motors propelled Apollo 8 into an elliptical orbit round the Moon measuring 113 x 300km.

The astronauts were keen to describe the Moon's appearance at such close proximity. Lovell (who was frustratingly to repeat the encircling of the Moon without landing in the ill-fated Apollo 13) described the Moon as essentially grey and colourless, like plaster of Paris or greyish sand. He thought the Moon awe-inspiring, and the blue Earth represented to him a "grand oasis in the big vastness of space." Borman described the lunar surface as "vast, lonely and forbidding." He imagined that it looked rather like "clouds" of pumice stone. Anders also remarked that lunar photography needed only black and white film because the surface was essentially colourless.

Apollo 8 completed ten orbits about the Moon on Christmas Eve, during which period the astronauts were engaged in planned activities. Behind the Moon, on the final orbit, the spacecraft's main engine fired and it was pushed Earthwards. The command module splashed down safely on December 27, only 5km from the recovery vessel.

The Moon landings (despite what some people are saying - see page 1) started in 1969 with Apollo 11, and continued to the last mission, Apollo 17 in December 1972. The astronauts visited an area 30km south of the crater Littrow near the southeastern shore of Mare Serenitatis, an area on the border between a highland and a Mare. Photographs taken from orbit had revealed numerous craters encircled by mysterious dark haloes here. About 30km west of the landing site lie the Littrow Rilles which intersect the concentric rilles around the border of Mare Serenitatis near the crater Clerke. These rilles can be observed through a 100mm telescope under favourable conditions. The mountainous area appears markedly striated.

Apollo 17's lunar excursion module *Challenger* descended into a valley between two large mountain massifs on 11 December 1972, touching down just 200m from the planned site. The very last Moon walkers were Eugene Cernan and Harrison Schmitt, the latter being a qualified geologist and the only member of this profession (continued on page 6 ☞)

Letter to the Editor

Tutor wanted for astronomy courses

There is an interesting opportunity for an astronomy educator to provide a useful service and earn a good fee in pleasant conditions. Too good to be true? Please read on!

I am involved with Chris King at Keele University in delivering booster courses in astronomy to PGCE university students. The content would focus on astronomy in the secondary curriculum, KS3 and KS4, for ages 11 to 16.

The project is in its early days, but we do have dates and general venues in universities. Duing 2004 eight courses, each of four consecutive days, will be run and I am looking for someone who would be interested to take the three courses scheduled for the south of England.

Dates & venues are: the week beginning 2004 May 17 in Herts; the week beginning 2004 May 24 in Southampton or Guildford; and the week beginning 2004 May 31 in London.

The full project involves earth science and astronomy booster courses for PGCE students aiming to become teachers in secondary schools.

Chris King, with members of the Earth Science Education Unit, will cover the earth science aspects. I have been recruited to cover the astronomy side only. Each course would be of ten days in total, comprising six earth science days, and four days of astronomy.

The budget for each ten- day course is £8000. This covers hire of rooms in the university, loan of AV equipment, administration costs, production of resources for course members, travel, accommodation if needed etc. The tutor fee works out at from £350 to £500 per day (£1400 to £2000 per four-day course).

The Astronomy sessions will deliver background astronomy knowledge of the secondary KS3 & KS4 National Curriculum, classroom resources and classroom activities for the students. There would be ideally be one session in a planetarium / mobile dome. I have a presentation CD-ROM, resource lists and classroom activities available on request.

There is a programme proposed for each course, but if you decided to become involved you would doubtless design your own schedule for the four days.

Would any interested *Gnomon* reader let me know if they would like to be involved or if they would like more information.

Best wishes

Dennis Ashton
Stardome Planetarium in Sheffield
stardome@blueyonder.co.uk

Select Committee come up trumps

A big step forward along the road towards better night skies over the UK was taken on October 6, when the Parliamentary Select Committee for Science and Technology issued its report on light pollution.

In June 2003, representatives from the BAA's Campaign for Dark Skies (CfDS) and from the Royal Astronomical Society gave illustrated talks to the Committee, and supplied evidence during formal sessions at Westminster, as did Guy Hurst, BAA President. The two Astronomers Royal, the CPRE, the Highways Agency, Ministers, PPARC, lighting professionals and local authorities were also involved. Written evidence was submitted by hundreds of societies and individuals.

The report is totally "sky-friendly". It does not change the law, nor does it oblige the Government to act; but its direct accusations of Government indifference and confusion on the subject of light pollution is such that they surely cannot be ignored. The Select Committee writes:

We regret that PPARC and the Government have adopted a defeatist attitude towards light pollution and astronomy . . .Light trespass and glare affect astronomers, but... can also affect us all. We recommend that obtrusive light should be made a statutory nuisance.

Discussing the educational implications of light pollution, the Committee states:

We believe that amateur and professional astronomers have played a valuable role in the introduction of young people into science. As Sir Patrick Moore commented "the amateur of today is the professional researcher of tomorrow".

Astronomy in the UK plays a valuable part in supporting the work of professionals, engaging young people in science, and producing astronomers and physicists through UK universities. It is not good enough that PPARC and the Department for Education and Skills had to pay for young people in schools to "book time" on overseas telescopes to see the night sky as it should be.

Pupils should be able to study the night sky at school primarily with the naked eye or through a telescope rather than via a computer and the internet. There seems to be an acknowledgement within Government that Space is a good way to engage young scientists, but there is little real support for schools to use observing facilities in this country. The Department for Education and Skills should be supporting efforts to make the night sky available to all. We regret that it is not doing so at present.

There are substantial numbers of amateur astronomers, astronomy undergraduates and postgraduates and professional astronomers observing in the UK. Amateur and professional astronomers have undertaken a dual role of showing and explaining the night sky to students, pupils and the general public, whilst campaigning for the last ten years to prevent further degradation *of the night sky.*

It is time they received support from PPARC and the Government. There is a real opportunity of using the enthusiastic astronomy community to increase the numbers of school pupils taking astronomy and continuing into physics. PPARC and DfES together should bring to bear more pressure on ODPM and DEFRA to find a way to protect the skies, particularly around those observatories who work with local schools.

The battle will still be long, and the skies can never again be as dark as they were a century ago. But the optimum rural and urban night sky is achievable for all, if those in power allow it to happen, and if we continue to inform as many people as possible about the subject.

The Select Committee report is not a "quick-fix" magic wand. But it is certainly a big stick with which to beat the decision-makers if they continue to close their eyes to the value and majesty of the environment above.

For the full report, see

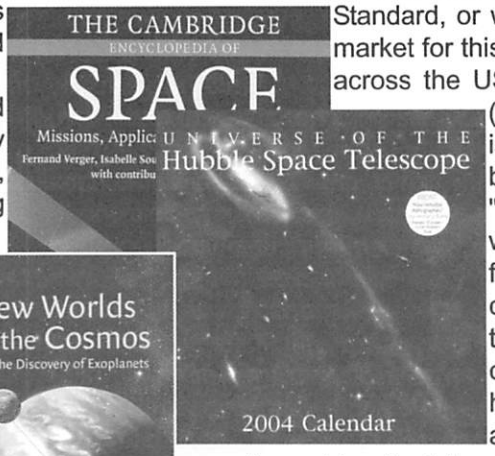
www.parliament.the-stationery-office.co.uk/pa/cm200203/cmselect/cmsctech/747/747.pdf

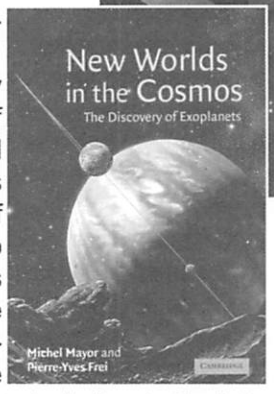
Bob Mizon

FOR YOUR CHRISTMAS PRESENT LIST

The Cambridge Encyclopedia of Space - missions, applications, and exploration. *Fernand Verger, Isabelle Sourbès-Verger and Raymond Ghirardi. Cambridge University Press. 418pp. Illustrations (4 col.). ISBN 0 - 521 77300 8 (hardback). £35.00 (US$50.0).*

This is a compendium of the history, technology, politics, astronomy, applications (civil and military), and just about any aspect of the exploration of space as carried out by each country of the world that has a significant interest.





The team of authors is led by Fernand Verger, Emeritus Professor of Geography at the École Normal Supérieure in Paris, who also works with NASA. The resulting scholarly quality of the book has been maintained by the translators.

The first chapter briefly describes the basic environment of outer space, close to the Earth and far away, and goes on to discuss the nature and physical science of orbits. From this point it goes on to deal with ground tracks of orbits and what their significance is. The authors discuss what the main purposes of satellites are, and the requirements to meet these needs, including both civil and military applications.

The authors describe the national programmes, their costs, their goals and the international politics of spaceflight. The book then compares the technical capacity in different countries. All space missions to the date of publication are studied in detail, dividing them into several categories: circumterrestrial; exploration beyond geocentric orbits; Earth-observation; telecommunications; positioning and navigation; and military applications. Finally, the 13th chapter is devoted to living in space. There is a generous list of relevant web sites and a bibliography of books and periodicals.

This is an essential addition to any library for senior school age pupils, and a very generous gift to find in your Christmas stocking. Pin this review page up somewhere prominently with the judicious addition of highlighter, and you never know your luck. **Richard Knox**

Universe of the Hubble Space Telescope. *2004 Calendar. £10.95 incl. p.p. Armagh Planetarium. (order by phone: 028 375 23689, or from* **ww.astrosales.biz**

The Armagh Planetarium continues to expand its marvellous Mail Order Catalogue and shop, but the calendar must be one of the best regular annual "must-haves". It offers a good design, year-long usefulness and fantastic pictures. It gives plenty of space in each daily rectangle for jotting reminders to pay the tax man etc. A thumbnail calendar of the preceding and following month is also provided.

The new edition comprises large (30.5cm square) pages. There are 12 new Hubble Space Telescope pictures with the monthly calendars, and the calendar will hang on your wall with the picture on the top and the calendar beneath, a whole page each. Although produced in the USA, the calendar gives national holiday dates and many additional festivals of varying degrees of gravity - Victoria Day (Canada), Groundhog Day (USA), Chinese New Year, Labour Day (Queensland Australia), Hanukkah, St. Stephen's day (Ireland), and even Guy Fawkes Day (UK) - just to take a few examples! The Skywatching Guide is excellent, with a monthly summary and daily information including the "technical" (Earth at aphelion 1.017AU (152 million km) from Sun), and the practical (Binoculars show 6th mag. Uranus 0.9° N of Venus and 0.5° left [*sic*] of 5.5mag. 38Aquarii).

Purists may object to the timings of events in Eastern Standard, or worse, Eastern Daylight Time. With a market for this calendar across the planet, let alone across the USA, it would have more professional (and fairer to all) to use UT. Similarly, it is a bit lazy to describe Uranus as being 0.5° to the left of 38 Aquarii, or "look 2° lower left of Mars". What's wrong with "east" and "south-east"? As far as the southern hemisphere is concerned, these upside down directions will be rather annoying and could put off some potential southern hemisphere purchasers. It will be an academic point only as far as most of Armagh's clientele are concerned however, so rush out and get one for all your friends now, and don't leave 2003 without it! **RAK**

Redshift 5. *Astronomical software. Maris Technologies. Published by Focus Multimedia. £29.99 inc. VAT*

The new version of this popular PC planetarium and database shows the results of the new partnership between the software developers, Maris Technologies, and the publishers Focus Multimedia and Unites Soft Media. The presentation has undergone a complete facelift, new applications and even packaging. Not everyone will find that justifies the rise in price since *Redshift 4*, but the new features on the technical and resource side more than justify the new price - which is still very modest.

The most important changes since the last edition are the addition to an already impressive database of the Hubble Guide Star catalogue 2 and the Tycho Double Star catalogue. Other new catalogues include optically visible open clusters, variable stars, quasars and BL Lacertae. There is also an update of 50,000 asteroids from the Bowel Database, the Caldwell Objects, and planetary and satellite data including surface features and maps from the latest space missions.

The display now includes meteor showers, "quasi-realistic" comet images and an increased choice of user information to be shown on the sky maps. The display may also be dimmed and coloured red for use on a laptop at night during observational sessions, and the image may be flipped mirror-wise and upside down as required to match the display in an astronomical telescope with or without a star diagonal.

Armchair browsers have an unlimited scope for taking guided tours through space, from the surface of the Moon to other galaxies, from riding on a comet or satellite, to setting a viewpoint almost anywhere in space. New discoveries may be integrated into the database using mathematical data, or downloading from the internet. Other new features introduced by the developers may also be downloaded as required.

One feature of the program makes it of particular interest to science and mathematics departments. The algorithms used in the compilation of the positional data, time and calendars etc. are explained in an appendix in the Help menu. Excellent value! **RAK**

New Worlds in the Cosmos. The discovery of exoplanets. *Michel Mayor and Pierre-Yves Frei. T. Cambridge University Press. 248pp. Illustrations (4 col.). ISBN 0 - 521 81207 0 (hardback). £18.95 (US$30.0).*

Michel Mayor is Director of the Observatory of Geneva, Switzerland, and credited together with Didier Queloz and their team with the discovery of the first planet beyond the Solar System, an exoplanet, 51Peg b. They, together with many other astronomers since, have added to the list and (at 2002 October 7) there were already 100 planets known belonging to other stars. David Hardy's impression of the 100th to be found, orbiting Tau Gruis, adorns the cover of this book (shown in the illustration on the facing page).

This is still, however, a very young field of discovery. As yet, not a lot is known about the new planets - which is hardly surprising since it took a huge step forward in space sciences (as described thoroughly in the book by Fernand Verger *et al* reviewed above) before very much was known about our own planetary neighbours! So perhaps we will have to await the development of new "Voyagers", "Mariners", and "Hubble Space Telescopes" before we can say much about them. So this book concentrates on the story of their discovery.

The story begins with the discovery of 51 Peg. b told by Michel Mayor. The book then goes back in time to Aristotle (!) and reviews planetary discovery from then to the present day. The style is easy, maybe due to the co-author's life as science journalist with a Swiss newspaper, but the collaboration between astronomer and journalist has worked well. The account of the famous John Couch Adams/Urbain Le Verrier saga and the discovery of Neptune, gives credit to Adams that is far more generous than has usually been the case, especially by non-British authors. (*As a Cornishman I should also champion Adams. But it was sobering to read the Nicholas Kollerstrom article in the latest* RAS Journal *Vol. 44 no.5 on the recovery of the "borrowed" Royal Greenwich Observatory's Neptune discovery files from Chile, that indicate Adams may not have been as far ahead of the Neptune prediction game as I would like! - Ed.*)

The book continues by explaining the various techniques that have been brought to bear on the detection of exoplanets. The "wobble" of stars in their proper motion, the use of spectroscopy, detecting variations in the luminosity of a star indicating a body in transit and the development in interferometry have all played their part. Planetary theory and the expectation of finding planets have both been boosted by the discovery of protoplanetary discs around forming stars.

The book concludes with speculation about life in the Universe that must follow the discovery of planets all over the galaxy. It describes the projects such as SETI and its subdivisions, including the use of any spare time on any home computer connected to the internet to help crunch the enormous quantity of data being generated by the Serendip project. **RAK**

Astronomy. A physical perspective. *(Second edition) Marc L. Kutner. Cambridge University Press. 582pp. Illustrations (4 col.). ISBN 0 - 521 52927 1 (paperback). £34.95 (US$75.0).*

This book is a successor to Professor Kutner's book of the same title published in 1987, and has been comprehensively updated. It is a textbook, but the author shows that a "higher level" book can still be visually attractive. It is an important contribution to the literature intended for serious students, but it could catch any reader's imagination.

Aimed at the physics undergraduate with a year of classical physics and calculus behind them, it has surely succeeded in being as close to a coffee table production as a detailed science textbook could be! Although fairly expensive, (a hardback edition is also able at £90.00!) there is much for any serious astronomical student to enjoy, even if more advanced mathematics is not your scene! A frequent problem of physics and astronomy teaching is when students ask "how do you know?" The author shows how precious little information is gleaned from the depths of space and how this can be turned into facts, or at least, plausible explanations. Because this invariably comes down to some mathematics sooner or later, it is not always possible to answer completely without some such comment as "according to Newton's laws . ." (and those are the easy ones!).

There is also much to read and admire in the text and illustrations that does not depend on mathematics - or even physics - so it would be an excellent addition to a high school library. Students at many levels could enjoy the book, and at the same time see for themselves the application of the physics and mathematics they are learning. There is even a mention of John Couch Adams (see above)!

The contents, in the order given in the book, include the properties of ordinary stars, the light and radiation from stars and how they are collected and analysed. Binary stars and stellar masses leads on to stellar dimensions and orbits. The Sun has a section to itself, being an "ordinary" star, and conveniently close to the observers.

Part 2 deals with relativity, special and general. This is a fascinating account, and very approachable for anyone who has a fear of bendy space! This section leads into black holes. The next part is on stellar evolution, stellar types and classes, the physics of stellar energy production, and the birth, old age and death of stars, close binaries and clusters.

Part 4 is about the Milky Way Galaxy, its composition and evolution, and the fifth part is on galaxies and the shape and evolution of the Universe as a whole. This concludes with a review of modern cosmology, and consideration of the Big Bang itself.

The next section is the Solar System, dividing it broadly into an overview, the Earth /Moon, the inner planets, the outer planets, and the minor planets. The final part is the origin of life, and considerations about life elsewhere in the Universe. It is interesting to compare Professor Kutner's approach to the subject of Michel Mayor's book (reviewed above). Kutner's chapter is headed "Other planetary systems?" (note the question mark) and his description of the field is that the observations of a group headed by Marcy and Butler at the Lick and Keck 1 telescopes have found "evidence for more than 90 systems". He points out that there are a number of important questions that have not yet been resolved. Why there are so few discoveries of really massive planets (say five Jupiter masses) which ought to be the easiest to discover? Why are so many of these planets extremely close to their primary bodies (much closer than Mercury to our Sun). Why do many of these planets have highly eccentric orbits? There is a clear division of opinion as to what is established fact between these two books. Which brings us back to that old question "how do we know?".

There are some annoying discrepancies and errors that this reviewer has seen on dipping into the pages. These included that light takes 2100 years to reach us from the Andromeda galaxy, while taking 25,000 years to reach us from the centre of our own galaxy! Some of these are probably merely typographical at the manuscript stage, but they could do with removing.

Richard Knox

(☞ ***The men in the Moon***. Cont. from p.2) After the two previous missions had successfully used the lunar rover, Cernan and Schmitt confidently drove more than 6km south-east towards the base of South Massif across light coloured material deposited by a lunar avalanche which might have been triggered by the Tycho impact 100 million years ago. Bedrock was exposed on the mountainside where it had shaken off its covering of soil. Boulders had rolled down the mountain slopes, leaving distinct trails. The rocks brought back from this location were similar to those of Apollo 16. One particular specimen was found to contain material dating back almost to the birth of the Moon. One surprise discovery was that of orange soil, initially postulated to be a sign of recent vulcanism. However, it turned out to consist of microscopic glassy beads which had probably been created by a meteoritic impact.

During a stay of more than three days a total of 23 hours of exploration was achieved, in which Cernan and Schmitt had traversed 30km and collected 110kg of lunar rock and soil samples.

Peter Grego
Editor *Popular Astronomy*
Director, SPA Lunar Section

Making the most of a marvellous Mars

Peter Ford took advantage of the recent interest generated by the close approach of Mars, and showed what can be done with an ordinary camera, and some extra-ordinary effort to commemorate such events! Ed.

Strangely, I had no real adventures taking these images, except tripping over an unseen hole and sprinting an uncontrolled five yards or so in total darkness behind the Midland Hotel in Morecambe.

The photographs were taken with an exposure of about 30s at f2 with 50mm lens on ASA 800 film. After a very successful sale day at Royal Lancaster Infirmary, I had raised £61 selling framed pictures for hospital funds. This is very encouraging as people were obviously very interested in Mars, as they were in Comet Hale-Bopp six years ago.

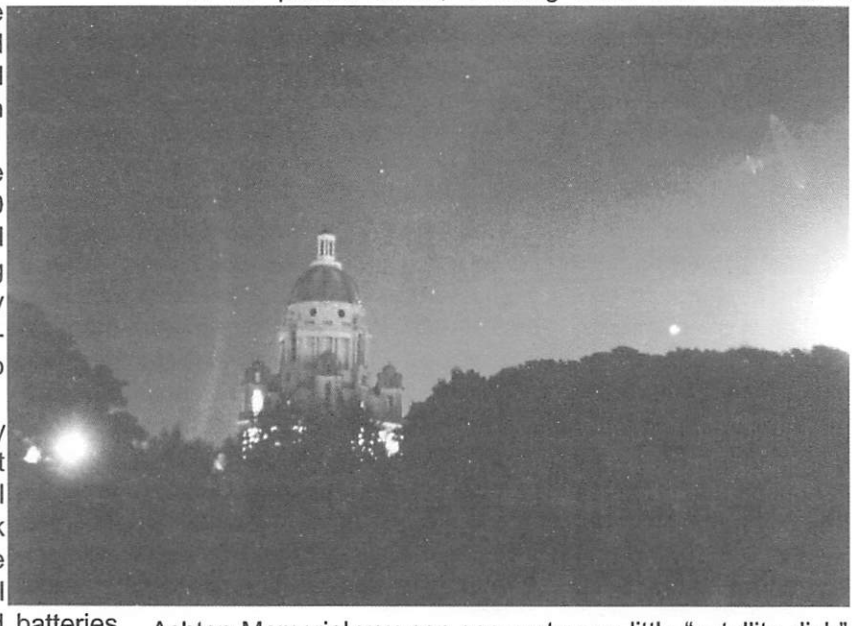
With forthcoming events, I hope to improve my exposure timing. Unfortunately, my ancient Zenit camera tends to scratch films on rewind, so I will be getting my slightly more modern Chinon back from a friend who has borrowed it for telescope photography. My dealer tells me that mechanical SLRs are in demand as electronic shutters and batteries can be rather temperamental in cold night conditions.

I asked our local top photographer, Jon Sparks, what his secret was. His advice was to know what is going to happen and when - be it high tide or Mars rising. Then be there with a camera. As a result, I travelled several miles to get local landmarks in line with Mars. Unfortunately, I could not get it over the sea, as it was in the wrong part of the sky (that's rather like British Rail having "the wrong kind of snow"!) Travelling some 30 miles round Morecambe Bay produced disappointing results as the street glare was too much and the planet had risen too high, as could have been expected. The images of the planet are hazy, as there was a thin layer of cloud.

It has been very gratifying to see the amount of public interest in the Mars visit. Having seen the pictures, several people have been quite excited to have identified and observed it for themselves, feeling that they have really seen something worthwhile. Although now receding, it is still a familiar and somehow friendly presence in the sky.

While out with tripod and SLR taking such pictures, I have been approached by several very interested and enthusiastic passers by. One couple in Lytham, near Blackpool were walking a chocolate labrador, a breed of dog I had never dreamed existed, so our exchange of knowledge was mutual. In this case, the project was only partially successful. Although Mars showed up quite well next to Lytham Windmill, the white coastal landmark's lighting, though subtle and non-polluting, was enough to take the edge off the planet's gleam.

In the picture below, showing Mars with Lancaster's Ashton Memorial you can see a strange little "satellite dish" apparently descending on the right. This caused some excitement at photo finishers until the manageress identified it as a common pattern of lens flare.



Peter Ford

P.S.Here is a verse I recall from a childhood annual published some 45 years ago, intended to be sung in under 16 seconds:

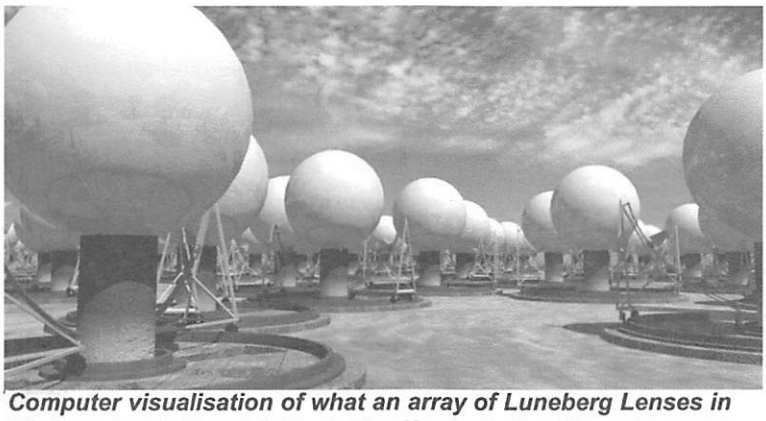
Theophilus Sprockett invented a rocket
And sailed to the Moon with his lunch in his pocket
And no more was heard, neither whisper nor word
Of Theophilus Sprockett, the lunch or the rocket
Till astronomers wise peering into the skies
Gave incredulous cries of alarm and surprise
For the Moon's face was new and indeed it was true
'Twas the face of Theophilus Sprockett !

The tune, Gentlemen, is *The Irish Washerwoman* !

News from Down Under

The "next generation" of radio telescope will be unlike the monolithic dishes, such as the Lovell 76m, Effelsberg 100m, and Parkes 64m antennas, which have reigned supreme because of their sheer collecting area. To see back to the "Dark Ages", when galaxies were first collapsing from their primeval gas clouds, radio astronomers estimate they need something approaching 1 square kilometer of collecting area. At a cost approaching US$500 million, radio astronomers have been forced to do what their optical colleagues concluded decades ago - to collaborate, rather than compete. Thus was born the concept of the Square Kilometre Array, or "SKA" for short (or until construction is underway, and a more fitting title emerges).

The international SKA consortium (💻 **www.skatelescope.org**) is made up of 11 countries, which include Australia, the USA, the UK, Canada, the Netherlands, South Africa, and China. All partners have agreed to jointly fund development studies. Since a healthy amount of competition has been shown to produce novel designs, and spur innovation, each partner has selected a unique antenna concept. The USA has gone with conventional, small "satellite" dishes; China has opted for "karsts" (mini-versions of Arecibo); Canada is promoting a balloon-borne receiver tethered above a ground reflector; and Australia is running with the "Luneberg Lens", egg-shaped globes which bend rather than reflect radio waves (see the photograph).



Computer visualisation of what an array of Luneberg Lenses in Western Australia might look like, if selected as the antenna design for the SKA.(Image: courtesy of Chris Fluke, Swinburne University of Technology.)

While the contract to build the structural elements of the SKA is keenly sought, the big "prize" is the opportunity to actually host the SKA. Among the factors that will decide the best site to locate the SKA are: sufficient land to enable "clusters" of antennas to be distributed across thousands of kilometers, yet still be accessible; radio "quietness"; geological (not to mention political) stability; and access to particularly interesting sources, such as the Galactic Centre, and the Magellanic Clouds. One area that appears to meet all these criteria is Western Australia. Indeed, site-testing has already begun at a site near the town of Geraldton, and the state government is keen to support such a venture, which could bring much needed high-tech infrastructure, and non-polluting industry to this remote area.

Australia's chances of hosting the SKA recently received a major boost, when it was selected as the preferred site for the LOw Frequency ARray (LOFAR -💻 **www.lofar.org**). Although conceived independently of the SKA, and somewhat more modest in scope, LOFAR in many ways represents a crucial "pathfinder" for the kinds of networking, signal processing, and scheduling that will be needed for the SKA. The LOFAR consortium (MIT and the Naval Research Lab in the USA, plus ASTRON in the Netherlands) compared sites in the southwest of the USA, and in the Netherlands, with Western Australia. Aside from the southern hemisphere advantages, WA also had the advantage of low radio interference across the whole LOFAR frequency range from 20-240 MHz, in particular, the lack of radio stations broadcasting in the FM band from 90-110 MHz.

The only catch is that unless Australia can contribute substantial funds to the LOFAR project, the consortium will have to compromise and locate it elsewhere. The sort of money involved is of order A$60m, about a third of which could come from the Western Australian government, a third from the CSIRO (which funds radio astronomy in Australia), and the rest will have to come from a special request to the Australian government. Assuming sufficient funding is forthcoming, construction could get underway in 2004, with initial operations in 2006-2007. Hopefully this could be followed by a decision to also locate the SKA in WA. Thus, by the middle of the next decade, Western Australia could be home to not one, but two of the world's largest radio observatories!

Stuart Ryder

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Sky Diary Winter 2004

2004 is the first leap year of the third millennium A.D. In case anyone wants to argue that 2000 A.D. was a Leap Year, I agree - but it was not in the third millennium. It was a peculiar Leap Year though, and it will be 400 years before we encounter another year that defies the exception to the Leap Year "rule" that most of us remember. A year that is exactly divisible by four is a Leap year - then the part most of us forget, unless the year is also exactly divisible by 100. The exception does not apply if the year is divisible by 400 (as was 2000)! This all arises because there are approximately 365.24219 mean solar days in a tropical year. The neater way of expressing the rule, which was established with the Gregorian calendar, is that the four-yearly intercalary day in years divisible by four is omitted every centurial year not divisible by 400. However, not many of us are likely to see another centurial year, let alone 2400A.D!

March 21 at 01h 00m UT is the northern vernal equinox when the Sun's apparent motion across the celestial sphere is at the maximum rate northwards. The Sun's apparent path across the celestial sphere, the ecliptic, crosses the celestial equator at an angle equal to the axial tilt of the Earth to its orbit, about 23.4°. This has a number of important influences on various astronomical phenomena.

As far as the Sun's apparent motion is concerned, the easterly progress in right ascension (that is, parallel with the celestial equator) is slowest. Its motion round the ecliptic (the mean value of which is 0.98561°/day) must be multiplied by the cosine of the obliquity of the ecliptic, which gives the rate of "easting" reduced to about 0.9°/day. This reduction of the Sun's progress eastwards results in garden sundials running slow! The Sun reaches a maximum easterly rate three months later, causing sundials apparently to be fast, then starts to decline again to the autumn equinox, and repeats the whole cycle again during the northern ☞

☞ winter months. This produces a twice-yearly cycle.

The Sun's apparent motion round the ecliptic is merely the relative effect of our moving observatory, planet Earth, orbiting its primary star. From Kepler's Second Law, we know that the Earth speeds up in its orbit as it approaches perihelion in early January, and is at its slowest at aphelion in early July. This results in an annual Sun-fast and slow cycle compared with the position of the "mean Sun".

Add the two effects together and we get the Equation of Time. This gives the correction that must be applied to the Sun's actual position to find the position of the mean Sun, and hence, it also gives a correction that must be applied to sundial times. The Equation of Time and the changing declination of the Sun throughout the year result in a fascinating pattern of the Sun's position in the sky at any given mean solar time each day. The pattern is known as an *analemma*. Some sundials have been designed with anelemmatic gnomons (being a reader of this newsletter, you *must* know what a gnomon is - but just in case, it's the shadow-casting device of a sundial). If the shape of the gnomon, or an aperture in it, is made anelemmatic the mean time can be given precisely by reading it at a point on the shadow given by both the date and the position of the shadow on the hour scale. The photograph here, taken from the website **www.antwrp.gsfc.nasa.gov/apod/astropix.html** (a very entertaining website giving an "astronomical picture of the day"), shows the effect of taking a photograph of the Sun at the same time each day at intervals through the year with a camera fixed in position. It clearly shows that the Sun is the worst at keeping time when at its furthest south.

Moon phases for the first quarter of 2004

Month	New Moon	First Quarter	Full Moon	Last Quarter
January	21	29	7	15
February	20	28	6	13
March	20	29	6	13

In the table in column 2, note how throughout the quarter, Mars sets at much the same time while its time of rising changes comparatively rapidly. This arises from the prolonged race between the Sun and Mars round the ecliptic due to Mars' synodic period, over two Earth years, the longest of all the planets. So in much the same way that the Harvest Moon seems to be around all evening every day for a week in late August, so Mars chases ahead of the Sun which closes the gap between them at less than half a degree per day. Mars and Earth will be rapidly moving apart, and Mars will fade from magnitude 0.2 in Pisces as the year begins to 1.4 in Taurus by the end of March.

Jupiter will still be in the south-eastern part of Leo, and prominent all winter, while Saturn begins to speed up his slow descent southwards from the furthest north position occupied last year. As a result, our view of the rings will begin to change as the tilt of Saturn's south pole towards Earth begins to diminish, and the rings that have been visible all round the globe of the planet will take on a narrowing angle. We will have to wait for nearly 30 years to see the wide-open rings once more. So I (for one) had better make the most of it!

Saturn will be clearly seen all winter, so that the four brightest naked eye planets will be in the evening sky throughout the quarter. At the end of the quarter, March 29 to be precise, both Venus and Mercury are at their maximum eastern elongations (46° and 18° respectively) at a time close to the vernal equinox when the ecliptic crosses the horizon at the most favourable angle for the year (during evenings). As happened just under two years ago, all five naked eye planets will then be in the evening sky, but this time more easily seen - although spread across most of the sky. On the evening of the 29th, the Solar System objects to be seen, reading from west to east, will be Mercury (12° high at the end of Civil Twilight), Venus, Mars, Saturn, the Moon (at First Quarter), and Jupiter.

Rising and setting times (UT): lat. 52°N; long. 3°W

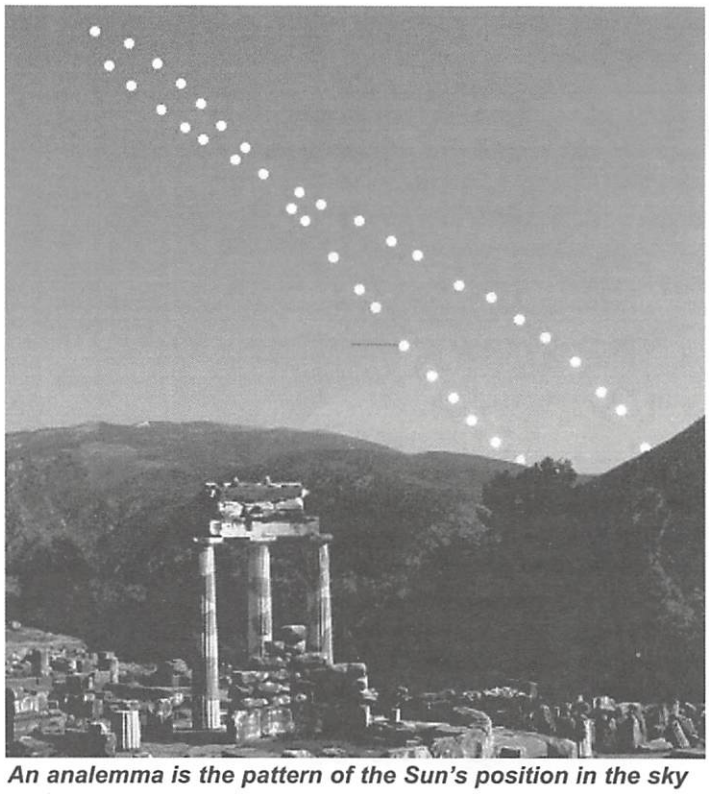
	January 15		February 15		March 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	08h 13m	16h 29m	07h 28m	17h 24m	06h 25m	18h 16m
Mercury	06h 36m	14h 40m	07h 15m	15h 58m	06h 46m	19h 18m
Venus	09h 52m	19h 47m	08h 43m	21h 22m	07h 32m	22h 45m
Mars	10h 58m	00h 23m	09h 29m	00h 16m	08h 15m	00h 10m
Jupiter	21h 20m	10h 28m	19h 04m	08h 23m	16h 48m	06h 23m
Saturn	14h 58m	07h 25m	12h 47m	05h 17m	10h 51m	03h 22m
Uranus	09h 46m	19h 47m	07h 47m	17h 54m	05h 56m	16h 10m
Neptune	19h 02m	18h 03m	07h 03m	16h 08m	05h 12m	14h 19m

Venus will become progressively more conspicuous in the evening skies through the quarter. On January 14, it will provide a good locator for the planet Uranus, which you may be able to pick up in binoculars about 1° to the north, and slightly west, of Venus. Both planets will be low (about 13° high, in the deepening evening twilight.

Because the synodic month is about 29.5 days, it is only in Leap Year, with February lasting almost a synodic month, that the dates of the four lunar quarters coincide for consecutive months so closely as happens this year (see the table in the left-hand column).

Finally, keep an eye on the Sun (figuratively - see "Curriculum Corner"). If you make a sundial as suggested you will see the Sun cross the celestial equator at the equinox in March. Take care when letting children see the behaviour of the Sun. Accidents are all too easy.

Richard Knox



An analemma is the pattern of the Sun's position in the sky at the same local mean solar time throughout the year. This photograph, taken by Anthony Ayiomamitis from the ruins of Tholos, in Delphi, Greece, is a composite exposure of the Sun near sunrise at intervals throughout 2002